PREFACE

Praise to Allah SWT for all the blessings and guidance given to us all, so that the program of the International Seminar on Science Education (ISSE) 2016 book with the topic about *Nurturing Innovative And Highly Literate Generation Through Science Education* which held on October 29th 2016 at Rectorate Hall, Yogyakarta State University can be completed successfully. This book comprises number of abstracts that have been presented in the seminar, written by lecturers and students from Yogyakarta State University and other universities.

We owe many parties for the success of the seminar. Therefore, we would like to sincerely extend our gratitude to:

1. The rector of Yogyakarta State University, Prof. Dr. Rochmat Wahab, M.Pd., M.A. for facilitating all the activities of the International Seminar on Science Education (ISSE) 2015;
2. The director of Graduate School of Yogyakarta State University, Dr. Moch. Bruri Triyono for providing all the facilities of the International Seminar on Science Education (ISSE) 2016;
3. The invited speakers for their willingness to share thoughts and insights on science teaching and learning in the seminar;
4. All committee members for the time, effort, and thoughts for the success of this activity; and
5. All presenters and participants who have come a long way to contribute to the success of the seminar.

However, we truthfully understand that some imperfections might be found in this book and in the seminar. Thus, suggestions and constructive criticisms are very much welcome. Finally, we do hope that this book can bring some contributions for innovative and highly literate generation through science education.

Yogyakarta, Oktober 29th 2016
Chairperson

Dr. Heru Kuswanto, M.
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Optimazing Local Potential into Science Learning to Improve Science Process Skills and Scientific Attitudes
NEEDS ANALYSIS OF THE DEVELOPMENT OF A MINI LABORATORY MODEL IN THE BIOCHEMISTRY INSTRUCTION

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Abstract—This research aims to analyze the problems identified in the implementation of the Biochemistry laboratory work in Mataram University, the students’ critical thinking skills through writing Biochemistry laboratory work reports, and the opportunity to develop a mini laboratory model for the Biochemistry instruction. The method used in this research is a quantitative method and questionnaires were used to collect data. The questionnaires were distributed to 105 students at Mataram University taking a Biochemistry course and to two Biochemistry lecturers. The analysis results were corroborated by the students’ and lecturers’ written comments and the analysis of the students’ laboratory work reports. The research results show that the problems identified during the implementation of the Biochemistry laboratory work in Mataram University were, among others, that the students were not given enough opportunity to conduct a preliminary research, that the lecturers were not involved in the process of laboratory work and in giving feedback on the laboratory work results by means of presentation. The analysis of the Biochemistry laboratory work reports shows that the students had not developed their ability to think critically. This finding provides an opportunity for the development of a mini laboratory model which is integrated, unlimited to space, dynamic, and which provides ample opportunities to the students to present the results of their laboratory work.

Keywords: Biochemistry, Laboratory Work, Mini Laboratory Model

I. INTRODUCTION

Biochemistry is one of the compulsory courses that students must take in the Chemistry and Chemistry Education Study Program. Currently, the students’ response to biochemistry shows that they find the materials difficult. Broman et al. [1] assert that biochemistry is the most difficult subject for students to understand and the most interesting subject of all at the same time. The research results corroborate the previous research conducted by the students at Mataram University taking Biochemistry Course. 90% of the students found Biochemistry course difficult, and 80% of the students stated their difficulty in learning Biochemistry II [2].

The difficulties that students encounter in Biochemistry are the concepts related to the abstract bodies of living beings, which are difficult to visualize, and need higher thinking skills [3]. The complex concept is related to the interconnectedness of the macroscopic, microscopic, and symbolic levels of thinking. The macroscopic level deals with the description of real phenomena which occur daily or which can be observed in the laboratory as an observation result or real evidence of their existence. Elucidation, the way to describe and make prediction related to the chemical nature and process can be explained through submicroscopic thinking. Symbolism covers signs used to communicate concepts and ideas [4].

Sirhan [4] reveals that the difficulties in learning Biochemistry are related to some factors such as the content of the curriculum, overlapping concepts, language problems and communication, and motivation. The curriculum of Biochemistry in the university level in Indonesia covers a very broad range of materials delivered through a relatively short period of instruction. The main Biochemistry materials cover protein, enzyme, nucleic acid, biosynthesis protein, structure and classification of carbohydrate, carbohydrate
catabolism and anabolism, and triglyceride catabolism and anabolism. The wide range of materials delivered in a very short period of time leads to the use of lecturing as the best teaching method to deliver materials to the students. This method leads to the decrease of motivation and interest among the students to explore the materials deeper [5].

The laboratory work activity is one of the methods which can relate the macroscopic, microscopic and symbolic levels and is able to stimulate the students’ interest and attention [6]. The laboratory work is also able to increase students’ ability to make arguments as the center of development of knowledge and science [7].

Biochemistry course has included laboratory work activities in the curriculum. The laboratory work manual written is sometimes only to fulfill the semester credit requirement without considering the content. This ineffectiveness of the laboratory work activity which does not fulfill the empirical aspect of learning is the main cause of students’ difficulties, and is therefore unable to train students to develop their critical thinking skills.

Reid & Shah [8] propose a model of effective implementation of laboratory work. There are 4 stages, namely the planning stage to make chemistry more real, to train the ability to observe, deduce and interpret, and to develop basic practical skills. The pre-laboratory stage deals with presenting the goal of the experiments and planning the experiments to be done. The experiment stage gives freedom to the students in deciding the methods to conduct the experiment. The last stage deals with the application of learning in a wider context for evaluation. These four stages are described in Figure 1.

![FIGURE 1. STAGES OF LABORATORY WORK IMPLEMENTATION [8]](image)

The concept of mini laboratory using classrooms, library, and the surrounding environment involves students in problem solving. Mini laboratory can facilitate students in connecting different disciplines of knowledge as the basis to design a small or big experiment to develop students’ creativity and experience [9,10].

II. METHODOLOGY

This research aims to (1) analyze the problems in the laboratory work implementation in the Biochemistry Course in Mataram University, (2) analyze students’ critical thinking skills in writing Biochemistry laboratory work reports, and (3) analyze the opportunity for the development of mini laboratory model in the Biochemistry learning instruction.
The research to identify problems in the implementation of laboratory work in the Biochemistry course in Mataram University was conducted using a quantitative method and questionnaires were employed as the data gathering technique. Two types of questionnaires were developed, namely a questionnaire for the lecturers of Biochemistry course and a questionnaire for the students of the Biochemistry course. The questionnaire items consisted of 5 indicators, such as the implementation of laboratory work in the Biochemistry course, lecturer’s involvement in the implementation of Biochemistry laboratory work, the integration of the implementation of the Biochemistry laboratory work and face-to-face interaction in class, the implementation of the Biochemistry laboratory work in training students’ critical thinking skills, relevance of the Biochemistry laboratory work to the students’ needs and the feedback on the implementation of the Biochemistry laboratory work to the students’ critical thinking skills. The questionnaire for the students consisted of 18 questions using a 4-item Likert scale of never, sometimes, often, and very often. The questionnaire for the lecturers consisted of 18 questions using a 4-item Likert scale of has never been implemented, has been discussed, has been planned to be implemented, and has been implemented. After the questionnaires were validated by two experts in Chemistry education, it was found that only 16 items were qualified for the lecturer questionnaire and 17 items were deemed valid for the students’ questionnaires.

The valid questionnaires were then distributed to the samples to fill in. The research samples were 54 students in the Chemistry Education Study Program, Faculty of Teachers Training and Education, and 51 students of the Chemistry Department, Faculty of Mathematics and Natural Sciences, Mataram University taking Biochemistry course. There were two Biochemistry lecturers.

III. RESULT

The results of the questionnaire analysis show that the problems and obstacles identified in the implementation of the Biochemistry laboratory work are (1) the laboratory equipments were not available, the Biochemistry laboratory work were not able to develop students’ critical thinking skills, the feedback of the laboratory work results had not been best responded, the lecturer’s involvement in the implementation of the laboratory work was not optimum. However, students gave positive responses to the relevance of laboratory work to their needs and the implementation of group work during the Biochemistry laboratory work in the laboratory.

From the analysis results of the students’ answers, it was found that 61% of the students working well in a group work responded positively to collective laboratory work. Students felt that through laboratory work they had an opportunity to develop their interest in the Biochemistry course. The students responded quite differently to the integration of laboratory work materials and the theory discussed in the class. The students of Chemistry Education, FKIP, Mataram University taking Biochemistry course, gave a positive response to the integration of the materials being practiced and the theory they learned in the class. 55% of the students of the Chemistry Study Program, FMIPA, Mataram University, stated that sometimes the laboratory work materials in the laboratory did not correspond to the theories they learned in the class.

Some 0.06% of the students felt comfortable working in the laboratory, some also felt that they did not understand and did not get clear explanation of the laboratory work procedures from the manual. Students felt that they found obstacles during the laboratory work caused by the unavailability of laboratory equipments. In terms of the implementation of laboratory work, the session did not start with the problems to be solved but they only worked according to the procedures in the laboratory work manual. Therefore, the implementation of the Biochemistry laboratory work was more like a cookbook laboratory experiments. The majority of the students explained that they had never been given an opportunity to conduct a preliminary research and to design an independent experiment.

The students stated that the lecturer’s involvement in the practicum activity was very minimum. 56.2% of the students stated that the Biochemistry lecturers never gave an explanation of the topics to be practiced, 61.9% of the students stated that the lecturers did not give feedback, and 65.7% of the students stated that they did not have an opportunity to have a discussion. In addition, 66.7% of the students stated that they never discussed the results of the Biochemistry laboratory work in the class.
The results of the questionnaire analysis distributed to the students were corroborated by the students’ written comments and suggestions. The comments from 105 students showed that there were four factors being focused on, namely the laboratory instruments or facilities, laboratory work materials, lecturers’ involvement, and the laboratory work implementation. The summary of the students’ comments are shown in Table 1.

From the questionnaires distributed to the Biochemistry lecturers, it was described that the Biochemistry course was equipped with laboratory work. In addition, the goal of the laboratory work was clearly stated in the laboratory work manual, the implementation of the laboratory work was integrated with the theories learned in the class; there was a concordance between the laboratory work material and the materials presented in the class, and before the laboratory the goals of every laboratory work activity were explained. Biochemistry lecturer gave meaning to the integration of the theory and practice done by combining the evaluation results of the laboratory work and the scores of assignments, midterm tests and final tests.

Some statements in the questionnaires show that some activities were not done, according to two lecturers. Lecturers did not provide an opportunity for the students to conduct preliminary studies, discuss the preliminary studies being conducted, carry out the experiment according to the laboratory work manual, propose more laboratory work topics to be demonstrated by the laboratory work assistants and lecturers, and the students were not given opportunity to present and discuss the results of the experiments in the class. In addition, efforts were not made to use laboratory work materials which could be found in the surrounding environment, although they had discussed the issues previously. Lecturers did not give feedback to the students’ laboratory work reports. The evaluation of the laboratory work reports were entirely conducted by the laboratory assistants. Although every year the laboratory work manual is revised, it has not been designed to develop the students’ critical thinking skills. The Biochemistry lecturers suggested to improve the learning and teaching of Biochemistry by extending the duration of the laboratory work, and it was necessary to provide a training session for the lab assistants assigned to help the Biochemistry laboratory work.

<table>
<thead>
<tr>
<th>No.</th>
<th>Suggestions</th>
<th>Percentage (%)</th>
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<tr>
<td>1.</td>
<td>The Laboratory Facilities Must Be Added And Repaired, Especially The Laboratory Glassware And The Laboratory Work Materials.</td>
<td>61</td>
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<tr>
<td>2.</td>
<td>Laboratory Work Materials:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Laboratory Work Materials Must Be Updated</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>B. Relevance With The Theories They Learn In The Class</td>
<td>27</td>
</tr>
<tr>
<td>3.</td>
<td>Lectures’ Involvement In The Implementation Of Laboratory Work, Feedback And Discussion Of The Laboratory Work Results.</td>
<td>35</td>
</tr>
<tr>
<td>4.</td>
<td>Implementaion Of Laboratory Work:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Laboratory Cleaniness</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>B. Discipline Of The Laboratory Work Assistants</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>C. Grouping</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>D. Meaningful Reports</td>
<td>4</td>
</tr>
</tbody>
</table>

The research results being explained above were used as the basis to develop the biochemistry laboratory work. In accordance to the requirements of the chemistry curriculum in the university, Mbajigoru & Reid [11] show that laboratory work aims should emphasise the role of labwork in making chemistry real as well as developing (or challenging) ideas rather than a focus on practical hands-on skills; labwork should offer opportunities for genuine problem solving. Laboratory work does not necessarily train the students’ psychomotor, but it is also expected to develop ideas and processes, and to offer ample opportunities for students to solve problems completely.

Laboratory-based learning consists of four types, namely expository, inquiry, discovery, and problem-based learning. These types of learning are classified based on three descriptors, namely outcomes, approach, and procedures. The three laboratory-based learning descriptors are shown in Table 2. The outcomes of all types of laboratory-based learning can be predetermined or undetermined. The expository, discovery, problem-based learning activities have predetermined outputs. In the expository learning, both students and instructors will know the expected outputs. For the discovery and problem-based activities, only instructors
know the expected results. Expository and problem-based learning specifically use deductive approach which preconditions the students to use basic principles to understand specific phenomena. The discovery and inquiry learning allow students to use the inductive approach through observation of real examples [12].

TABLE 2. DESCRIPTORS OF THE LABORATORY-BASED LEARNING

<table>
<thead>
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<th>Style</th>
<th>Descriptors</th>
<th>Approach</th>
<th>Procedure</th>
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<tr>
<td>1</td>
<td>Expository</td>
<td>Predetermined</td>
<td>Deductive</td>
<td>Given</td>
</tr>
<tr>
<td>2</td>
<td>Inquiry</td>
<td>Undetermined</td>
<td>Inductive</td>
<td>Students Generated</td>
</tr>
<tr>
<td>3</td>
<td>Discovery</td>
<td>Predetermined</td>
<td>Inductive</td>
<td>Given</td>
</tr>
<tr>
<td>4</td>
<td>Problem-Based</td>
<td>Predetermined</td>
<td>Deductive</td>
<td>Students Generated</td>
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</table>

The implementation of cookbook laboratory experiments using an expository method has some limitations, such as (1) students tend to repeat the observation conducted by the previous batch; (2) students have limited understanding regarding the laboratory work process; (3) students conduct the laboratory work only by using a cookbook method without having an opportunity to make and develop a hypothesis; (4) students are not trained to be responsible for their own groups [13]. Cookbook laboratory experiments do not create a meaningful learning as it is only able to develop lower-level cognitive skill [14,12].

The expository method to implement laboratory work is not always a bad method. The expository method is good to convey basic knowledge, but it is not good to apply and train students' analytical skills [15].

The ability to develop students’ critical thinking skills can be evaluated through their laboratory work written reports. The analysis result of 105 students’ laboratory work reports highlights some shortcomings, such as:

a. Quotes are not cited clearly.
b. Inconsistency between quoted texts and references
c. The discussion section focuses more on explaining working methods than on the laboratory work results
d. The written language is hard to understand.
e. The students are unable to connect the results, theories cited in the theoretical foundation and the concepts learned in the class.
f. Students are not able to defend the laboratory work results so that in the discussion, it is common to see expressions such “due to student’s errors.”
g. The sentences in the conclusion section are too long.

The students’ Biochemistry laboratory work reports have not been used as the materials for an integrated evaluation of the theories. The laboratory work evaluation is fully given by the laboratory work assistants, while the students’ laboratory work reports end at the evaluation stage. An oral report and information sharing with other students as a useful feedback of the investigation process have not been done.

Reid & Shah [8] identify some problems which impede laboratory experiments in the university such as (1) the concept of laboratory experiments has not been implemented properly in the higher learning institution, (2) the cost and time are not worth students’ learning experience, and (3) the overlapping of the skills students are expected to master. The tendency to use the expository method also dominates the implementation of laboratory work so that it does not develop students’ critical thinking skills. This triggers the development of other methods to be able to produce high-quality laboratory work in the university.

Bartholomew et al. [16] compare the expository laboratory experiments and simulation. The research results illustrate that a simulation approach gives the same performance as the expository method even though the students’ ability to use laboratory simulation exceeds those who use expository laboratory work. The laboratory simulation approach brings more advantages to the students in that students are able to control time, location, and speed of their interaction compared to the laboratory work using expository instruction.

Other research attempts to replace the expository method with another method in the laboratory experiments. Vianna et al. [17] use a mini project which results in the increase of students’ self-confidence. It is reported that the inquiry laboratory approach has advantages such as in developing students’ understanding.
on materials, and applying their knowledge in new situations; improving ability in the knowledge construction, reasoning, communication, explanation, and the increase of motivation among the students [18,19]. The excellence of inquiry-based laboratory instruction shows that the laboratory work patterns in the university should reduce the use of expository method in the implementation of laboratory work. The inquiry method in the Biochemistry course is expected to facilitate students to observe phenomena macroscopically, so that it would be easier to connect microscopic and symbolic aspects. In addition, inquiry-based laboratory instruction can develop dynamically according to the phenomena being observed by the students in their daily life. This is different from the current laboratory work which is implemented merely to copy the existing laboratory work manual and which has not been reconstructed.

In addition to the inquiry method, the use of Problem Based Learning (PBL) in the chemistry laboratory work can be an alternative to increase the quality of laboratory work. Liceaga et al. [20] found that 80% of the students treated with modified Problem-based learning approach gained enough background knowledge to understand and solve the problems, 70% of the students show that the use of PBL approach can reinforce the course materials during the course and laboratory work, 50% of the students respond that PBL can help them develop new ways of reasoning the learning materials and 65% of the students respond that teaching using PBL will train students’ critical thinking skills. From the survey, 56% of the total respondents prefer to participate in a modified PBL compared to the expository method.

The concept of mini laboratory emphasizes on the fact that laboratory is not limited to a building containing chemical equipments and samples, but has a wider meaning. Laboratory work can be done outside the laboratory and students can be required to design their own laboratory work. The problem being investigated in the laboratory work can adopt problems in the society, such as malnutrition or enzyme utilization to create a simple product.

The result of the questionnaire analysis being described above provides an opportunity for development in Mataram University. The development of mini laboratory model attempts to seek integration between laboratory work and face-to-face interaction in the Biochemistry course. The integration is related to the implementation process of the laboratory experiments all the way through the evaluation process, not by combining the evaluation results of the laboratory work and the assignment scores, midterm tests and final tests. The learning model shows that laboratory work and face-to-face interaction are a continuous learning cycle to attain correspondence between theories and practice. Evaluation is not merely assessed through laboratory work combined with midterm and final tests. Evaluation is done through the assessment of the students’ laboratory work reports by giving them a chance to present the results of the laboratory work and an opportunity for the lecturers to discuss the results of the laboratory work.

Efforts to develop a mini laboratory model are expected to facilitate students to develop high critical thinking skill and scientific attitude. In addition, a KKNI (Indonesian National Qualifications Framework)-based curriculum is about to be applied in the university for undergraduate students qualifications which cover attitude, values, work skills, mastery of concepts in specific and general fields of knowledge, and responsibility. The qualifications are closely related to the thinking skills which do not only cover a critical thinking process but also involve the development of attitude [21]. The laboratory work activities are able to develop students’ critical thinking skill and attitude [22].

Mini laboratory is expected to solve the Biochemistry laboratory work problems in Mataram University as characterized by (1) the integration of the learning process in the class and that cookbook laboratory experiments which only copy previous laboratory work procedures can be minimized, (2) unlimited to building, chemical equipments and samples, but on the reuse of waste and cases existing in the environment so that laboratory work manual will be more dynamic and relevant to current situations, 3) students are given opportunity to design their own investigation, and 4) students’ written reports are used as the basis of evaluation which allows students to write a good and systematic Biochemistry laboratory work report and to present the results of the laboratory work in the class.
IV. CONCLUSION

The findings from the analysis of the students’ and Biochemistry lecturers’ questionnaires show that the integration of Biochemistry laboratory work and the theoretical lectures in the class is not optimum yet. This is shown by the fact that students were not given opportunities to conduct a preliminary research, lecturers’ involvement in the process of laboratory work was not optimum and the lecturers did not give feedback on the results of laboratory work through a presentation. Students’ laboratory work reports have not become an integral part of the classroom learning process. The results of the analysis of the students’ Biochemistry laboratory work show that the students have not developed their critical thinking skill. This finding opens an opportunity for the development of mini laboratory model which is integrated, unlimited to space, dynamic, and which allows students to present the results of the laboratory work in a class presentation.

REFERENCES

THE UTILIZATION OF SUBJECT SPECIFIC PEDAGOGY (SSP) SCIENCE TO OPTIMIZE MASTERY KNOWLEDGE, ATTITUDE, AND SKILLS JUNIOR HIGH SCHOOL STUDENTS

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Abstract – The purpose of this paper is to find out the effect of science SSP in optimizing the acquisition of knowledge, attitude, and skills of students. A teacher in performing his duties as an educator in the school, it is necessary to have a set of knowledge about how it should educate children. Teacher is not just skilled in delivering teaching materials, but in addition he must also be able to develop the child’s personal, developing a child’s temperament, and develop and sharpen the conscience of the child. In the implementation of teachers also must have the ability in the field of content and pedagogy to support their professional competence. One of the innovations that can optimize these capabilities is to produce a device in the form of SSP, science SSP devices have been because it can help teachers who have specific disciplines still are physics, biology and chemistry but should teach science in an integrated manner. SSP developed consists of lesson plans, Syllabi, worksheets, and student assessment sheets, with packaging content science becomes a learning tool that educates, comprehensive and solid is expected to have an impact on the increase can be used as a reference for optimizing use of science SSP mastery of knowledge, attitude, and skills of students.

Keywords: Attitude, Knowledge, Science SSP, skill

I. INTRODUCTION

A professional teacher not only has the ability to master the material in teaching but also must have the ability pedagogy, where these capabilities include the ability to manage learning, by combining a display teaching strategies that support classroom environment, and applied to all subject areas of learning and teaching. Based on Undang-Undang Number 14 of 2005 about teachers and lectures subsection 10(1), states that: the teachers’competency includes: pedagogical, personal, social, and professional competence acquired through professional education. When teacher mastery four of competencies, will create a learning design as expected. The successful learning depending on standard design learning that conducted was the obtaining of the success of learners after participating in learning activities is the form acquisition of knowledge, attitude and skills. So a teacher is a profession that requires special expertise, because the teacher is not just appear in delivering teaching materials, but should be able to develop the child's personal, developing a child's temperament, as well as shaping children's moral, therefore, teachers must master the content (material), and science teach. For that a teacher must have the ability to integrate understanding of content (content knowledge) and understanding of how to educate (pedagogy knowledge) or the term is known as the PCK (Pedagogical Knowledge Content). According to Shulman [1], PCK is a unique knowledge for teachers in learning as it relates to how teachers educate (what they know about teaching) and how to submit material (what they know about what they teach)[1].

Subject Specific Pedagogy has the same meaning as the pedagogical content knowledge (PCK) as stated by Shulman [2] that PCK includes the most useful forms of representation of (topics), the most powerful analogies, illustrations, examples, explanations, and demonstrations-in a word, the ways of representing and
formulating the subject that make it comprehensible to others [2]. Therefor PCK give useful thing to representing and formulating the subject matter to be understood by the students, with a focus on how to present and teach so that the students can understand.

Subject Specific Pedagogy (SSP) is a set of instruments development results of PCK which the SSP is packed into a learning device that educates, comprehensive and solid competence, subkompetensi, content, methods, strategies, media, and evaluation. SSP components, among others: (1) the syllabus; (2) Learning Implementation Plan (RPP); (3) student Worksheet (LKS); and (4) assessment. Certainly in its application, SSP can be combined with the model or method appropriate learning, for learning more creative, and innovative. The goal of the use of SSP this is the form mastery of knowledge, attitude, and skills

Based on some of the reasons, it is necessary to study on the use of science SSP to expect this study to be a reference of innovation for teachers to improve the quality of learning is more effective.

II. RESEARCH METHOD

This study aimed to examine the science SSP as a learning tool in optimizing knowledge, skill and attitude of students. The research methodology used is the study of literature. Literature used are journals, books and the internet articles based on this study is expected to be an additional reference in the science IPA optimize learning.

III. RESULT AND DISCUSSION

In the last two years, this Science SSP had been developed to improve aspects of knowledge, attitude, and skill. The following are some studies literature related to science SSP can be viewed on table 1.

<table>
<thead>
<tr>
<th>Table 1. List The Research Science SSP 2015-2016</th>
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<tbody>
<tr>
<td><strong>Title of research</strong></td>
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<tr>
<td>Developing a subject-specific pedagogy (SSP) for science based on the scientific approach to the science process skill and character of the students of SMPN 1 Padang Batung, Hulu sungai regency</td>
</tr>
<tr>
<td>Developing Essence and Energy Subject Specific Pedagogy Based on Local Wisdom to Improve Literacy Science and Environmental Care of Students of madrasah Tsanawiyah.</td>
</tr>
<tr>
<td>The Development of Subject Specific Pedagogy (SSP) model Problem Based Learning to Improve the Critical Thinking Skills and Problem Solving on implementation of Curriculum 2013 with The Theme of Climate Change in Junior High Scholl</td>
</tr>
<tr>
<td>The Development of Subject Specific Pedagogy (SSP) of science based on project based learning (PjBL) to Improve Student’s Science Process Skill and Curiosity of SMP Negeri 1 Pambanan</td>
</tr>
<tr>
<td>Developing Subject Specific Pedagogy (SSP) Ecosystem Subject Using the SETS Approach to Enhance the Problem Solving Skill of 10th Grade Students of SMA/MA in Montong Gading Distrit, Lombok Timur</td>
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</table>

According to reference [3] Science SSP is a packing content into a field of study learning device that educate comprehensive and solid competence, subkompetensi, materials, methods, strategies, media, and evaluation. Teacher can make learning device that is the result of creativity in the form of components of learning such as Syllabi, lesson, plans, worksheets, and student assessment sheets [3].

Reference [4] states that knowledge, attitude, and skill have the following definitions: knowledge is a condition/conclusion or information that describing knowledge after receiving information compared with prior knowledge owned. The knowledge of the person can be grouped into three categories: (1) declarative knowledge is factual information on a subject that is stored in one's memory, (2) Procedural Knowledge is one's understanding about how and when to use factual information, (3) Knowledge Strategy is knowledge of the facts and procedures used to plan, monitor and revise the direction of the planned objectives [4].

The level of competence of a person is determined by its attitude, which will determine how to behave in a certain way on an object events. Experts argue that human is not born with attitude, they obtained attitude
from the series process of lessons from childhood to adulthood. Attitude involves the evaluation of the issues over the object or event that is perceived and observed, and put the person in a particular behavior. Many experts argue that individual knowledge should not be as a result of their skill, but skill is evidence of the knowledge. Skill is the result of apply their knowledge and abilities. Skill is a talent and learned person to do a job.

Skill will change with training or experienced. Skill divided into three: (1) a Cognitive skill are the ability to view and analyze the events and observe the important truth, critical thinking skills to analyze future events and is able to be proactive. (2) Psychomotor skills are skills that involve the ability to perform physical tasks or technical. (3) Interpersonal skills are personal interaction skills involves the ability to cooperate with others.

The legal basis in the developing SSP in accordance with Regulation 19 of 2005 article 17, paragraph 2, which reads and school committee, or madrasah and madrasah committee, develop curriculum and syllabus education unit curriculum is based on the basic framework and standard competencies of graduates under the supervision of district offices/city responsible for education for elementary, junior high, high school and vocational school, and departments of the government affairs in the field of religion for MI, MTS, MA, MAK.

Research on the use of science SSP have been much done out which result have an impact on knowledge, attitudes and skills of students, such as the research that has been conducted by Norhamidah, the results showed that the SSP developed consists of syllabi, lesson plans, worksheets learners (LKPD), and sheets assessment process skills and character, which is based on an expert assessment, science teacher, peers, and through trial one-on-one, small group trial, as well as field trials declared eligible for use in science learning in SMPN 1 Padang Batung. From this study showed that sains SSP effective based on scientific approach to improve science process skills of students in SMPN 1 Padang Batung and scientific-based science SSP effective approach to improve the character of the students in SMPN 1 Padang Batung [5].

Research on science SSP also carried by Muhammad Fuad Sha’ban, which shows that the SSP has developed a decent used, based on assessment results validator "very good" and based on the results of different test between control and experimental class that shows the differences in the average value of literacy science between the two classes which there is increasing scientific literacy of students using the SSP developed based on local wisdom [6].

Results development SSP of Atha Yessi Saputri form of syllabi, lesson plans, and instrument ratings LKPD critical thinking skills and problem solving as well menunjukian decent results used in learning the excellent category. SSP developed can improve critical thinking skills of students from both categories to be very good, and included in an increase in the medium category. SSP developed can improve critical thinking skills of students from both categories to be very good, and included in an increase in the medium category. SSP developed can improve the problem solving skills with a modest increase in the category [7].

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The results of the Rias Retnadi Wiworo Hayu about science SSP which feasible to use the category of "very good" 2. Science SSP based PBL can improve process skills IPA 3. SSP can increase curiosity. 4. Science SSP based Project Based Learning effectively improve the skills and curiosity [9].

Based on some development results Science SSP has been done, on average, show the results that the use of SSP had a significant impact in improving knowledge, attitudes and skills of learners. SSP result this development could be a reference for teachers and innovation in science teaching. Teachers can further optimize the time in class because you’ve set learning device that consists of a syllabus, lesson plans, student assessment sheets LKPD and which have been designed in accordance with the needs of content and can be delivered to students to be more simple so that students more easily understand the material presented.
IV. CONCLUSION AND SUGGESTION

This study provides information that the use of subject-specific pedagogy is very important in learning science. With science SSP, teachers can draw on a comprehensive learning materials. Another benefit derived from the development of the SSP is in addition an impact on knowledge, skills, and attitudes of the students, that teachers who have basic knowledge that is not specific Science can be helped in the teaching of science as a whole. In the future, this SSP can be optimized further by using IT-based media. Because SSP is a dynamic devices that evolve constantly in line with the teaching experience of the teachers themselves.

REFERENCES

EMBEDDING CHARACTER BUILDING BASED ON LOCAL WISDOM IN BIOLOGY SUBJECT MATERIALS

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Abstract - Character building is life learning values in order to develop students’ personality of which is related to the culture where the education is hold. One of the hereditary cultures is local wisdom. It is human intelligence that is owned by a particular ethnic group gained experience through society. This paper aims to analyze the embedding of character building based on local wisdom in Biology subjects Materials. This paper was made based on literature study by using qualitative data. The technique of data collecting was documenting the prime and secondary data. The collected Data was Analyzed so that the conclusion could be drawn. The findings gained from this study are local wisdom literature values can improve students' character values.

Keywords: Character Building, Local Wisdom, Biology Subject Materials

I. INTRODUCTION

Character education is the transformation of life values to be fostered and promoted in one's personality to become a human life in our behavior. The term in character education is derived from two words: education and character [1]”. According to the Law on National Education System, education is a conscious and deliberate effort to create an atmosphere of learning and the learning process so that learners are actively developing the potential for him to have the ability religious spiritual, self-control, personality, intelligence, character, and skills needed him, community, nation and state [2]”. According to David Elkind & Freddy Sweet (2004), character education is defined as follows: “character education is the deliberate effort to help people understand, care about, and act upon core ethical values. When we think about the kind of character we want for our children, it is clear that we want them to be-able to judge what is right, care deeply about what is right, and then do what they believe to be right, even in the face of pressure from without and temptation from within”[3]. Meanwhile, Hurlock indirectly reveal the characters are in personality. Character implies a moral standard and involves a value judgment[1].

Historically-geneologis, originator of character education that emphasizes ethical-spiritual dimension in the process of personal formation is the German pedagogue FW Foerster (1869-1966). There are four basic traits in character education according to Foerster. First, the regularity of the interior with every action is measured based on a hierarchy of values. Values become normative guidelines of each action. Secondly, the coherence that gives courage, makes one firm on principle, not easily swayed in new situations or fear of risk. Coherence is the foundation that builds trust each other. The absence of coherence undermined the credibility of a person. Third, autonomy. There someone internalize external code to be for personal values. It can be viewed through an assessment of the personal decisions without being influenced by or pressure from others. Fourth, constancy and fidelity. Tenacity is one's resistance to covet what is considered good. Faithfulness is the basis for respect for the commitments that have been selected. Characters that determine the shape of a person in his actions [4].
II. MATERIALS AND METHODS

In essence, the national education goals based on the conceptual philosophy of education that can prepare future generations to survive and successfully face the challenges of the times. The function and purpose of national education according to the National Education System Act of 2003 Chapter 2 Section 3 “national education serves to develop the ability and character development and civilization of the nation’s dignity in the context of the intellectual life of the nation, aims to develop students’ potentials to become a man of faith and devoted to God Almighty, noble, healthy, knowledgeable, skilled, creative, independent, and become citizens of a democratic and responsible[2]. The aim of education is considered very severe when associated with who is responsible for the continuity of the functions listed in the law. Character education in the school setting has the following objectives [5]:

1) Strengthen and develop the values of life that are important and necessary to have a personality / ownership typical learners as values are developed. Strengthening dean has the meaning that the development of education in the school setting is not just dogmatization value to learners, but a process that brings learners to understand and reflect on how the value becomes important to be realized in the behavior.

2) Correcting behavior of learners who do not conform with the values developed by the school. Character education has a target to correct a behavior to be better learners, which is interpreted by correcting behavior that is understood as a pedagogic process and not an imposition or condition that does not educate.

3) Building a harmonious connection with the family and society and living environment in the educational responsibilities portray characters together. Character education in schools should conjunction learners with educational process both in the family and community and their environment, because it affects the achievement of the grow - develop the character of learners and be able to know and develop its potentials and their place of residence.

Character education is embedded in the attitudes of learners through the learning - formal and informal learning as training and habituation attitude for the nation's children. Character education can be inculcated early, like praying before and after the study. Character education is directed as identity formation and behavior of students. There are 18 character values that can be instilled in children [6],[7]:

a. Religious: attitudes and behaviors are obedient in carrying out the teachings of his religion, tolerant implementation of the practice of other religions, and live in harmony with other faiths.

b. Honestly: behaviour which is based on an attempt to make himself as a person who always trustworthy in word, action; and jobs.

c. Tolerance: attitudes and actions that respect the action that respects differences of religion, race, ethnicity, opinions, attitudes, and actions of others who are different from themselves.

d. Discipline: actions that demonstrate orderly behavior and comply with various appointment and regulations.

e. Hard Work: behavior that shows an earnest effort to overcome various barriers to learning and assignments, affiliate finish the task as well as possible.

f. Creative: think and do something to generate new ways or results of something already owned.

g. Self-sufficient: attitudes and behavior which are not easily dependent on others to complete tasks.

h. Democratic: the way of thinking, acting, and acting the opinion that there are equal rights and obligations to himself and others.

i. Curiosity to know: attitude and actions are always working to find more depth and breadth of something learned, seen, and heard.

j. National spirit: the way of thinking, acting and sound that puts interests of the nation above self-interest and group.
k. Love homeland: the way of thinking, being and doing that show of loyalty, care and high appreciation of language, physical and social environment, culture, economics and politics.

l. Rewarding Achievement: attitude and actions that drove him to result something useful for society, and recognize and respect other people's success.

m. Friends / communicative: actions that demonstrate a sense of love to talk, mingle and cooperate with others.

n. Love Peace: attitudes, words, and actions that cause others to feel happy and secure on the presence of himself.

o. Reading habit: the habit of the time to read the various readings are on ability for him.

p. Environmental Care: attitudes and actions which seeks to prevent damage to the surrounding natural environment, and develop measures to repair the environmental damage that has occurred.

q. Social care: attitudes and actions that always wanted to help other people and communities in need.

r. Responsibilities: attitudes and behavior of people to carry out their duties and obligations, he should do, to ourselves, community, environment, country and God Almighty.

Reference [8] explained by considering the increase the quality and meaningfulness of character education, it will encourage the tendency of behavior and attitude of students towards the implementation of the characters in everyday life. It is rather difficult to measure the results of character education students because it requires quite a long time, too often we feel deceived by the attitudes and behavior of students during the school day that often feature pretense, but indicators of a positive trend towards the implementation of the student's character can be seen at the moment educational process takes place[8].

Education is seen as a strategic factor in creating the progress of a nation. Quality education is able to produce quality human resources with indicators of qualified experts, skilled, creative, innovative, quality, productive, and have the attitude (attitudes and behaviors) were positive. Character education is moral education plus, namely education which involves aspects of knowledge (cognitive), feeling (feeling), and action (action). Teachers have a significant role because through character education, students will be emotionally intelligent. Emotional intelligence is the most important provision in preparing students to succeed in the face of all kinds of challenges, including the challenge to succeed academically. Character education in schools is necessary, although the basis of character education is in the family. When children get a good education character of the family then the next child would be a fine character anyway. But many parents are more concerned with aspects of intelligence rather than character education. Besides Daniel Goleman [9] also said that many parents fail to educate their children characters either because of busy or because it is more concerned with the cognitive aspects of the child. But all this can be corrected by providing character education in schools. The role of the school is certainly much needed by the quality of its teachers [9].

Local knowledge is a way of life and science as well as various life strategies that intangible activities undertaken by local communities in addressing the various problems in the fulfillment of their needs (journalulfah Fajarini). According Rahyono, local knowledge is human intelligence which is owned by certain ethnic groups obtained through the experiences of communities [10]. Scientists anthropology, as Koentjaraningrat, Spradley, Taylor, and Suparlans, has categorized human culture into the container to the idea that local wisdom, social activities, artifacts [11]. Local knowledge is also defined as a policy or noble values contained in the local cultural riches in the form of traditions, proverbs, words of wisdom, and the motto of life.

According to Gunawan there are several characteristics of local wisdom is: (1) awakened by the experience; (2) tested after being used for centuries; (3) can be adapted to the culture now; (4) commonly done by individuals and society; (5) is dynamic; and (6) is associated with a belief system. Local knowledge of rules concerning intangibles: (1) human relationships, such as marriage; (2) the relationship of man to nature, as nature conservation efforts, such as indigenous forests; and (3) the relationship with the unseen, like God and supernatural spirits. Local knowledge can be customs, institutions, words of wisdom, and the proverbial [12].
For example, according to Fibre pinandhita satriya Candra Rini [13] is the character satriya pastor. Meaning of satriya character is the main character in the form of truth, weweka character (character always choose good works than that is not good) and the nature of science priority. The meaning of the character is a character prioritizing pastor tranquility and character acting puja (be loving). Therefore, local wisdom satriya pinandhita a human attitude that promotes truth, knowledge, calm, and always strive to avoid actions that not good. For example, when a physician to practice it must be based on science that is adequate, prioritizing accuracy (truth) in the act, and ready to account for what it does as proof character weweka. Character satriya pinandhita for students can be applied in the form of scientific work not only from In terms of cognitive but also its implementation is definitely beneficial for everyone. Besides honesty or cheating on exams is one theory that is easily and often, but in practice very hard done by students. Of course, slah the causes is the education system in Indonesia which places great emphasis on the value or number only as a measure of student success [13].

Problems that occur in using local knowledge to instill character in self-learners is how to implement it in schools. It is very closely linked to the potential of teachers in using/ namafsakan environment as a learning medium that can help in instilling character learners in accordance with the purpose of education itself. Value or competence to be integrated customized with local knowledge of each area. Then analyzed and adjusted with the competence to form instructional materials and assessment materials that can eventually be implemented into the learning process.

Implementation of local wisdom-based character education in schools aimed at contextual learning. Biology to face various problems faced life today and in the future. Biological objects easily found in the environment, so that the teacher should be able to bring the object is significantly better in the classroom and outside the classroom structured tasks. From this description, it is local wisdom based character education should be integrated in biology learning at all levels of education from primary school to college. For example, cultivation of character education based on local wisdom in the high school. The first is to determine the theme and local knowledge, the next theme tersbeut integrated into the syllabus and lesson plans. This theme is then determined character values that must be owned by the students. In other words, this integration starting from mapping SK-KD, syllabus development, lesson plan development, development of teaching materials and test materials to the implementation into the learning process. Integrating local knowledge to infuse character education into subjects of Biology aims to introduce the values of character education and internalize these values into the behavior of learners through the learning process, both in the classroom and outside the classroom. In addition to the learning activities intended that students master the material taught, also designed so that learners know, care about and making behavior.

This paper was made based on literature study by using qualitative data. The technique of data collecting was documenting the prime and secondary data. The collected Data was Analyzed so that the conclusion could be drawn.

III. RESULT AND DISCUSSION

Instill character education through local wisdom school is appropriate. The role of the teacher is required to have the sensitivity slip character values in the local wisdom in the learning process, but the students could not be likened to empty glasses were filled at school and then filled with what is taught by the teacher, because a lot of cultural values which are absorbed through the environment and surrounding communities.

In a study Anvari, entitled "Development of Learning Module Biology Based Local Wisdom at Mount Merapi National Park for SMA/ MA Class X Matter of Biodiversity" that aims to identify indigenous communities around Merapi and the potential of biodiversity in the National Park of Mount Merapi showed that the Community Turgo living around Merapi have local knowledge relating to environmental preservation, known as ecological wisdom. The wisdom of people's views Turgo to Merapi, the use and cultivation of various species of plants and ceremonies. Ecological wisdom is reflected in the views of the community Turgo Merapi, the use and cultivation of various plant species as well as traditional ceremonies as a form of gratitude to God for the gift of abundant natural. With local knowledge of ecology are integrated into the material of biological keankeragaman more students have a sense of caring for others, cooperate and religious [14].
In a study Aan Hasanah, entitled "Development of Character Education Based Local Wisdom Community Minorities" that aims to uncover the values of local wisdom of the indigenous peoples Baduy Banten as forming the character, which is concerned about the environment, like cooperation, adhere to the laws / adat, simple / independent, democratic, hardworking and uphold honesty the result that the values are really internalized and preserved among the indigenous peoples to be taught, socialized, modeled and enforced strict rules so as to form a strong character. These values can be transmitted to learners in learning biology, for example in the matter of biodiversity in Indonesia, Ecosystems and Environment. One of the values that could be developed that is concerned about the environment; which is evident in the Commission Buyut following, "Buyut nu nitipkeun ka puun, nagara satelung puluh telu, bangan sawidak lima, pancer salawe nagara, gunung teu meunang dilebur, lebak teu meunang dirusak, larangan teu meunang dirempak, buyut teu meunang dirobah, lojor teu meunang dipotong, pondok teu meunang disambung, nu lain kudu dilainkeun, nu ulah kudu diulahkeun, nu enya kudu dienyakeun. "that is, the great-grandfather who Leave to puun, country thirty-three, rivers sixty-five, the center of twenty-five, the mountain should not be destroyed, the valley should not be undermined, the ban should not be violated, great-grandparents may not be altered, the length should not be cut short, not to be connected, which is not to be excluded, which is not to be denied, and that right must be justified [15].

In a study Wagiran entitled "Character Development Based Local Wisdom Hamemayu Hayuning Bawana" aims to reveal the meaning of such wisdom that is always seeking to improve social welfare and encouraging attitudes and behaviors of individuals which emphasizes the harmony between human beings, human nature, and human with God in carrying out life and livelihood [16]. Sri Sultan Hamengkubuwono X (Ansory, 2008 in Wagiran) argues that the philosophy hamemayu Hayuning Bawana obligations contained therein Tri Satya Brata which includes such things as the following. (1) Rahayuning Buwana Kapurba Dening Kawaskithaning manungsa (welfare of the world depends on the man who coined the sharpness of flavor). It refers to the harmony of the relationship between humans and nature, both in the scope of the world as well as a duty "Hamangku Earth", as well as a wider scope in the entire universe as a liability "Hamengku Buwana". (2) Dharmaning Satriyo Mahanani Rahayuning State (duty of human life is to maintain the safety of the state). It is the duty of human beings for living in a world where human life is dynamic, ie "Hamangku Nagara". (3) Rahayuning manungsa dumadi saka Kamanungsane (human safety by humanity itself). Based on the Tri Satya Brata, it appears that the philosophy hamemayu Hayuning Bawana contains a grand mission for man in the world in three substances, namely: Hamangku Nagara, Hamangku Earth, and Hamangku Buwana. Human duty to "Hamangku Nagara" because God made humans different, bergolong-golong and tribes, so that the necessary existence of state and government are set in order to avoid cross-surnup and crisscrossed among humans. A person must "Hamangku Earth" for the earth as a natural environment has provided livelihoods for humans to continue the descent from generation to generation, so that man must also keep, maintain, and develop sustainability. "Hamengku Buwana" is a human duty broader in recognizing, maintain, and preserve the entire contents of the universe in order to continue to provide resources for human life, such as the moon, sun, and other planets.

In studies M. Rizqon Al Musafiri, Sugeng Utaya, I Komang Astina entitled integration values using local wisdom ethnic in character education high school. Aiming for applications integrating the values of local wisdom ethnic in character education Using SMA in Banyuwangi. The results also have a biology lesson material that discusses local wisdom. In Class X KD 3.2 Communicating Indonesia's biodiversity and conservation efforts as well as the use of natural resources, also can put the values of local wisdom Using tribes. At the ceremony Kebo-Keboan local wisdom that can be included in this study is an attempt to preserve and maintain natural resources. In addition there is the attitude of caring for the environment by planting rice at certain times so that the environmental balance is maintained. The integration of character education by indigenous tribes Using performed in high school in Banyuwangi is expected to reduce the negative impact that comes from the influence of foreign cultures [17].

In a study entitled Sudarmiati build the character of children with the culture of local wisdom in the learning process at school. The goal is to build indigenous implement character education in the learning process at school. The results of some wise words based on local wisdom can be used as a positive attitude
development of character education just as crowded ing gawe, selfless containing a command or invitation. Becik ketitik striking style to inspire anyone, a great life always starts with big dreams. Educating with the heart will give priority to the establishment of such a positive attitude: honest, tolerant, trustworthy, and foster mutual grindstones, optimistic, confident, resilient tough and so forth. Wise words are used to motivate the students to build positive [6].

In the study Miranita Khusniati titled science learning model based on local wisdom in growing conservation character. Learning science is expected to create the character of learners to appreciate the various cultures that exist and try to preserve it. Science learning model based on local wisdom can be done through the reconstruction of the original science (indigenous science) into western science or scientific science. Application of science learning model based on local wisdom is to observe the culture in the community for the next reconstructed their science concepts that could ultimately grow the value of conservation character learners. observations on the culture in Brebes, Central Java, namely in terms of planting onions. Selection of this topic is the desire of the students themselves, who disclosed that one of the sub-sector that plays an important role in contributing to agricultural is horticulture. Horticulture consists of vegetable crops, fruits, and medicines. Shallots is a strategic vegetable crops, it is associated with the function of the onion as the main ingredients in almost all foods in Indonesia. They make the cultivation of onions in accordance ways taught by their ancestors. That prompted studentto make observations on planting onion culture that still use cropping systems that are ingrained since the first. Science learning model based on local wisdom through the reconstruction of the original science is able to deepen the concept of science students, and fostering conservation character[18].

IV. CONCLUSION

Based on the results obtained can be concluded that, by infusing character education based on local wisdom in biological materials, learners acquire the values themselves are integrated within himself and did it in everyday actions, thus forming characters to expect as values spirituality/ religious, concerned about the environment, cooperation and others.

REFERENCES

[12] Imam Gunawan, Mengembangkan Karakter Bangsa Berdasarkan Kesarifan Lokal.
THE USING OF COMPUTER AS A TOOL FOR PHYSICS COGNITIVE ASSESSMENT TEST “PhysCoTest” IN 21st CENTURY

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Abstract - The purpose of this paper is to determine the important of cognitive test for student with assisted computer. Computer based test became one of the innovations in the world of education. Cognitive tests in physics learning as a benchmark for educators to know the extent ability of learners achieve competence contained in the curriculum. The use of computer in form of Computer Physics Test "PsyCoTest" as an alternative to prevent cheating and efficiency of scoring test. Basically "PhysCoTest" is part of the Computer Based Test which complement the Paper Based Test. "PhysCoTest" created using Macromedia Flash 8 application and system test is displayed random. Test validated using Item Response Theory (IRT) model, and then the cognitive tests were valid will be packaged into "PhysCoTest" and tested to learners. The use of "PhysCoTest" is important in cognitive tests to help educators and learners in time efficiency test and accuracy of the test results.

Keywords: Cognitive Test, Computer Based Test, PhysCoTest, Item Response Theory (IRT)

I. INTRODUCTION

Physics is one branch of science that studies the phenomena of nature through a series of scientific process. Learning physics oriented cognitive abilities, psychomotor and affective. Assessment of attitude and affective character more unique because it is directly related to the character of the students, so that the process of the assessment should also be through direct assessment, whereas for cognitive assessment with regard to the intelligence of the students followed the teaching and learning process, educators can more easily assess what has been accomplished participants learners through cognitive assessment tests using either the Paper Based test (PBT) or take advantage of technological developments by using Computer Based test (CBT). As the days turned out development Paper Based Test (PBT) have some weaknesses, so that the Computer Based Test (CBT) is presented as a complement to the assessment exercise.

Assessment at the level of cognitive domain of Bloom’s Taxonomy consists of six categories consisting of Lower Order Thinking Skills (LOTS) include C1, C2 and C3 and Higher Order Thinking Skills (HOTS) include C4, C5 and C6. Taxonomy in education is a scheme for classifying the purpose of education, and standard of the end of a lesson [1]. Assessment can be seen as a tool used to measure learning outcomes, while generally vote seen as a way to determine the value, the extent to which students have achieved the objectives [2].

Tests are planned measurement tool used by educators to provide an opportunity for students to demonstrate achievement and its relation to predetermined objectives [3]. The variation in developing a written test, which is multiple choice, sentence completion, listing, true-false, matching, essay, and a modified form [4]. A cognitive tests created or developed based on Bloom’s taxonomy, every aspect of the taxonomic level emphasizes the assessment of learning with many examples of test items (mostly multiple choice) is provided for each category. Teachers so easy to know at what level of knowledge the students).

In practice they are rarely teachers use computer assistance in the administration of the test, while the computer apart as an innovative learning media, can also be used as an effective media ratings. The use of computers in class assessments increasing the interest in assessment which resulted in finding potential varies
between learners [5]. This means that the use of computers in the assessment showed mixed results so that the possibility of the same test results among students to be minimal. Due to the inclusion of ICT in education, it is necessary to reconsider and rethink, modify or alter the traditional inspection methods, electronic assessment tool has reduced the burden on teachers and facilitates to conduct the examination [6]. Computer Based Test (CBT) has many advantages, among others, saving testing time, save costs, reduce cheating in tests, reduce errors in the assessment and feedback the results of the test can be quickly and accurately known [7].

Preparation of the test generally uses classical test theory (CTT = Classical Test Theory). But in the preparation of the cognitive tests used the modern theory of the Item Response Theory (IRT), wherein the preparation of the test does not depend on the sample tests so that the results of the preparation of the test is more accurate. (Hambleton, Swaminathan and Rogers: 2]. The preparation of the tests in modern equipped with presentation of the tests in the modern use of computer Based test (CBT) needs to be done, it is encouraging the process of testing more accurate and efficient. So the use of computers as tools of cognitive tests physics "computer physics test" (PhysCoTest) designed using Macromedia Flas 8, that of a random question shown. Consistent with these problems, this research is intended to: 1) obtain cognitive test instruments are valid and reliable, 2) generate effective PhysCotest construction used in cognitive tests students.

II. LITERATURE REVIEW

Some of the theories that support the use of computer-related articles as an assessment tool physics cognitive tests include:

A. Assessment Cognitive Test

Principles of valuation and assessment standards emphasize two main ideas that should improve the assessment of learners and assessment is a valuable tool to make teaching decisions [8]. Assessment is not just a data collection learners, but also its processing to obtain a picture of the process and the learning outcomes of students. Dilakuukan assessment of teachers as a medium of reflection to determine what action to do next.

Assessment instruments are made must meet the cognitive, affective and psychomotor. During this time we already know the domain of Bloom's taxonomy, especially in the cognitive, usually in the realm of writing is written in C1 stands for cognitive stage of knowledge up to C6. Tests on the cognitive tests used to measuring the extent to which understanding of the subject matter is acceptable learners, of cognitive domains are domains that include mental activity (brain) [9].

Bloom creates cognitive domain into six levels, later revised to Bloom's taxonomy revision. Taxonomy comparison of before and after the revision is shown as in Table 1.

<table>
<thead>
<tr>
<th>Older Bloom's Taxonomy</th>
<th>Revised Bloom's Taxonomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Remember</td>
</tr>
<tr>
<td>Comprehension</td>
<td>Understand</td>
</tr>
<tr>
<td>Application</td>
<td>Apply</td>
</tr>
<tr>
<td>Analysis</td>
<td>Analyzing</td>
</tr>
<tr>
<td>Synthesis</td>
<td>Evaluate</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Create</td>
</tr>
</tbody>
</table>

But this time to design a test that is not focused on the skills of lower grade, Bloom's taxonomy revisions started to be used, thus analyzing, evaluating and creating including at high-level thinking skills. Test high-level thinking skills are also included into the cognitive tests that high-level cognitive tests. More clearly realm kognitif in bloom taxonomic revision is presented in Table 2.
<table>
<thead>
<tr>
<th>TABLE 2. STRUCTURE OF THE COGNITIVE PROCESS DIMENSION OF THE REVISED TAXONOMY [1]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.0 Remember</strong> – Retrieving relevant knowledge from long-term memory.</td>
</tr>
<tr>
<td>1.1 Recognizing</td>
</tr>
<tr>
<td>1.2 Recalling</td>
</tr>
<tr>
<td><strong>2.0 Understand</strong> – Determining the meaning of instructional messages, including oral, written, and graphic communication.</td>
</tr>
<tr>
<td>2.1 Interpreting</td>
</tr>
<tr>
<td>2.2 Exemplifying</td>
</tr>
<tr>
<td>2.3 Classifying</td>
</tr>
<tr>
<td>2.4 Summarizing</td>
</tr>
<tr>
<td>2.5 Inferring</td>
</tr>
<tr>
<td>2.6 Comparing</td>
</tr>
<tr>
<td>2.7 Explaining</td>
</tr>
<tr>
<td><strong>3.0 Apply</strong> – Carrying out or using a procedure in a given situation.</td>
</tr>
<tr>
<td>3.1 Executing</td>
</tr>
<tr>
<td>3.2 Implementing</td>
</tr>
<tr>
<td><strong>4.0 Analyze</strong> – Breaking material into its constituent parts and detecting how the parts relate to one another and to an overall structure or purpose.</td>
</tr>
<tr>
<td>4.1 Differentiating</td>
</tr>
<tr>
<td>4.2 Organizing</td>
</tr>
<tr>
<td>4.3 Attributing</td>
</tr>
<tr>
<td><strong>5.0 Evaluate</strong> – Making judgments based on criteria and standards.</td>
</tr>
<tr>
<td>5.1 Checking</td>
</tr>
<tr>
<td>5.2 Critiquing</td>
</tr>
<tr>
<td><strong>6.0 Create</strong> – Putting elements together to form a novel, coherent whole or make an original product.</td>
</tr>
<tr>
<td>6.1 Generating</td>
</tr>
<tr>
<td>6.2 Planning</td>
</tr>
<tr>
<td>6.3 Producing</td>
</tr>
</tbody>
</table>

The development phase good test as follows: 1) preparing test specifications, including: a) define test objectives, b) arrange grating tests, c) determine the test form and d) determine the length of the test, 2) writing test, 3) examine the test, 4) to test the test, 5) analyzing test items, 6) improvements in the assay, 7) assemble the test, 8) carry out tests and 9) to interpret the test results [10].

B. Computer Based Test (CBT)

The development of Information and Communication Technology (ICT) in teaching and learning has changed the paradigm of ratings [11] from the Paper Based Test (PBT) into a computer-based test that is usually called Computer Based Test (CBT). Bodmann & Robinson (2004), computer-based test offers several advantages over the traditional paper and pencil or paper-based, one of the benefits of CBT is the result of more accurate test and test results faster known student of the use of paper based test that requires a longer time correction.

Methods of using paper and pencil testing is already a few years ago, but as the development of technology testing method is equipped with electronic media, namely computer. Computer Based Test (CBT), present to complete the lack of testing methods using paper and pencil. Computer Based Test (CBT) has many advantages, among others, saving testing time, save costs, reduce cheating in tests, reduce errors in the assessment and feedback the results of the test can be quickly and accurately known [7].

C. PhysCoTest

PhysCoTest is a product that contains material question banks Temperature and Heat. PhysCoTest created using Macromedia Flash 8. The system developed at PhysCoTest illustrated in Figure 1, PhysCoTest System Flow Diagram.
I. Model Development

The development model used is the 4-D, which includes four stages Define, Design, Development and Dissemination [13]. Figure 2 shows the flow development 4D.

II. Trial Design Products

Design of product trials in the study include two packages question the temperature and heat the material, design trial conducted through the stages of validation expert, empirical validation, initial field trials and field trials.

III. Subject Try

Two sets of instruments which have been revised based on input from experts and declared valid, then tested on 250 students of class X Senior High School in DIY.

IV. Data Collection Techniques

Data collection techniques include engineering tests and nontes. Mechanical tests are used to measure the ability to think critically, while nontes technique using a questionnaire to measure the effectiveness of adherence to PhysCoTest.

V. Data Analysis Techniques

Data collection instruments include the validation questionnaire consisting of a questionnaire item development instrument validation test, questionnaire validation PhysCoTest display, as well as the questionnaire responses of teachers and students of the enforceability of the provision of tests using PhysCoTest.

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1) Instruments Validity

a) Content Validity

   Expert validation questionnaire prepared by the interval scale of 1 to 4. Quantitative data is converted into qualitative data. Analysis of questionnaire data validation is performed by the following steps:

   - The first step is to find the index V of Aiken [14] using the formula:
\[ V = \frac{s}{n(c-1)} \]  

Information:
Grading scale from \( I_0 \) to \( c \)
\( I_0 \) = the smallest scale
\( r \) = from \( I_0 + 1 \) to \( I_0 + c - 1 \)
\( s = total \ s \) of n rater

- The second step is the index V Aiken each item questionnaire validity converted into qualitative data with V index ranges from 1 to 0. The validation results declared invalid if the index V Aiken has a value with a range > 0.8.

b) \textit{Empirical Validity}

Test instruments that have been declared valid by the experts then tested empirically to learners. Grain tests analyzed using modern theory of Item Response Theory (IRT) model of Rasch (1 PL). Scoring test items using techniques Partial Credit Model (PCM) is a development of the model 1 OT and development of grain dichotomous Rasch model is applied to the grain polotom.

The results of empirical test data were analyzed using the Quest program has met unidimensional assumption test. Determination of criteria validity of each item on the Rasch model-based. Criteria declared invalid item (fit) criteria [15] validation of grain used in the study using the criteria infit mean square (MNSQ), with the criteria of 0.77 to 1.30. Validation whole grains developed by a mean value of INFIT Mean Square (Mean INFITMNSQ) and standard deviation or average value observed INFIT t (Mean INFIT t) and its standard deviation [16]. If the average INFIT MNSQ about 1.0 and 0.0 standard deviation or mean INFIT t approaching 0.0 and 1.0 standard deviation then the entire test fit with the model.

2) \textit{Instruments Reliability}

Reliability instrument performed with the help of Quest program, which the reliability test performed by reading the output of sh, the summary of case estimates the value of the reliability of the estimate indicates reliability. The value of the overall reliability of the instruments seen in the output data with the suffix tn, ie on the value of internal consistency.

<table>
<thead>
<tr>
<th>Reliability Value</th>
<th>Interpretation of Reliability Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;0,94</td>
<td>Excellent</td>
</tr>
<tr>
<td>0,91-0,94</td>
<td>Very good</td>
</tr>
<tr>
<td>0,81-0,90</td>
<td>Good</td>
</tr>
<tr>
<td>0,67-0,80</td>
<td>Enough</td>
</tr>
<tr>
<td>&lt;0,67</td>
<td>Poor</td>
</tr>
</tbody>
</table>

\textit{a) The Level of Difficulty (b)}

The level of difficulty (b) for each item is said to be good if the index lurch between -2.0 <b <2.0 were analyzed using Parscale program.

\textit{b) Item Characteristic Curve (ICC)}

Characteristics of the item indicated by the item characteristic curve (ICC) and the index of difficulty. To get the item characteristic curve (ICC) level of difficulty in each category using Parscale program.

\textit{c) The function of Information and SEM}

Based on the analysis of the characteristics obtained item information functions and standard error of measurement (SEM). Based on information and SEM functions, then the test is suitable for learners with the ability of low, medium, or high.
3) The Effectiveness Test Using Psychotest

The development of effectiveness test instruments using PhysCoTest performed by administering a questionnaire on PhysCoTest Teachers. Results of Teachers and students responses were analyzed descriptively. Data analysis was performed by calculating the scores achieved from all aspects assessed [17], is then calculated by the following formula:

\[ N = \frac{K}{N \times 100}\% \quad (2) \]

Information:
- \( N \) = Percentage feasibility aspects
- \( K \) = Scores on data collection
- \( N_k \) = Total scores on the data collection

Scores are compared to Table 3 to determine the response criteria teachers and students in applying PhysCoTest.

**TABLE 3. RESPONSE SCORE INTERPRETATION TEACHERS AND STUDENTS**

<table>
<thead>
<tr>
<th>Interval Criteria</th>
<th>Criteria Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>86 % ≤ N &lt; 100%</td>
<td>Very Effective</td>
</tr>
<tr>
<td>72 % ≤ N &lt; 85%</td>
<td>Effective</td>
</tr>
<tr>
<td>58 % ≤ N &lt; 71%</td>
<td>Quite Effective</td>
</tr>
<tr>
<td>44 % ≤ N &lt; 57%</td>
<td>Ineffective</td>
</tr>
<tr>
<td>N ≤ 44 %</td>
<td>Very Ineffective</td>
</tr>
</tbody>
</table>

**ACKNOWLEDGMENT**

We would like to thank Dr. Edi Istiyono, M.Si as supervising the course of this study.

**REFERENCE**


CHEMISTRY LEARNING MODULE DEVELOPMENT BASED ON PEDAGOGICAL CONTENT KNOWLEDGE FOR STUDENT LEARNING INDEPENDENCE

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Abstract - This research was conducted in MA Irtiqaiyah Banjarmasin. The purpose of this study was to (1) produce a form of chemistry learning modules based on Pedagogical Content Knowledge (PCK) in the subject matter of atomic structure (2) determine students' learning independence after using learning modules that have been prepared. This study is a Research and Development (R & D) that adapted from Brog & Gall design through six stages: stage (1) a preliminary study; (2) planning; (3) the initial product development; (4) validation of the product; (5) a revision; and (6) a broader product test (to measure student learning independence). The study involved three experts for validation modules including the chemistry teacher. 10 students of MA Irtiqaiyah Banjarmasin are tested for the effectiveness of the module due to the independence of student learning. Data were collected using a questionnaire and observation. Data was analyzed using quantitative descriptive analysis. The survey results revealed that: (1) chemistry learning module based on PCK in the subject matter of atomic structure that has been compiled meets eligibility as a learning tools in the medium category. The results of the assessment module by experts on the feasibility aspect of the content of the total score (30.00) included in the excellent category, aspects of language with a total score (29.00) included in the excellent category, aspects of the presentation of the total score (85.00) included in the excellent category, aspect of graphic with a total score (27.50) included in both categories, and the aspect of compatibility with the components of Pedagogical Content Knowledge with a total score (56.00) included in the excellent category. (2) Independence of student learning increased after using the learning modules. Results obtained from this research is that percentage of student learning independence increase before and after learning while using the module. Through the questionnaire increased by 4.86%, while the observation increased by 7.50%.

Keywords: chemistry learning module development, pedagogical content knowledge, learning independence

I. INTRODUCTION

The learning activities are most important in the whole process of education. In the process of teaching and learning interactions, establish communication to achieve a goal between educators and learners. This means that the success or failure of education goals depend on how the learning process is held. The learning process will be successful, if an educator has two core competencies, pedagogical knowledge and content knowledge.

The learning activities based on information from chemistry teacher at MA Irtiqaiyah is still prioritizing teacher as the lead role. The teacher are the center of the learning process (Teacher Centered Learning) because of the lack of student learning resources. The teacher's role is more dominant than the students. The teacher doing a lot of explanation while only a few students are responded when learning takes place, so that the student is still much less active in seeking his own knowledge. In the learning process, students rely on notes given by the teacher alone. This type of learning does not give students the chance to explore a broader knowledge. Students just fixated on the materials and working instructions given by the teacher, so this kind
of learning do not train students' independences. This situation is worrisome when the teacher does not have sufficient core competencies (content and pedagogical knowledge).

One of the solution to assist teachers in implementing the learning process and to help students to get more easier way to learn is through teaching materials. One of the teaching material is a learning module. When using a learning module, student independence in learning will be formed and reduce dependence on the presence of a teachers.

The learning module is a unit of teaching programs arranged in a certain shape for learning purposes. The learning module can be seen as a package of teaching program consisting of components that contain learning objectives, teaching materials, learning methods, tools or media, as well as a source of learning and evaluation system [7]. Learning modules have certain characteristics, to distinguish it from other teaching materials. Depdiknas in [3] explain the characteristics of the learning module, which are: (1) Self Instructional; learners are able to rely on their self, do not depend on other parties; (2) Self Contained; all learning materials from one unit of competency or sub competencies contained in the module as a whole; (3) Stand Alone; modules developed do not depend on any other media or should not be used together with other instructional media; (4) Adaptive; which is "up to date" on the development of science and technology; (5) User Friendly; namely instruction, information gregarious, using language that is simple and easy to understand.

Reference [8] recommended that the science teachers of Primary and Secondary schools should have the capability of interdisciplinary science. A teacher is required to implementing science (IPA) content material in accordance with the standards expected. One area of science that is chemistry. According to [6], the characteristics of chemistry are as follows: (1) most of the chemistry topics are abstract; (2) chemistry studied a simplification of the truth; (3) chemistry topics or subjects are growing quickly; (4) the chemistry is not just solving problems; (5) there are so many material or topics that must be learned in chemistry.

With these characteristics, the learning of chemistry should be able to fit between theory (concept) and the reality, especially in everyday life so that students can understand the chemistry in a concrete and integrated understanding. On this research the subject matter that is implemented at learning module is the atomic structure. This subject was selected because the atom is a microscopic level material (molecular) making it difficult to observe by naked eye (macroscopic level). Characteristics of the atomic structure of matter can cause students to experience difficulties in understanding the concepts contained in it.

Two major parts that make up the Pedagogical Content Knowledge (PCK) is the content knowledge and pedagogical knowledge. According to [2], content knowledge includes knowledge of concepts, theories, ideas, frame of mind, the method of proof and evidence. In line with the content of this knowledge is the professional competence of teachers that the professional competence of a teacher's ability to master the knowledge of science, technology, art and culture which at least include mastery of subject matter in accordance with the program content of education unit, subjects and groups of subjects that will be of teaching, concepts and methods of scientific disciplines, technologies or the relevant art that is conceptually coherent with a shade or educational unit program, and also group of subjects that will be of teaching.

Pedagogical knowledge is synonymous with pedagogical competence of teachers. The pedagogical competence of teachers is a learning management capabilities of learners who at least include educational foundation of understanding or insight, understanding of the learners, the development of the curriculum (silabus), instructional design, implementation of learning that educates and dialogue, the use of learning technologies, evaluation of learning outcomes, as well as the development of learners to actualize various potentials. PCK components described by the model as proposed on Fig.1.
Self-reliance is the ability to take the initiative, responsible and confident with herself, do something without the help of others. While the definition of independence of the student is the student can solve a problem in learning that he did in his own abilities, their own initiative and are responsible through learning strategies specific then confidently find the solution of the problem without the help of others [4]. Indicators independence of students in this study are: (1) responsible for the act; (2) active and creative in learning; (3) are able to solve the problem in learning; and (4) continuous in learning. Student independence in learning is something that is very important and needs to be nurtured in the students as individuals who positioned as learners. With growth of independence in students, making students can do everything according to their ability. But the fact of the initial questionnaire independence for students at MA Irtiqaiyah Banjarmasin is still low. So, we need a new innovation in the learning that takes place in school. One of them is the development of chemical-based learning modules Pedagogical Content Knowledge of the subject matter of atomic structure, then implement it to improve student learning independence. Therefore the aim of this study was to produce chemical-based learning module Pedagogical Content Knowledge of the subject matter of atomic structure and to determine the effectiveness of the modules that have been developed in MA Irtiqaiyah against the independence of student learning.

II. RESEARCH METHOD

This study is a Research and Development adapted from Borg & Gall, and then simplified in accordance with the needs of researchers. This simplification of course, refers to the provisions of the development of products that comply with the steps that have been described by Borg & Gall. Simplification includes six principal stages, to be able to understand each step can be explained as follows: (1) Preliminary Study (research and information collecting process); (2) Planning Research; (3) Design Development (develop preliminary of product); (4) Preliminary Field Testing (validation); (5) Revised Results of Field Test (main product revision); (6) Main Field Test (test the effectiveness of products to independent learning). The population of this study were students grade XI Madrasah Aliyah (MA) Irtiqaiyah Banjarmasin. The sample in this study were all members of the population, this is done because the population is relatively small. At Madrasah Aliyah (MA) Irtiqaiyah Banjarmasin XI grade class consist only 10 students. The instrument used in this study consisted of questionnaires using Likert scale and simple observations. Questionnaire for module validated by experts and for independent learning are filled by students. The observations were filled by a chemistry teacher at MA Irtiqaiyah as the observer.

III. RESULT
This research created a chemistry learning module based on Pedagogical Content Knowledge on the subject matter of atomic structure. Qualified learning module is a good compilations of teaching materials, according to the [1]. Components or aspects that must be considered is the contents feasibility, language and images, presentation, and graphic aspects. Based on the results of the overall assessment by experts, the learning module obtained mean total score that can be converted into five categories [8].

Learning module assessment by experts from the aspects of the contents feasibility as showed on Table 1 get a total score of 30.00 with very good categories, aspects of language and images get a total score of 29.00 with very good categories, presenting aspects get a total score of 85.00 with very good categories, graphic aspects on the first validation obtain a total score of 27.00 and the second validation obtain a total score of 28.00 with good categories and aspects of compatibility with the Pedagogical Content Knowledge on the first validation obtain a total score of 47.00 and the second validation obtain a total score of 65.00 by category both being very good.

<table>
<thead>
<tr>
<th>No</th>
<th>Aspect</th>
<th>Mean Score</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Content feasibility</td>
<td>30</td>
<td>2nd Validation</td>
</tr>
<tr>
<td>2.</td>
<td>Language and image</td>
<td>29</td>
<td>-</td>
</tr>
<tr>
<td>3.</td>
<td>Presentation</td>
<td>85</td>
<td>-</td>
</tr>
<tr>
<td>4.</td>
<td>Graphic</td>
<td>27</td>
<td>2nd Validation</td>
</tr>
<tr>
<td>5.</td>
<td>PCK compatibility</td>
<td>47</td>
<td>2nd Validation</td>
</tr>
</tbody>
</table>

Results of the assessment of student learning independence obtained through questionnaires filled out by the students before and after using the learning module are showed on Table 2. The mean percentage of every aspect increase in independent learning before and after learning to use the learning module. On the whole aspect of independence is measured by a questionnaire on average increased by 4.86%, while the percentage increase in each aspects: being responsible increased by 7.00%, active and creative aspects of doing the study increased by 1.45%, aspects able to solve problems increased by 4.00%, and the aspect of continuous learning increased by 7.00%. The results of the independence of each aspects are presented on Fig. 2.
Results of the assessment of student learning independence gained through the observation made by a chemistry teacher at MA Irtiqaiyah Banjarmasin are showed on Table 3. On the whole aspect of independence that measured increase by 7.50% while the percentage increase in each aspects: being responsible increased by 4.00%, active and creative aspects of doing the study increased by 8.00%, aspects able to solve the problem increased by 14.00%, and the aspect of continuous learning increased by 4.00%. The percentage of the observation of the independence of students in each of these aspects are presented in Fig. 3.

<table>
<thead>
<tr>
<th>No</th>
<th>Aspect</th>
<th>Before</th>
<th>After</th>
<th>Increasing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Responsible</td>
<td>40%</td>
<td>44%</td>
<td>4%</td>
</tr>
<tr>
<td>2</td>
<td>Active and creative</td>
<td>36%</td>
<td>44%</td>
<td>8%</td>
</tr>
<tr>
<td>3</td>
<td>Able to solve problems</td>
<td>34%</td>
<td>48%</td>
<td>14%</td>
</tr>
<tr>
<td>4</td>
<td>Continuous learning</td>
<td>36%</td>
<td>40%</td>
<td>4%</td>
</tr>
</tbody>
</table>
Changes in the attitude of the four indicators or aspects observed in the learning process. The first aspect is responsible. This aspect are being seen from the number of students who fill the task independently. From the research we found that after using the learning modul student inclined to be more independent. This was happened because of the function of learning modul is to assist studend to learn by themselves. After using the learning modul, number of student that answering task independently are increased compared to number of student before using learning module. The second aspect are active and creative. This aspect of independence are still less increasing than the first aspect. This described that the student is still not accustomed to take their own notes and organize their own material. This is showed from the number of increasing mean questionnaire that are the most least than other aspect. The third aspect are solve the learning problems. This aspect of independence showed from the capability of students to solve the problem on their task. From this research concluded that the student capability to solve problems are increasing significantly. The fourth aspects is continuous learning. This aspect are showed from the number of students who repeat and recall learning. Changes in attitude from this research showed that this aspect is also increased significantly.

IV. CONCLUSION

Chemistry learning module based on Pedagogical Content Knowledge of the atomic structures subject matter that have been developed meet eligibility as a learning. The learning module is rated very good overall and fit for use in learning process. This is based on the assessment of the products supplied by experts as follows: on the feasibility aspect of the content gets mean score (30.00) included in the excellent category, aspects of language got a mean score (29.00) included in the excellent category, aspects of the presentation got mean score (85.00) included in the excellent category, and aspects of graphic got a mean score (27.50) included in good categories, and aspects of conformity with the components of Pedagogical Content Knowledge got a mean score (56.00) included in the excellent category.

Chemistry learning module based on Pedagogical Content Knowledge of the subject matter of the atomic structures that had been developed is also able to improve student learning independence. It can be seen from the average percentage increase in student learning independence before and after learning to use the learning module through the questionnaire increased by 4.86%, while the observation increased by 7.50%.

REFERENCE

THE EFFECT OF PBL & INQUIRY ON STUDENT SCIENCE PROCESS SKILLS AT UNIVERSITY OF MUHAMMADIYAH BENGKULU

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Abstract

The study aims at determining science process skills of students in plant anatomy course of student who learn biology using inquiry model. This study has been conducted in October-December 2013 in Department of Biology Education, Faculty of Teacher Training and Education University of Muhammadiyah Bengkulu semester academic year 2013/2014. The method used in this study is quasi-Experiment. With a pretest-post test design. The samples in this study were all student of 3rd semester consists of 95 students. It consists of 3 classes which are two classes as experiment classes and one class as control class. Data collected by using test and observation. the data were analyzed using One Way ANOVA Test. The result shows that: (1) there is a difference between PBL, inquiry, and conventional on science process skills of students; (2) the inquiry class gets better score; (3) class inquiry got a better score than the PBL learning model and conventional.

Keywords : Science Process Skills, PBM, Inquiry

I. INTRODUCTION

Education is an effort to accelerate the development of human potential to be able to carry out tasks assigned to them, because only humans can be educated and educate. Education can affect physical, mental, emotional, moral, as well as one's faith and devotion [1].

The era of globalization and advances in science and technology today to bring change various aspects of life, so the problem becomes complex life that arise. This is a challenge that must be faced by educational institutions to equip students to solve problems related to everyday life. Education should be able boost the quality associated with everyday life. Education should be able to improve the quality of people in different aspects include cognitive, affective and psychomotor [2].

Student success in learning is not determined by sheer intellectual ability, but is determined by learning skills such as learning how to learn, learn to analyze /listening, creative thinking, writing, reading, learning communication and convey ideas to others [3]. How to effective learning for students to be more giving students the opportunity to have the learning skills. Students not only to remember the facts given lecturers in lectures, but should be capable see various phenomena behind the facts.

Mastery and application of science for learners provided supplies to take part and competent in their fields in responding to the challenge. In studying biology, students need to build a structure of thinking and skills to enable process. Depth think is expected of students in the study of biology is the trace levels of thinking and science process skills were adequate, not just the level of rote material [4].
Science process skills consist of basic skills (basic skills) and skills (integrated skills). Basic skills consists of six skills, namely observing, classifying, predicting, measuring, and communicating concluded. While skill is integrated consists of identifying the variables, makes tabulation of data, presenting data in graphical form, describe relationships between variables, interpret observations (interpretation), analyzing the research, draw up hypotheses, defining variables operationally, designed the study, and carry out experiments [5]. In addition, the science process skills in learning also very necessary in order to support the students knowledge in the can. One of the strategies that can be implemented to empower science process skills is a problem based learning [4].

Problem-based learning is one of the instructional approach used to stimulate students’ higher-order thinking in situations oriented to real world problems, including learning how to learn. In this model, students can grow the problem solving skills, where students act as a problem solver and are built in learning the process of thinking, teamwork, communication and give each other information [6], explained that the problem based learning can provide opportunities for students to explore to collect and analyze data to solve the problem, so that students are able to think critically, analytically, systematically and logically in finding alternative solutions to problems. Besides solving the problem can train students to organize their knowledge and skills so as to develop the motivation, perseverance, and self-confidence of students.

In the context of learning science, Sund & Towbridge (1973) explained that the inquiry learning can facilitate students develop the skills to acquire something new (acquisitive skills), skills manipulate (manipulative skills) and process skills, communication skills (communitative skills), creative skills (creative skills) and attitudes. Other views of learning by inquiry approach can involve students actively using the process of science and scientific skills and creative abilities as they find answers to the questions posed [7].

Model inquiry is a series of learning activities that involve maximally throughout the student's ability to locate and investigate the systematic, critical, logical, analytic so that they can formulate their own findings with confidently [8]. It is also in accordance with the Ministerial Regulation No. 22 (2006) states that learning science should be taken of scientific inquiry (scientific inquiry) to develop the ability to think, work and communicate scientific attitude as well as an important aspect of life skills [9].

Inquiry is one of the learning model that was instrumental in building a constructivist learning paradigm which emphasizes the students' learning activeness. The learning activities aimed to cultivate students' ability to use their skills with the process of formulating the question that led to the investigation activities, draw up hypotheses, conduct experiments, collect data and processing data, evaluating and communicate findings in a learning society. Activity inquiry is very necessary because it can optimize the involvement of direct experience in the learning process.

Based on result of of preliminary observations lectures Anatomy Plant on the course for biology education at Muhammadiyah University of Bengkulu, the lecturer has given students the opportunity to develop the skills they have with the apply the method of discussion with the additional tools of media power point, which is where the discussion method is a method is commonly used in everyday teaching, so that it can be said conventional learning. However, the study yet to be felt capable improve the science process skills of students in these courses.

Both the combination of material aspect of plant anatomy with the application of problem-based learning and inquiry are considered effective in helping to improve the students to be more creative thinking to master the basic concepts of plant anatomy and certainly more improve science process skills of students [10], there is the influence of inquiry learning model laboratory on creative thinking skills and science process skills of
students, further the learning model Problem based learning approach science process skills can increase learning motivation and learning outcomes of students in learning biology[11].

Based on the background, it is necessary to research Science Process Skills Student Effect on Problem Based Learning and Inquiry at Muhammadiyah University of Bengkulu.

II. RESEARCH METHODS

This study has been conducted where at early stage begins with giving pretest. When learning takes place researcher acted as a lecturer in plant anatomy, by applying the model of problem-based learning, inquiry, and conventional learning. Furthermore, all of the collected data is analyzed and given a conclusion. This research used a quasi-experimental research in which not all variables can be controlled.

The design used in this study is a pretest, posttest design [12], which were divided into three groups: problem based learning, inquiry model and conventional learning group. For the treatment group that is a class that implements the learning model based problem (X1), inquiry model (X2), while the control group applied a conventional learning (X0), after which both groups were given a test in the form of knowledge about plant anatomy both pretest same (O1) nor the same posttest (O2), and further tested Anava One Way. The draft table is as follows:

<table>
<thead>
<tr>
<th>Group</th>
<th>Pretest</th>
<th>Treatment</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (experiment)</td>
<td>O1</td>
<td>X1</td>
<td>O2</td>
</tr>
<tr>
<td>B (experiment)</td>
<td>O1</td>
<td>X2</td>
<td>O2</td>
</tr>
<tr>
<td>C (control)</td>
<td>O1</td>
<td>X0</td>
<td>O2</td>
</tr>
</tbody>
</table>

Information :
O1: Pretest
X1: Problem Based Learning Model
X2: Inquiry Learning Model
X0: Conventional Learning Model
O2: Posttest

A. Research Instruments

This study used several instruments to perform research activities, namely:
1. Instrument of Learning
   a. Units of Learning Events
   b. Student Worksheet
2. The data collection instruments

Data collection instrument using Observation sheet based on the rating scale in which the rating scale is more flexible, not restricted to the measurement of attitude alone but measure the perceptions of respondents towards other phenomena such as a scale to measure the status of the social, economic, institutional, capabilities, process activities and others [13].

B. Data collection

To obtain data science process skills using observation sheet with 12 items of observation, observation sheets that are tested in the form of observations regarding the subject sub root anatomy. In this making, the researchers first create a grid based aspects to be measured on the observation sheet and scoring guidelines for each of the observation sheet. Observation sheet is given to the three groups with the same test tools and results of data processing is used to verify the research hypothesis.

Materials and the subject matter presented in learning about the anatomy of the root is in accordance with the GBPP and Units of Learning Events anatomy in Biology Education Studies Program faculty of teacher training and education science Muhammadiyah University of Bengkulu. Preparation of observation sheet also refers to indicators of student science process skills that are tailored to the material being taught when research.
C. Data analysis

Prerequisites Test Analysis

1. Normality test

Normality test was used to test whether the data in the study was obtained from a population of normal distribution or not. In this research normality test using SPSS 17 that is through test One Sample Kolmogorov-Smirnov. The steps are as follows:

1) Determine the hypothesis

\[ H_0: \text{The sample is not normal} \]
\[ H_1: \text{Samples normal distribution} \]

Decision of The Test: \( H_0 \) is rejected if the \( p \) value \(<0.05 \) or rejected if the \( p \) value \(>0.05 \)

2. Homogeneity test

If a normality test gives an indication of the research data were normally distributed, then the next test the homogeneity of the sample. This test is intended to test the similarity of the population variance normal distribution, homogeneity test using SPSS ver. 17.0 through Levene test Statistics. If the probability value \(>0.05 \) then the data came from the same population variance or homogeneous.

3. Hypothesis testing

The data obtained will be used ANOVA one way and statistical analysis aided by Software IBM SPSS Statistics 17.0 for Windows and Microsoft Excel. If there are significant differences continued with LSD or the Tukey test in determining are : 1) Determining hypothesis, \( H_0: \) There is no difference science process skills in problem-based learning, the inquiry and conventional, and \( H_a: \) There is a difference science process skills in problem-based learning, inquiry and conventional; 2) Criteria testing, If the significance \( >0.005 \), then \( H_0 \) is accepted and if significance \( <0.005 \), then \( H_0 \) is rejected

III. RESULTS AND DISCUSSION

A. Description Data Science Process Skills

The data obtained and analyzed in this study a score observations science process skills that students acquire problem-based learning, inquiry and Conventional. Collecting data science process skills using observation sheet items amounts to 12 observations with 0-3 scoring guidelines. Data from observational studies science process skills using ANOVA analysis. The following the measurement result data science process skills of the experimental class inquiry, problem-based of Learning and conventional control class.

Observation of Science Process Skills, data science process skills obtained as follows:

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Experiment</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Problem Based Learning</td>
<td>Inquiry</td>
</tr>
<tr>
<td>Total score</td>
<td>773</td>
<td>788</td>
</tr>
<tr>
<td>Highest score</td>
<td>33</td>
<td>34</td>
</tr>
<tr>
<td>Low score</td>
<td>18</td>
<td>19</td>
</tr>
<tr>
<td>Average</td>
<td>24.93</td>
<td>23.41</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>4.83</td>
<td>4.76</td>
</tr>
<tr>
<td>Variance</td>
<td>23.39</td>
<td>22.71</td>
</tr>
</tbody>
</table>

Table 2 can be seen from the total score, the highest score, lowest score, average, standard deviation, and variance for the three learning classes have different values, there is none. So to be sure we continue with normality test, homogeneity and Anova one way, if there is a difference then tested further.

Based on Table 2 have been known frequency data from all groups. Before continuing the analysis, it must be known in advance the data is normal or not this data. It is necessary to test for normality with Test One sample Kolmogorov-Smirnov test using SPSS. Normality test results obtained from the following data:
TABLE 3. NORMALITY TEST (NPAR TESTS) RESULTS SCIENCE PROCESS SKILLS

<table>
<thead>
<tr>
<th>Aspect Ability</th>
<th>Group</th>
<th>Kolmogrov-Smirnov</th>
<th>Conclusion</th>
<th>Ket.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science Process Skills</td>
<td>Problem Based Learning</td>
<td>4.836</td>
<td>0.869</td>
<td>Accepted H₀</td>
</tr>
<tr>
<td></td>
<td>Inquiry</td>
<td>4.766</td>
<td>0.280</td>
<td>Accepted H₀</td>
</tr>
<tr>
<td></td>
<td>Conventional</td>
<td>3.953</td>
<td>0.659</td>
<td>Accepted H₀</td>
</tr>
</tbody>
</table>

Normality test assessment criteria, That is:

H₀: the population has a normal distribution if sig > 0.05
H₁: population have no normal distribution if sig ≤ 0.05

Based on the above data it can be seen that the value of science process skills in normal circumstances. Having in mind the normality of the data it is further necessary to test the homogeneity, using Levene. Results of homogeneity test science process skills as follows:

TABLE 4. HOMOGENEITY TEST RESULTS SCIENCE PROCESS SKILLS

<table>
<thead>
<tr>
<th>Levene Statistic</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.965</td>
<td>2</td>
<td>92</td>
<td>.146</td>
</tr>
</tbody>
</table>

Levene test assessment criteria, that is:

H₀: the population have the same variance if sig > 0.05
H₁: population has a variance that is not the same / different if sig value ≤ 0.05

From Table 2 above can be seen a significance value of 0.146, it meant greater than 0.05 so we know that the data of science process skills with problem-based learning, inquiry, and Conventional homogeneous variance. Based on the normal distribution of data analysis and homogeneous then continue Anova one way.

To determine the homogeneity of the three classes then do Anova one way after it emerged that the data science process skills is normally distributed and homogeneous, then the next we need to see the average difference between problem based learning, inquiry and conventional. The following Table Anova science process skills:

TABLE 5. ANOVA ONeway RESULTS SCIENCE PROCESS SKILLS

<table>
<thead>
<tr>
<th>Sources existence of differences</th>
<th>Amount Quadratic</th>
<th>df</th>
<th>Mean Quadratic</th>
<th>F</th>
<th>Sig.</th>
<th>H₀</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inter Group</td>
<td>189.152</td>
<td>2</td>
<td>94.576</td>
<td>4.620</td>
<td>0.012</td>
<td>Rejected</td>
</tr>
<tr>
<td>Inter Group</td>
<td>1883.480</td>
<td>92</td>
<td>20.473</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amount</td>
<td>2072.632</td>
<td>94</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Viewed from above, the significant value gained 0.012 less than 0.05. Means the results of science process skills of students using problem based learning, inquiry, and conventional highly significant to know the difference between treatments then conducted post hoc test in Table 6.

TABLE 6. POST HOC TEST ADVANCED SCIENCE PROCESS SKILLS

<table>
<thead>
<tr>
<th>Class</th>
<th>Difference of Mean</th>
<th>Sig.</th>
<th>H₀</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Based Learning</td>
<td>Inquiry</td>
<td>.48387</td>
<td>.675</td>
</tr>
<tr>
<td></td>
<td>Conventional</td>
<td>2.69306</td>
<td>.019</td>
</tr>
<tr>
<td>Inquiry</td>
<td>Problem Based Learning</td>
<td>-.48387</td>
<td>.675</td>
</tr>
<tr>
<td></td>
<td>Conventional</td>
<td>3.17693</td>
<td>.006</td>
</tr>
<tr>
<td>Conventional</td>
<td>Problem Based Learning</td>
<td>-2.69306</td>
<td>.019</td>
</tr>
<tr>
<td></td>
<td>Inquiry</td>
<td>-3.17693</td>
<td>.006</td>
</tr>
</tbody>
</table>

Based on Table 6 obtained sig less than 0.05 means that there is a difference, it is necessary to proceed with the advanced test LSD to see the difference. From Table 4 we can know that there is no difference between the student science process skills of students using problem based learning and inquiry where obtained equal 0.675. But there are differences between the science process skills of students based learning model and conventional issues obtained 0.19 and 0.06 of inquiry and conventional. Because all three classes
there is no real difference then there is no learning model is excellent for improving science process skills of students, but when compared to the problem based learning model and conventional well as inquiry with conventional then the inquiry and problem-based learning is better to improve the skills of process science students learning plant anatomy.

**IV. DISCUSSION**

The comparision of science process skills on inquiry learning, problem based learning and conventional : from the analysis result, that the average of inquiry learning model comparisons with problem-based learning for 0.483, inquiry learning model with a conventional type of 3.176 and a learning model type of problem based learning with Conventional amounted to 2.693. So It can be concluded that for the development of science process skills is better done using inquiry learning model for values greater effectiveness than other learning models. Based on research that has been done, with some research journals that similar can be said that the application of problem-based learning model of learning and inquiry both to try and serve as an alternative learning biology in college in enhancing science process skills of students.

**V. CONCLUSION**

Based on the results of data analysis and discussion, it can put forward a few conclusions:
1. There are effect in science process skills of students using problem based learning, inquiry and conventional.
2. Model inquiry learning is a learning model that is very good when compared to conventional since the third grade problem based learning, inquiry and conventional individually no differences were highly significant.

**REFERENCES**

AUTHENTIC ASSESSMENT OF PROBLEM SOLVING AND CRITICAL THINKING SKILL FOR IMPROVEMENT IN LEARNING PHYSICS

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Abstract—Assessment in learning is said to be effective if it can measure in accordance with the capabilities of the students. Authentic assessment can be used to measure the ability of the realm of cognitive, affective and psychomotor. Authentic assessment in problem solving and critical thinking needed on learning physics in the 21st century. Problem solving and critical thinking is mutually sustaining capability, both of these are included in the realm of higher order thinking skills. The ability of higher order thinking required in the curriculum of 2013. This article aims to study the cognitive aspects of authentic assessment of higher order thinking that emphasizes on the level of knowledge in the form of reasoning, memory and process. The level of knowledge is very important in increasing of higher order thinking skills in physics. The results of this study concluded that the cognitive aspects of authentic assessment process higher order thinking is very important in learning physics and as a source of reference for educators and education experts to improve the quality of learning is effective.

Keywords: Innovation of learning physics, authentic assessment, Problem solving, Critical Thinking, Higher Order Thinking Skills

I. INTRODUCTION

World Education in Indonesia are experiencing the transformation of the curriculum in several decades. One of the current curriculum is a curriculum of 2013. One of the principles in curriculum development in 2013 is centered on the potential developments, needs and interests of students to the environment [1]. Students should be the main offender (student centered) in the activity-based learning contextual. An important aspect in the curriculum emphasizes on learning that the 2013 based scientific approach that includes aspects of knowledge, attitudes and skills. In contrast to the previous curriculum that emphasizes the aspect of knowledge. Activity-based learning approach in scientific emphasis on science process skills which include observing, inquiring into, collect data, association and processing the information obtained. In the stage of scientific approach required a process of science skills into a high level of cognitive ability so that learning can be achieved effectively. A high level of cognitive ability is the level in analyzing, synthesizing and creating. The level of cognitive aspects are categorized as high level thinking ability. The ability of higher-order thinking is problem solving ability category, critical thinking ability. Both the continuous mutual capabilities in shaping high level thinking ability. That is also a capability the demands in the 21st century [2]. The 21st century is a benchmark in achieving the educational goals set forth in the constitution the number 20 of 2003 on the national education system. Expected in the educational system can realize quality development of students as the generation that has a spiritual attitude and character of higher-order thinking abilities that become demands in the 21st century.

The real world in the form of education with regard to results achieved through learning. Learning starts from the introduction of the material up to the stage of the evaluation. The evaluation obtained through the assessment process. Assessment is an important component in learning to know the success rate of students. Defines the assessment is a process to obtain the information needed to make decisions about students, curriculum, programs at schools and certain policies [3]. Assessment can encourage students receive feedback from an error in the resolution of a problem [4]. Educators need to do development in the field of assessment in
order to obtain an effective assessment results [5] as well as the development in the field of assessment in accordance with the demands of the 21st century, one of which was science process skills. Assessment is done when it can be a test and non-test. Assessment of developments in the field of education are always trying to create innovations to provide effective measurement results. Assessment of the competence of students as measured in the form of cognitive aspects [6], affective [7] and psychomotor [8]. One of the innovations in the development of authentic assessments i.e. judgment.

Authentic assessment has continuity with authentic learning. Authentic learning is a learning environment using real learning resource as in conceptual understanding-based problems. In learning physics there are concepts that relate to the surrounding environment [29]. Concepts of physics that have a relationship with the environment can be completed by students to use problem-solving ability. The ability to solve problems has relevance to the critical thinking ability so that interpretations of the problem can be resolved much more accurate [9]. But in fact, in learning educators are still using traditional assessment, where traditional assessment only emphasize on the aspects of cognitive course without regard to aspects of psychomotor and affective [10].

Based on the description above, this article examines the cognitive aspects of authentic assessment of higher-order thinking that emphasizes on the levels of construction knowledge in the form of reasoning, memory and process. The knowledge construction levels is crucial in improving the ability of higher-order thinking in physics.

II. DISCUSSION

A. Authentic assessment

Authentic assessment is assessment obtained based on measured results of the learning students in the realm of knowledge, skills and attitudes [11]. Argues that in the authentic assessment required extensive thinking ability in solving problems in the real to coordinate the construction of knowledge, skills and attitudes in response to various situations of the new issue [12]. In the authentic assessment students are given the opportunity in developing the thinking ability of students and checking as well as actions to show that students experienced the process of analytical study [2]. The ability to think and act emphasizes that students not only develop their cognitive competencies such as problem solving and critical thinking but other development competencies such as the competence of reflection and social competencies such as communication and collaboration. So, these competencies combined into consideration in the development of authentic assessments to improve the thinking ability of students [13]. The definition of authentic assessment according to the American Library Association, is the process of evaluation in measuring performance, achievement, motivation and attitudes students on the relevant activities in learning.

Through authentic assessment students are motivated to learn more meaningful because the students are aware of the relevance between fact and usefulness they have learned for future lives [14]. According to some sense of authentic assessment from some experts, then summed up the authentic assessment can be defined as the kind of assessment that is used to measure the ability of educators to students that involves high level thinking skills and understandings of students. Therefore, the tasks given is authentic tasks that contextual learning activities involving students.

B. Characteristics of authentic Assessment in physics

Physics is a branch of natural science (Science). Physics is a way of thinking, a way to investigate, a set of knowledge and science as well as interaction with technology and social [15]. Physics in the contextual approach which requires learning phenomena that occur in the context of the real world is very familiar with the personal experiences of the students that can be used as a context in learning. Through contextual learning physics students get more opportunity to think, suggested or argued, work in the laboratory, conducting discussions with the teacher or with her friends, even doing real activities in the field. Contextual learning model in accordance with contextual assessment that is authentic assessment, where students are expected to develop skills in applying the knowledge and skills to solve real problems. To resolve the issue that is contextually required ability of problem solving and critical thinking ability.
Problem solving ability is defined as a key aspect in the independent learning and help learning a meaningfulness [16]. Category indicator the development of problem solving [17] consists of five indicators, namely 1) can identify the problem and the problem-solving process; 2) can define a problem in thinking about the different situations of fact; 3) can think of many alternatives which allows from some solutions; 4) can verify the results of the solution; 5) can be verified in the process of obtaining a solution. Thus, the ability of problem solving include: 1) understanding; 2) plan solutions in problem solving; 3) outlines the problems; 4) find a way of settlement in accordance with planning solutions; 5) carry out the problem; 6) evaluating the results of problem solving. Furthermore, the ability of critical thinking that is the ability to know the issues, find ways that can be used to deal with problems, collect and compile the information required [18]. Critical thinking ability according to Ennis [19] indicators be developed critical thinking skills which consists of five major groups: (1) provide a simple explanation; (2) build basic skills; (3); (4) provide further clarification; (5) set the strategy and tactics.

Adopted from Wiggins in [20] and [2] authentic assessment of the characteristics is as follows.
1. Leads to the core of essential learning, understanding and ability
2. Reflect real life, a challenge that is both interdisciplinary
3. Exposes students to the problems and tasks that are complex, ambiguous, and open the integrated knowledge and skills
4. Are the educational and exciting
5. Form of setting standards and brings students toward mastery level of higher knowledge and rich
6. Acknowledge and appreciate the ability of students to multiple, diverse learning styles, and diverse backgrounds

Based on the description of the characteristics of authentic assessment, it can be inferred that the authentic assessment on the ability of problem solving and critical thinking of physics meet the characteristics of the construction aspect of knowledge in the form of reasoning, memory and process. Authentic assessment characteristics of continuous aspect with the scientific methods used in the study. Figure 1 describes the implementation of scientific method using authentic assessment starts from the teaching-based authentic relating to assessment where students are required to understand the problems that occur in real-world contextual so that students can construct what has been learned.

![FIGURE 1. FRAME OF AUTHENTIC ASSESSMENT](image)

C. Authentic assessment techniques

Several techniques of authentic assessment include performance assessment, project assessment, portfolio assessment, written and oral, and self-assessment.

1. Performance Assessment

Performance assessment is an assessment involving the ability of problem solving into real life students [21]. Assessment of authentic performance assessment focusing with the kind of students in terms of collection of duties or undertake a project that will be assessed based on the criteria of the settlement as well as based on the process of obtaining the information collected by the students. Performance-based assessment in the form of a list of check (checklist), notes anecdotal/narrative (narrative record/anecdotal), the scale of assessment (rating scale), memory or recollection (memory approach).

Performance assessment require special considerations. First, the performance measures should be undertaken to demonstrate the students a real performance for one or several types of specific
competencies. Second, the accuracy and completeness of the aspects assessed performance. Third, the specific skills needed by students to complete learning tasks. Fourth, the main focus of the performance will be assessed, in particular absolutely indicators that will be observed. Fifth, the order of ability or skill students will be observed [22].

3. Project Assessment

Project assessment is the assessment conducted in activity based on the given task in completing the students results in parentheses time [23]. The settlement was made with the scientific stage in the form of planning, data gathering, organizing, processing, analysis, and presentation of data. The completion of the task demanded of students in investigating issues that want solved students [24].

4. Portofolio

Portofolio assessment is assessment against a collection of artifacts in the show the progress as well as valued as the work of the real world. Portofolio assessment describes the work of students in certain subjects within the time specified [25]. Portofolio assessment can leave from work the students individually or in groups, produced requires reflection the students, and evaluated based on several dimensions.

5. Written and Oral Assessment

Test written essay or description-shaped while the oral test in the form of an interview. Written essay-shaped test demands two kinds of answer patterns, namely an open answer (extended-response) or answers limited (restricted-response) [26]. The written assessment may use a pencil paper or computer based test.

6. Self Assessment

Self-assessment is an engineering assessment do students in assessing her own achievement of competence that has been mastered [27]. Self-assessment with regard to status, the process and the level of achievement of the competencies he had learned in a particular subject. Techniques of self-assessment can be used to measure cognitive competence, affective and psychomotor. With the self-assessment then it can foster a sense of confident students, aware of her strengths and weaknesses as well as encouraging, familiarize, and train the students to behave honestly [30].

Advantages and disadvantages of authentic assessment compare with tradisional assessment show in Table 2.

<table>
<thead>
<tr>
<th>TABLE 2. A COMPARISON OF AUTHENTIC AND TRADITIONAL ASSESSMENT [28]</th>
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<tbody>
<tr>
<td><strong>Traditional assessment</strong></td>
</tr>
<tr>
<td>Relies on indirect or proxy items</td>
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<tr>
<td>Reveals only whether students can recognise, recall or ‘plug in’ what was learned out of context</td>
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<tr>
<td>Conventional tests are usually limited to pencil-and-paper one-answer questions</td>
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<tr>
<td>Conventional tests typically only ask the student to select or write correct responses - irrespective of reasons</td>
</tr>
<tr>
<td>Traditional testing standardises objective ‘items’ and the one ‘right’ answer for each</td>
</tr>
<tr>
<td>Test validity is determined by matching items to curriculum content</td>
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<tr>
<td>Traditional tests are more like drills, assessing static and too-often arbitrary elements of those activities</td>
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</table>
FIGURE 1. CRITERIA OF AUTHENTIC ASSESSMENT

III. CONCLUSION

Authentic assessments are examined in the article authentic assessment that has advantages over traditional assessments that are still used by teachers. Authentic assessment of problem solving and critical thinking on aspects of cognitive ability, psychomotor and affective very necessary in relation to the assessment of authentic performance-based. Where in the real contextual solutions and critical thinking requires the construction aspect of knowledge, results achievement and an open attitude in the use of higher order thinking ability. Thus, the authentic assessment needs to be used by teachers as a means to improve learning, especially in the field of physics subjects.

REFERENCES


IMPLEMENTATION OF PESANTREN TADABBUR ALAM SSG-DT TO IMPROVE THE CHARACTER "BAKU" STUDENT SMK PASUNDAN 1 BANDUNG

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Abstract—This research was conducted in order to determine the influence of Pesantren Tadabbur Alam Santri Siap Guna-Daaruul Tauhid Training Character “BAKU” (Baik-Kuat) to students of class X SMK Pasundan 1 Bandung. In addition, this study was also conducted with the aim to provide an example for secondary schools in Indonesia about how to revamp the activities Student Orientation Program (MOS) have generally become the system of Pesantren Tadabbur Alam in order to educate and train students to become a generation character “good and strong”. This study is a qualitative research using experimental methods with simple random sampling. As for the steps are carried out, ranging from observations, program control, material analysis and evaluation of the achievement of education and training. Then, after two weeks from training, the researchers conducted survey by distributing questionnaires to 100 students from 308 students training participants as a population, at school who becomes the object of research studies. The results of the training held for 4 days was considered influential on the character changes, attitude and behaviors of students toward a better person and stronger. In addition it could be a reference in changing patterns of target new students from Student Orientation Program becomes the target pattern Pesantren Tadabbur Alam. Judging from questionnaires research, from 12 question the character of "Good and Strong" average of 45 people very agree to a change of character in students. In addition 46 people agreed, 9 people were neutral meaning there is no effect change of character.

Keywords: Character “BAKU”, Pesantren Tadabbur Alam

I. INTRODUCTION

The character of an individual is formed from a small age due to genetic and environmental influences around. Then, the birth of character education is as a platform to establish and nurture children's character, in the formal and non formal education. But the character education never touched a real if limited to the understanding of the character, or merely information without any real action. Therefore, the process of the formation of character, whether consciously or not, will affect the way people see themselves and the environment and will be reflected in everyday behavior. Besides formal education, one of the factors that influence the formation of student character is the low relevance of education to the needs of learners. As well as the activities of Student Orientation Program (MOS), which is now converted into a school environment recognition programs, is still considered less effective. Due to several schools, this program does not meet the guidelines imposed and still is hazing for new students. So the purpose of the student orientation program was not reached its full potential. Though the student orientation program is aimed very positive, one of which is formed of students of good character and strong. Therefore, the need for real programs for the achievement of the objectives of education namely motivation, passion and effective way of learning as a new student, and foster positive behaviors, among others, honesty, self-reliance, mutual respect. In addition to respecting diversity and unity, discipline, healthy and clean living to realize the students who have integrity, work ethic, and a spirit of mutual cooperation. So with this study, the authors offer a natural tadabbur boarding program packaged in the education and training of character "BAKU" (Baik&Kuat) in order to improve the student's character.
II. Literature Review

A. Pesantren Tadabbur Alam

Pesantren is one institution of Islamic education is a product of the culture of Indonesia. The existence of Pesantren in Indonesia started since Islam arrived in this country by adopting the religious education system that actually has long flourished before the advent of Islam. As an educational institution that has long been grown in this country, boarding schools recognized as having contributed greatly to education and the history of the nation. Pesantren is a religious educational institutions who participate become agents in achieving educational goals.

According Dhofier, boarding schools are communities where the students study and live. Another opinion of Poerbakawatja states that schools are where people gather to learn the religion of Islam. Boarding schools become a place to stay and a place to learn for the students. Boarding is a complex with a location that is generally separated from the life around it. In the compound stand several pieces of the building: the residence of caregivers (in local language called Java clerics, in Madura nun or flag), mosque, a place of teaching (madrasah), and the hostel as a student’s boarding.

B. Principles of Education Pesantren.

The principles of pesantren education systemare:

- Theocentric. Pesantren education system based on the philosophy Theocentric philosophy is the view that all events originate, process, and return to the truth of God.
- Voluntary and serve, holding boarding voluntary action and to serve the others in order to serve the Lord.
- Wisdom, schools emphasize the importance of wisdom in education schools and in the conduct of everyday wisdom referred to here is in being and behaving patient, humble, program comply with the provisions of the law, to achieve its objective without harming others and bring benefits to the common interest.
- Simplicity, schools emphasize the importance of simple appearance as one of the noble values of the school and to guide everyday behavior for all people in schools, simplicity is meant here is the ability to behave and think is reasonable, proportional and unpretentiousness.
- The collectivity, schools emphasize the importance of collectivity or unity higher than on individualism.

C. Formal Education System in Pesantren

Formal education is education that takes place regularly, governed by strict regulations such as length of study, the subject matter, learning time, level, age, educators, certificates and others in the school. The formal education system in schools experiencing rapid development of teaching methods are traditional, to modern education. In the development of the boarding school in addition to maintaining the traditional system, also manage and develop the system of madrasah. This development is intended to anticipate the changes that occur in the community, as well as to meet the needs and demands of society is more advanced in the field of education. Changes could be renewed or it could be an effort to enhance the old system is no longer appropriate to the demands of society [1].

Formal education in pesantren that are part of the national education system has three main characteristics that distinguish the other schools, namely:

- Kyai as an educator and owner of the cottage and the students.
- Curriculum of boarding school.
- Means of worship and education such as mosques, clerics house, cottage, and madrasah.

D. Tadabbur Alam

Tadabbur Alam is a learning tool to get to know to the Supreme Magnitude Allah Who created the heavens and the earth and everything in it. Well, if asked; Wahid, tadabbur Do you like nature? Surely I will answer, “Not like anymore but a hobby. Not that like brooding as media scatters time, but has become properly if we know God through His creation. In this way, it becomes a ‘character building’ that at least add
to the faith and piety. Meanwhile, _tadabbur_ means an education and training carried out in the wild, with the intention to draw closer to Allah, and keep the environment well while contemplating themselves [2].

**E. Character Education**

Education is not separated from the meaning and definition. In the world of education a lot of terms are used and need to be discussed regarding to the understanding. In this educational blog, Maswins for Educations, before going on to discuss the notions of terms in the world of education, it is better if it first discussed the notion of education itself. Here is some sense of Education under the Act and the experts I quoted from several sources;

- **Education According to the Education Law**
  Education is a conscious and deliberate effort to create an atmosphere of learning and the learning process so that learners are actively developing the potential for him to have the spiritual power of religion, self-control, personality, intelligence, character, and skills needed him, society, nation and country.

- **Education According to Carter V. Good**
  Education is the process of skills development in the form of a person’s attitudes and behaviors that prevail in society. Social process in which a person is affected by something that guided environment (especially in schools) so yeah can attain social skills and develop his personality.

- **Education According to Godfrey Thomson**
  Education is the environmental influences on individuals to make the right changes in the habits of his behavior, his mind and his feelings.

- **Education According Theodore Brameld**
  Robert W. Richey mention that; the term “Education” Refers to the broad function of preserving and improving the life of the group through bringing new members into its shared concern. Education is Thus a far broader process than that roommates Occurs in schools. It is an essential social activity by which communities continue to exist. Communities In this function is specialized and institutionalized in formal education, but there is always the education, outside the school with which the formal process is related.

  The term education contains extensive functionality of the breeder and the improvement of life of a community, especially bringing community members who are new to shared responsibility in society. So education is a process that is more extensive than the process that takes place inside school. Education is a social activity that allows people to stay there and grow. In complex societies, this educational function specialization and institutionalized experience with formal education who always keep in touch with the process of informal education outside of school [3].

**F. Definition of Character Education**

Terms of characters linked and interchangeable with the term ethics, the moral, and or value and deals with moral strength, a positive connotation, is not neutral. Meanwhile, according to KBBI, the character is a psychological traits, morals or manners that distinguish one person from another. Thus the characters are unique values-whether inscribed inside and be show in behavior. Characters coherently radiating from the result of a thought, though the heart, though the taste, and imagination, as well as sports person or group of people.

Characters also often associated with the term so-called temperament more emphasis on psychosocial definitions associated with education and environmental context. While the character from the standpoint behavioral somatopsychic more emphasis on elements of a person from birth. Thus we can say that the process of character development in a person is influenced by many factors typical of that of the person concerned who are also called congenital factors (nature) and environment (nurture) where the person concerned to grow and develop. Congenital factors can be said to be beyond the reach of communities and individuals to influence it. While environmental factors are factors that are at the reach people individually. So, someone business development or education can be done by communities or individuals as part of the environment through manipulating environmental factors [4].
G. Character “BAKU”

The character "BAKU" is an abbreviation of “Baik & Kuat” or Good and Strong. In which two characters are characters that serve as guidelines in conducting environmental education at Pondok Pesantren Daarut Tauhid Bandung. These include the nature of good character, *jujur* (honest), *ikhlas* (sincere) and *tawadhu* (humble), while strong characters include the nature of discipline, courage and survive.

As for the details of the two characters is as follows;

1) **Good character**

- **Sincere**
  
  Education is good and strong character is a character that is needed by humans. Such persons have a sincere heart and sincere. Why? Because nobody has abundant energy in the fight, except those who have sincerity. No one who has a strong steadfastness unless they are sincere. Those who do not expect the popularity, not expecting praise, do not expect a gift of what he did. What is expected is just Allah’s willingness. It is part of the foundation of good character. Sincerity is doing good deeds with the intention solely because Allah without even expecting votes from others, materialize, flattery, praise, promotion and other worldly. Sincerity is important pillars of faith, because sincerity is a condition of acceptance of one's deeds by Allah.

- **Honest**
  
  The next good character is honest. This character is embodied in speech and behavior. No lie, no theatrics, no promises were broken and no treacherous. Opponents of honest character is hypocritical. This character is busy using a mask, reverse speech good, packaging appearance, but their heart is bad. Such an attitude is a lot happening in our midst. Abstinence for our own hypocrisy. Honest is the opposite of a lie. In Arabic, honestly termed *Shidqu* which means it is a greeting that can be accepted as true. But in terms, honestly could mean more than true in word but also in deed true even true of the liver or intentions. Honest is also the most exalted character. Honesty is one of the properties of Prophet Muhammad SAW. Because honesty is the *Rasulullah* was given the title as Al-Amin (the trustworthy) by the people of Quraish in Makkah.

- **Humble**
  
  *Tawadhu* character is humility. Because the destroyer of all the good deeds we are when you are arrogant. Feel great, feel meritorious, had had a lot to do. Attitude-SKAP like this actually makes others nauseous, dislike and discomfort. Never a person to be beautiful with good deeds except for refined with *tawadhu*. Humble is a great trait. Humble is the opposite of vanity. Arrogant people that are not rich people, not the people who have high positions, not a man of many titles, nor those who has good looking. Humble people is the one who always keep themselves from too much pride and always flattering themselves.

2) **Strong characters**

- **Discipline**
  
  Maybe every time we hear the word “discipline”, our thoughts immediately lead to the army or troops marching or, it could be mind reflex leading to the Japanese state that is synonymous with a culture of disciplined life. If our mind ready, then be aware that the real discipline is a value that is ours as Muslims. Discipline in physical exercising will bear physical strength. Discipline in work, will give birth to a more productive work. Meanwhile discipline will bear intelligence. Discipline in maintaining health, will give birth to fitness. Discipline in driving, will give birth to safety and safety in driving. Discipline charity, gave birth financial strength. Therefore, the real discipline is not to be praised by others. Discipline is not because the rules made by humans. But that discipline is a form of worship to Allah. People who attend *majlis ilmu* discipline and discipline in the study, then he will get strong in the faith. Likewise, people who are disciplined in worship, in prayer five times a day, *tahajud, tadarus* then he will get strong in the faith.
• Courage
The second strong character is courage. Courage was not brave in the affairs of a fight. However bold in taking decisions, good or bad, God is the best choice. If death is regarded as the most frightening risks, then be aware that nothing is actually determining the power of life and death someone other than Allah. The brave dare not persecute the weak. Valiant in Islam is willing to take the decision to behave in the way of Allah. Indeed when the Prophet received revelation, he dared to pass despite the risks he faced enormous. Similarly, the Siti Khadijah ra. When he saw and believed in the truth brought by her husband, then he dared to support her husband the Prophet Rasulullah.

• Firm
After courage, then we need to navigate the continuous hurdles and obstacles, challenges, obstacles and all of it is the gift of Allah. All the obstacles created by God so that we are more knowledgeable, more skilled, more mature, more abundant reward [5].

H. Educational Character Factors
Environmental factors in the context of the character education has the importance of a role for behavioral changes learners as a result of the very character education was determined by environmental factors. In other words, the formation and engineering environments that include physical and cultural environments including schools, school management, curriculum, educators, and teaching methods. Manipulation of character formation by environmental factors can be done through the strategy, modeling, intervention, habituation done consistently and reinforcement.

In other words, the development and character formation requires the development of an exemplary transmitted, through learning intervention, training, habituation continuously in the long run is done consistently and reinforcement, and should be coupled with the noble values [6].

I. Pillars of Character Education
Character education is based on six ethical values that everyone can agree on - values that do not contain any political, religious, or cultural bias. Some of the things below which we can explain to help students understand the Six Pillars of Character Education, which is as follows:

• Trustworthiness
Honestly, do not cheat, plagiarize or steal, be reliable - do what you say you will do, ask for the courage to do the right thing, build a good reputation, obedient - stand by your family, friends and country.

• Respect
Be tolerant of differences, use manners, not bad language, consider the feelings of others, do not threaten, hit or hurt anyone, peace with anger, insults and disagreements.

• Responsibility
Always do your best, use self-control, discipline, think before you act - consider the consequences, be responsible for your choice.

• Fairness
Obey the rules, take the necessary and shared, open-minded; listening to others, do not take advantage of others, do not blame others carelessly.

• Caring
Be compassionate and show you care, express gratitude, forgive others, helping people in need.

• Citizenship
Making the school and community better, cooperate, get involved in community affairs, be a good neighbor, obey the law and order, respect for authority, protect the environment [7].

J. The Purpose and Function of Character Education
Character education is essentially aimed at shaping the nation's tough, competitive, high morals, tolerant, worked together, patriotic spirit, developing a dynamic, service-oriented science and technology are all animated by faith and piety to God Almighty based on Pancasila.
Character education serves to:

• Developing the potential of the base in order to be good, good thoughts, and good habits.
Strengthen and build multicultural nation behavior.
Increase civilization competitive nation in the association world.
Character education is done through a variety of media that include family, educational units, civil society, political society, government, business, and media.

**K. Shaping Character Values**

Actual education units so far has been developing and implementing the values forming the character through the operational programs of each educational unit. This is the precondition of character education in the educational unit to the next at this point is reinforced by the results of empirical studies grades 18 Curriculum Center. Value precondition (the existing values) in question include piety, clean, neat, comfortable, and well mannered. In order to further strengthen the implementation of character education has identified 18 values derived from religion, Pancasila, culture, and national education goals, namely: Honestly, Tolerance, Discipline, hard work, Creative, Independent, Democratic, Curiosity, Excitement Nationality, Love homeland, Rewarding Achievement, Friendly/Communicative, Love Peace, Joy of Reading, Environmental Care, Social Care, Responsibility, sisters. Values and descriptions contained in Appendix 1. Although there have been 18 values forming the character of the nation, but the education unit can determine development priorities by continuing value preconditions reinforced with some values are prioritized above a value of 18. In the implementation, the number and type of the selected character will certainly be different from one area or school with each other. It depends on the interests and conditions of each educational unit. Among the various values are developed, the implementation can be started from an essential value, simple, and easy to perform in accordance with the conditions of each school/territory, which is clean, neat, comfortable, disciplined, polite and courteous [8].

**L. Importance of Character Education**

Education applied in schools also require to maximize the skills and cognitive abilities. With such an understanding, there are actually other things in early-childhood education who are not less important that we unknowingly have neglected. It is to provide character education on our students. Character education is essential as a counterweight to cognitive skills. Some of reality that we often encounter together, a wealthy businessman just not a philanthropist, a politician did not even care about the starving neighbor, or a teacher it is not concerned about the street children who do not get a chance to learn in school. It is evidence of lack of balance between cognitive education and character education. There is a proverb that says “science without religion is blind, and religion without science is lame”. The same means that the cognitive education without character education is blind. As a result, because the blind cannot walk, even with the origin of crashing. Even walking with a stick will still run slowly. Conversely, knowledge without character cognitive knowledge, it will be paralyzed, easily driven, exploited and controlled by someone else. To that end, it is important not to ignore the students’ character education. Character education is education that emphasizes the formation of protege character values. I cite four basic traits of character education as formulated by the originators of the German educational character named FW Foerster:

- Character education emphasizing every action guided by the normative values. Protégé respect of existing norms and guided by the norms.
- The coherence or building confidence and courage, so students will be private firmeestablishment and not easily swayed and are not afraid of risk every time we face a new situation.
- The existence of autonomy, that students appreciate and practice the rule from the outside to be for his personal values. By doing so, the students were able to take independent decisions without being influenced by pressure from outside parties.
- Constancy and fidelity. Dependability is the durability of the students in realizing what is considered good. And fidelity is basic respect for commitments selected [9].

**J. Character Formation Process To Student**

Seeing the birth of butterflies, as well as the formation of the character of a child, it takes time and commitment from parents and schools or teachers to educate children to be individual character. It takes effort, time and love of the environment which is where she grew, love herein should not be mistaken pampering. If we are abiding by this process, the impact is not to our children, for we too have a positive impact, not least the character of patience, tolerance, able to understand the problem from a different angle,
discipline and integrity reflected in ourselves as parents or teachers. Remarkably, the process is doing a good job for parents, teachers and children if we are committed to the process of the formation of character. Everything needs a process, like so ugly even need a process. The naughty child also children who disiplin. He was disciplined for being naughty. He did not want to bathe on time, getting up always late, always consistent to not do the job and shall not be used in full uniform.

The character of a nation is an important aspect that affects the socio-economic development. High quality character of the community certainly will foster a strong desire to improve the quality of the nation. Character development it is best if started at an early age. An expression that is believed widely stated "if we fail to be good people at an early age, in adulthood we would be troubled person or a bad person".

Lickona says "a child is just a container where a responsible adult can be created". Therefore, prepare children is an investment strategy that is very precise man. A famous phrase expresses "Children are a total of only about 25% of the total population, but rather to determine 100% of the future". It has been proven that the most effective period to shape the character is before the age of 10 years. It is expected the formation of character in this period will have an impact that will last a long time against the moral formation of children.

Sustained effect (multiplier effect) on the formation of positive characters of children will be visible, as illustrated by Jan Wallander, "social skills and emotion in childhood will reduce risk behaviors, such as alcohol consumption is one of the major causes of health problems throughout period; social and emotional development in children can also improve human health throughout his life, such a reaction to the pressure that will have a direct impact on the disease process; emotional and social abilities are higher in adults who have the disease can help increase physical development."

It is natural to expect the family as the main actor in educating the basics of morality in children. However, many children, especially children who live in poor areas, do not get the moral education of their parents. Socio-economic conditions of low relating to various issues, such as poverty, unemployment, low education levels, low sociable life, usually associated also with high stress levels and further impact on the pattern of foster. One study showed that children who live in poor areas 11 times higher in those negative behaviors (such as physical and mental abuse, and neglect) than children from higher-income families. Many studies have shown that children who have received pre-school education has a higher ability than children who did not go to kindergarten, especially in academic ability, creativity, initiative, motivation, and social skills. Children who are not able to go to kindergarten will be enrolled in primary school generally a very young age, which is 5 years. It would be dangerous, because they are not ready mentally and psychologically, so as to make them feel inadequate, inferior, and can kill their love of learning. Thus a program dealing with this problem are needed to prepare children with a variety of important experience in preschool education. It is very important to mobilize people in poor areas to start sending their children to preschool and develop environmentally friendly with other kindergarten to jointly conduct character education [10].

IV. RESEARCH METHODS

The method used in this research is experimental research, by conducting surveys and randomly distributed questionnaires to 100 students as a sample of 308 students of SMK Pasundan 1 Bandung as a participant in education in schools tadabbur nature. Stages in this study, ranging from a direct observation of activities Pesantren Tadabbur Alam Daarut Tauhid Bandung, then surveying the level of success to the school associated with distributing questionnaires to students who have completed program schools for four days and solo bivoac in a mountain forest [11].

V. RESULT

A. Overview of Program

Tadabbur boarding program SMKN Pasundan 1 Bandung natural process to take place. This program provides many charge materials such class diniyah insight on participants such as study groups muta'alim, unlocking potential power, and tips for dealing with the problem presented by the chaplain boarding. It is based on the consideration and look to other factors in the psychological field as participants and attendees Islamic insight. In addition, the natural rhythm tadabbur boarding activities are adjusted to the conditions and needs of the participants and the school. Identical with most activities in schools, tadabbur program of this nature is a solo activity bivouac. This activity is one activity that prioritizes character code "BAKU". Where
participants are directed to practice the values of religion when released individually in the jungle. Bivouac participants create their own without the help of others. Participants are asked to really be sincere and honest from the heart to follow the bivouac solo activities. How do they appreciate and friends with nature depending on how the character they are friends with their natural surroundings. Not only a good character, but they are also geared for strong character, which is disciplined in following a solo activity bivouac, sleeping alone in the jungle without the help of others, and resilient and survive to continue the personal life into the character better.

Solo Bivouac seen at the time progresses, the participants enjoyed and activities can be run well, although not ideal as could be expected. Among these there are some participants who gathered in one bivouac with friends the other. But in general, participants can enjoy these activities very well. Participants filled times during their bivouac by reading the Quran, prayer nights, remembrance and prayer in their bivouac.

The activities ended with a solo bivouac muhasabah. Participants are invited to menghisab or self-contemplating, self-evaluation by considering the sins that has been done to parents, teachers and people who once they did cruelty. The participants dissolve in compassion.

B. Questionnaire results

In this study, researchers used two types of questionnaires that 6 indicate good character questionnaire (see Table 1) and 6 questions indicate strong character (see Table 2). As for the scoring models in this study is to provide signs or initials VE for the stated very agree, A to agree, N for neutral and NA for those who do not agree.

<table>
<thead>
<tr>
<th>No.</th>
<th>Statement</th>
<th>VA</th>
<th>A</th>
<th>N</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>More sincere in providing assistance or aid to teachers, friends and family.</td>
<td>49</td>
<td>50</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>More patience with any problems either at school or at home.</td>
<td>46</td>
<td>47</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Honest in every word spoken and deeds that I do</td>
<td>24</td>
<td>64</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>More honest in doing school work and the work at home.</td>
<td>33</td>
<td>57</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Allowing myself to tawadhu and keep away from the overbearing nature in the heart.</td>
<td>60</td>
<td>39</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Frequent meditation and surrender only to God.</td>
<td>53</td>
<td>37</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

From the table above shows that, of the 100 people in the sample, the average total. 44 states very agree to a change of character in themselves. While students who agree as many as 49 people and as many as 7 people prefer neutral, meaning that perceived no change in themselves.

<table>
<thead>
<tr>
<th>No.</th>
<th>Statement</th>
<th>VA</th>
<th>A</th>
<th>N</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brave in taking a stand or a good decision in accordance Islamic law.</td>
<td>53</td>
<td>44</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Bolder in speaking, asking and argued in the classroom.</td>
<td>30</td>
<td>30</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Discipline worship time on the obligatory prayer and worship other sunnah.</td>
<td>33</td>
<td>52</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>More discipline of studying and going to school on time.</td>
<td>53</td>
<td>42</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Abstinence complain in the face of challenging tasks of school and home.</td>
<td>38</td>
<td>39</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Not relentless and desperate to do goodness.</td>
<td>64</td>
<td>29</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

Result of the strong character questionnaire above shows that from 100 correspondents, 45 people stated strongly agree, 44 people answered disagree and 11 people declared themselves neutral. Total of the score questionnaire between good characters with strong questionnaire obtained the following results:

- Very Agree: both character questionnaire get about 44 people answered strongly agree, and strong character questionnaire as many as 45 people answered strongly agree, so the average of who answered very agreed amounted to 44.5%. This result show that as much as 44.5% of students admit strongly agree about the change in her character at once after the implementation of the natural tadabbur boarding program.
- Agree: the result of good questionnaire character showed about 49 people answered agree and in the character of "strong", as many as 44 people answered agree. After averaged between the two, as many
as 46.5% of students answered agree. This means that, as much as 46.5% of students agreed with the changing character of good and strong they felt after finishing boarding activities.

- Neutral: in the questionnaire character "good" as many as seven people hold an office and a character questionnaire neutral "strong" the neutral answer as many as 11 people. So approximately 9 people admitted not change the character.

VI. CONCLUSION

The function of character education for students is to develop, strengthen students' personal potential, and filter the outside influences that could eventually form the character of students who can reflect the culture of Indonesia. Efforts to establish the character of the students, as well as for students of SMK Pasundan 1 Bandung, made through natural *tadabbur* boarding, with a series of learning activities through the material conversion and self-development activities performed outdoors. Habituation-refraction good attitude and strong in daily life, such as: sincerity, honesty, humility, tolerance, hard work, love of peace, responsibility and so on, starting from the family and reinforced in schools and communities. Character education can thrive through supportive school culture. Establishment of school culture can be done through a series of activities: planning, implementation of learning-oriented learners, and the assessment is comprehensive. Planning at the school level is strengthening curriculum development at the school level, such as setting the vision, mission, goals, structure of the curriculum, academic calendar, syllabus and learning implementation plan. Overall the initial planning of the school which starts from analyzing the strengths and needs of the student orientation program when the school will be able to generate more targeted education programs that are not solely in the form of strengthening the physical realm, the knowledge and skills alone. But also the attitudes and behaviors that ultimately may form a noble characters and be clean. Character education is not a subject taught or value, but rather to instill good values through student orientation, application on all subjects, self-development program, and school culture. Map value presented in this paper are examples of the development program of character values that can be developed through a variety of subjects, in accordance with the standards of competence and basic competences contained in content standards; through self-development programs, such as the Islamic spiritual activities, *kultum* activities, visiting *pesantren, pesantren kilat*, as well as other conditioning program. The character education development planning needs to be done by all stakeholders in the school together as an educator community.

REFERENCES

OPTIMIZE THE INCREASE OF STUDENTS’ CONCEPTUAL UNDERSTANDING BY LEARNING AT THE ZONE OF PROXIMAL DEVELOPMENT

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Abstract—This study aimed to determine the effect of learning at the Zone of Proximal Development (ZPD) toward students’ conceptual understanding about water cycle. The research method used was quasi-experiment with non-randomized pretest-posttest control group design. Subjects of the study were 65 students of fifth grade elementary school divided into two groups, the experimental group (33 students) and the control group (32 students). Both groups learned water cycle topic by using problem based learning. The experimental group learned at the ZPD and the control group did not learn at the ZPD. The research instrument used was a conceptual understanding test about water cycle. N-gain average difference statistical test of both groups showed a significant difference (p = 0.000) between the experimental group (N-gain = 0.8) and the control group (N-gain = 0.12). This result indicates that the increase of students’ conceptual understanding can be optimized by learning at the ZPD.

Keywords: Conceptual Understanding, Elementary School, Water Cycle, Zone of Proximal Development

I. INTRODUCTION

One of the goals of science teaching is to help students develop scientific understandings on a variety of natural events [1,2,3]. In addition, science teaching is also obliged to train various process skills and scientific attitudes [4]. All these can be done by giving students direct experience of studying various phenomena that exist in their daily lives. By giving direct experience students will participate actively in the reconstruction of knowledge [5].

Science subjects provide also opportunities to develop students’ creativities. However, these opportunities are often overlooked [6]. One factor that led to the neglect of these opportunities is our perception as a teacher that our curriculum materials science is very dense but its teaching time allocation is limited. As a result lectures to be the method most preferred so that all curriculum materials can be delivered completely at the end semester. When the lecture became the dominant teaching method, it can be ascertained that the learning objectives beyond the cognitive aspects will be neglected.

The dominance of the lecture method is also likely due to the perception of teachers that all materials must be lectured so that students can understand. In this case teachers forget that students may have different potential and characteristics in learning. The lecture method will benefit certain students but it will harm other groups of students. Students who are diligently read science textbooks and can master science content materials independently will certainly be harmed by teachers accustomed to explain all science content materials. Students who are lazy to read will also be harmed by this teaching habit. They will not be motivated to read science textbooks. To avoid this negative effect of lectured method, science teachers need to identify which science content materials needs to be lectured and which do not need.

In line with the development of science, technology and the changing demands of the community, teaching-learning processes should also be adjusted to the developments and changes. As adjustment to these developments and changes, our current curriculum requires that learning science in schools needs to be more than just learning science as product, processes skills, and scientific attitudes. Learning science also need to
develop problem solving skills and creativities of students. To support these, our curriculum emphasizes the implementation of inquiry learning and learning that produce creative works based on problem-solving [7].

In line with the implementation of the new curriculum, an innovative learning such as problem-based learning (PBL) has been implemented and investigated. One of the goals under investigation is how PBL can enhance students’ conceptual understanding. Previous research findings showed that PBL increased students’ conceptual understanding higher than that of usual or conventional learning model [8, 9, 10]. However, previous researches conducted in Indonesia showed that the increase of students’ conceptual understanding were not high. Based on review of previous researches, the increase of students’ conceptual understanding through PBL model is still in moderate category [11]. Medium category means that current PBL implementations have not been able to help all students to achieve conceptual understanding optimally. This is a challenge of how to optimize the increase of students’ conceptual understanding through the PBL implementation.

There are two possibilities why the increase of students’ conceptual understanding through the PBL implementation was still in moderate category. Firstly, teachers delivered all science content materials and not focused only on parts that students find them difficult to understand. Secondly, students may have low prior knowledge related to science content materials to be studied. Hailikari stated that good prior knowledge will support students to achieve better learning achievements [12]. Given these two possibilities, teachers as facilitators need to identify science content materials that can be mastered by students independently and which ones cannot. Furthermore, teachers should motivate their students to read science textbook prior learning in classroom. So that, in order to be efficient and effective as well as achieve optimal results, lecture method should focus only on the content material that cannot be mastered by students independently. Or in other words learning is to be done in the area of proximal development (ZPD). ZPD is the area between the actual development level which is a person’s ability to solve problems independently and potential development level which is the ability to solve problems under the guidance of an adult or cooperate with peers that are more capable [13]. ZPD concept was developed by Vygotsky during the late 1920s and elaborated progressively until his death in 1934 [14].

As mentioned above, reading activities can provide students with better actual development level. Preliminary studies conducted at about 15 elementary schools in Bandung found that habituation reading science textbooks by elementary school students could increase students’ actual development level. The research conducted by Sopandi, Kadarohman, Sugandi, and Farida in chemistry course at one high school in Bandung also showed the same thing [15]. Their study found that the increase of students’ achievement in chemistry was in line with the increase of their actual development level.

Given all above, efforts to optimize the increase students’ conceptual understanding through PBL are needed. In line with this purpose, this research article reports optimization the increase of students’ conceptual understanding through learning at the ZPD. The article answers the problem of "How the optimization the increase of students’ conceptual understanding through learning at ZPD? Specifically, this article answers questions:
1. What is the profile a students’ actual development level?
2. What is the profile of students’ potential development level?
3. Can learning at ZPD optimize the increase of students' conceptual understanding?
II. RESEARCH METHODS

The method used in this study was quasi-experimental design with pretest-posttest nonrandomized control group design. 65 students of class V at one elementary school in Bandung were involved in this study. They were divided into two groups. Both groups showed so far no difference in learning achievements. Both groups were randomly selected to be used as the experimental group and the control group. Experimental Group consisted of 33 students and control group consisted of 32 students. Both groups learnt using the same model, namely PBL. In contrast to previous studies that many of them compared the application of PBL with conventional one, this study investigated the optimization of the effect of PBL on the increase of students’ conceptual understanding. Optimization was done by assigning students in experimental group to read textbooks at home before they learnt with their teacher in classroom. The optimization was also done by implementing learning in the area of proximal development. These optimization were not done in control group. The science topic chosen was the water cycle. The main research instrument was conceptual understanding objective multiple-choices test. The test was validated theoretically and empirically. This test was used three times, first (T1), second (T2), and third (T3). T1 was answered by students in experimental group before they read textbook at home. T2 was answered by students in experimental group after they read textbooks. T3 was answered by students in experimental group after they learnt with their teacher. To see the impact of the optimization activities, students in control group were also answer T1, T2, and T3 in a relatively simultaneously.

III. FINDINGS AND DISCUSSION

A. Students’ Actual Development Level

The students’ actual development level was obtained by giving T2 to the experimental group. As has been mentioned, T2 was conducted after students in the experimental group read textbooks related to Water Cycle. The scores obtained by the students in this test indicated the ability of students to understand the science content material independently. The students’ actual development level of experimental group can be seen in Table 1 below.

<table>
<thead>
<tr>
<th>No</th>
<th>Conceptual understanding Indicators</th>
<th>Cognitive Level</th>
<th>% of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Comparing the changes in the states of water</td>
<td>C2</td>
<td>29%</td>
</tr>
<tr>
<td>2</td>
<td>Explaining the causes of changes in the states of water.</td>
<td>C2</td>
<td>19.5%</td>
</tr>
<tr>
<td>3</td>
<td>Interpreting the factors that can change the states of water.</td>
<td>C2</td>
<td>14%</td>
</tr>
<tr>
<td>4</td>
<td>Applying procedures to changes states of water</td>
<td>C3</td>
<td>9%</td>
</tr>
<tr>
<td>5</td>
<td>Identify the processes of the water cycle</td>
<td>C1</td>
<td>98%</td>
</tr>
<tr>
<td>6</td>
<td>Explaining the relationship between the water cycle and water availability</td>
<td>C2</td>
<td>39%</td>
</tr>
<tr>
<td>7</td>
<td>Mentioning human activities that may affect the water cycle.</td>
<td>C1</td>
<td>85%</td>
</tr>
<tr>
<td>8</td>
<td>Analyzing the influence of human activities on the water cycle.</td>
<td>C4</td>
<td>0%</td>
</tr>
<tr>
<td>9</td>
<td>Giving examples of water saving activities.</td>
<td>C2</td>
<td>97%</td>
</tr>
</tbody>
</table>

Table 1 shows that for almost all indicators, there were always students who have already mastered the indicators by learning independently (% of Students > 0%). Only the indicator number 8 which none of the students were able to master it without the help of their teacher. The table also shows that indicators with relatively low cognitive level could be mastered by more students independently. Fewer students could master indicators with higher cognitive levels independently. This showed that to master indicators with high cognitive levels, many students need help of others (teachers or peers).
Through analysis of students’ actual development level, teachers can determine their role in helping their students master science content materials. Table 1 shows that teachers did not need to deliver almost all teaching materials. This was because for almost all materials there were students who understood independently through reading activities. Lecturing from the teacher will only be beneficial for all students if teachers do just for the indicator 8. Therefore, based on the ZPD learning construction, teacher’s lecture can be more focused on science content materials that all students cannot understand them independently [16]. When science content materials or parts of them can be mastered by all or most students, learning about those materials can be done through discussion and peer tutors. This will make certainly the use of time allocation of learning be effective and efficient. Understanding students’ learning needs and accommodate them into the design and evaluation of learning is a form of implementation of the ZPD in the learning construction [17].

B. Students’ Potential Development Level

The students’ potential development level was measured by T3. T3 was done after the students have learned in the classroom with the teacher.

Table 2 shows that indicator with cognitive level C1 could be achieved by all students (100%) after learning at ZPD. This shows an increase in the number of students who master these indicators after they have learned with their peers. It indicated that learning in the classroom with peers contributes to the increased number of students who reach the cognitive level C1. Indicators with C1 level were learnt by students through discussion and peer tutors. Teacher did not delivered science content materials related to these indicators because there were a lot of students that can be used as a resource (see Table 1). The number of students who mastered indicators with cognitive level C2 and C3 were also increased. This also shows that group discussion and peer tutoring contributed to the increase. The same increase was also occurred for C4 cognitive level. After learning there were as many as 48.5% of students who mastered the indicator. It seems that the scaffolding provided by the teacher help some students (from 0% to 48.5%) to master that cognitive level. However, more than 50% of students have not yet mastered the level even though their teacher has already helped them. The findings of this profile students’ potential development level indicates that the assistance of the teacher cannot guarantee that after completion of the learning students can achieve all the learning indicators or learning tasks targeted.

C. Increase students’ conceptual understanding through learning at the ZPD

The success of the optimization problem based learning through learning activities in the ZPD in increasing students’ conceptual understanding was measured by comparing the increase of students’ conceptual understanding of experimental class and that of control group. Increase students’ conceptual understanding (N-Gain) was measured by calculating the increase in scores obtained by students on T1 and T3. The average score
gained by each group in each test and the results of the average scores difference test between the two groups can be seen in Table 3 below.

**TABLE 3. THE INCREASE OF STUDENTS’ CONCEPTUAL UNDERSTANDING**

<table>
<thead>
<tr>
<th>Data</th>
<th>Groups</th>
<th>N</th>
<th>Score Average</th>
<th>Normality</th>
<th>Homogeneity</th>
<th>Mean Differences Tests (t/t')</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Experiment</td>
<td>33</td>
<td>27.7</td>
<td>0.200</td>
<td></td>
<td>0.863</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>32</td>
<td>28.4</td>
<td>0.131</td>
<td></td>
<td>0.780</td>
</tr>
<tr>
<td>T2</td>
<td>Experiment</td>
<td>33</td>
<td>44.7</td>
<td>0.200</td>
<td></td>
<td>0.030</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>32</td>
<td>29.4</td>
<td>0.200</td>
<td></td>
<td>0.000</td>
</tr>
<tr>
<td>T3</td>
<td>Experiment</td>
<td>33</td>
<td>84.2</td>
<td>0.110</td>
<td></td>
<td>0.364</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>32</td>
<td>37.5</td>
<td>0.200</td>
<td></td>
<td>0.000</td>
</tr>
<tr>
<td>N-Gain</td>
<td>Experiment</td>
<td>33</td>
<td>0.78</td>
<td>0.200</td>
<td></td>
<td>0.031</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>32</td>
<td>0.12</td>
<td>0.200</td>
<td></td>
<td>0.000</td>
</tr>
</tbody>
</table>

Data T1 show that before learning began there was no significant difference between students’ conceptual understanding of the experimental group and the control group (p = 0.780). A significant difference (p = 0.000) in conceptual understanding began to emerge after the experimental group did reading activities at home (T2=44.7) while the control group did not do so (T2=29.4). Because the experimental group gained on score average higher in T2, this proves that reading activities at home can provide students with a better learning preparation. Start to learn with a better learning preparation allows students to obtain better achievement. This is evident from the T3 of the experimental group (84.2) was significantly higher (p = 0.000) compared to the control group T3 (37.5). The success of the optimization problem based learning through learning at the ZPD in increasing students’ conceptual understanding can be seen from the average N-Gain of the experimental group (0.78) were significantly higher (p = 0.001) compared to N-Gain of the control group (0.12).

The above findings indicate that teaching at ZPD help students to gain better understanding than that of learning at no ZPD. This shows one of many other advantages of learning in the area of proximal development [18]. Cordova & Leong (1996, p. 42) expressed that the idea of ZPD has important implications for education [19]. This idea provides an alternative of how we help children in the process / learning in order to obtain better learning outcomes. As stated by Borchelt that the teacher's task is to provide social interaction in learners’ community so that learners can move from what they know heading to what they do not know [in 17]. Learning is determined by the interaction between the existing knowledge on the learner, the social context built, and the problems to be solved. Cognitive development is optimized in the ZPD or the area where the exploration of cognitive students have been prepared, but needs help through social interaction.

Based on classroom observations, at the beginning of the learning, students in the control group were less able to answer the apperception questions. As a result, teachers needed to explain the answers. This consumed learning time allocation. Unlike the situation in the control group, students in the experimental group were able to answer the questions correctly. Perhaps this related to their independent learning activities through reading. Their capabilities to answer initial questions were in line with their higher actual development level as shown by the results of the T2. Because of their fluency to answer questions at the beginning of lesson, less time was spent on this session.

At main teaching and learning activities, either in the control group and experiment, students were divided into groups heterogeneously based on their ability. This grouping was enabling students to interact with others. Things were different in the division of the group, namely that in the control group only by differences in the ability of students over the years. While in the experimental group division of the group members was based on the students’ actual development level acquired through T2. Based on the data T2 teachers arrange suitable
scaffolding types of assistance given to students, whether from peers or teachers. For indicators of learning that had been achieved by most students was done through discussion among students to reinforce their understanding. For the learning indicators that have not been mastered by most students were taught through peer tutors. And for the indicator in which all students have not been able to master it (indicator number 8) independently, the scaffolding method was conducted through an explanation from the teacher. So in this study, the scaffolding was not always needed by the students, but when they needed, it can be given from peers or teacher [20].

The teaching and learning process in the control group classroom was slow and not conducive to develop other aspects beyond the comprehension of the science content materials. Many students were confused with the activities to be carried out even if they have been given the opportunity to ask each other in the group. Students asked the teacher to explain the procedures and materials that should actually be studied in discussion groups.

Different phenomena occurred in the experimental group classroom, the learning process took place smoothly. Students in each group discussed procedures and science contents materials being studied smoothly. If the groups found difficulties, the teacher suggested them to ask friends from other groups seen more understand. Sharing information among them was done through by presentations, question and answer activities, as well as panel discussions. The teacher explained only teaching materials in which all students could not master them independently. This teaching strategy (learning at ZPD) made learning process in the experimental group took place according to the time allocation planned. Besides this benefit, learning at ZPD based on this study provided an opportunity to develop other things beyond cognitive domains (social skills). This is in accordance with Lyons which states that learning in the ZPD not only develops mental function but also other functions that are still in the developmental process [21].

The level of the smooth implementation of problem-based learning that took place in the two groups can be seen in Table 4. Table 4 shows the occurrence PBL indicators in every phase.

<table>
<thead>
<tr>
<th>Learning Phases</th>
<th>Occurrences PBL Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experiment</td>
</tr>
<tr>
<td>Phase 1</td>
<td>5</td>
</tr>
<tr>
<td>(5 indicators)</td>
<td></td>
</tr>
<tr>
<td>Phase 2</td>
<td>3</td>
</tr>
<tr>
<td>(3 indicators)</td>
<td></td>
</tr>
<tr>
<td>Phase 3</td>
<td>7</td>
</tr>
<tr>
<td>(7 indicators)</td>
<td></td>
</tr>
<tr>
<td>Phase 4</td>
<td>6</td>
</tr>
<tr>
<td>(6 indicators)</td>
<td></td>
</tr>
<tr>
<td>Phase 5</td>
<td>3</td>
</tr>
<tr>
<td>(3 indicators)</td>
<td></td>
</tr>
<tr>
<td>Percentage</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 4 shows that all the indicators appeared in the PBL learning in the experimental group classroom. While in the control group appeared only 33% of those indicators in the implementation of PBL. This indicated that the optimization which had been done in this study support the better implementation of PBL.

At the end of the lesson, the teacher in the classroom learning control just close with a prayer. The teacher did not have time to give appreciation and strengthening the implementation of PBL. While in the experimental group, the teacher could give students opportunities to formulate conclusions, provide reinforcements and appreciations of PBL implementation. The students in the experimental group after completion of learning had
an opportunity to express his feelings about the learning that has been implemented. Students with high cognitive ability, in general, give an opinion that learning was rather fast, fun, exciting, and challenging them to solve problems together. Students with moderate and low cognitive abilities suggested that they got help from friends and the teacher to do the materials they found to be difficult. They said quite be courageous and confident in following all learning activities through discussions, question and answer, presentation, and so forth because the teacher provided opportunities and also helped them to develop other than cognitive abilities.

IV. CONCLUSION

The findings of this study showed that not all conceptual understanding indicators of learning (cognitive domain) should be lectured by the teacher. The findings showed that some of them could be mastered by certain students through learning independently. Some of them can be mastered by certain students with help from their peers or teacher. With scaffolding only in the ZPD was proven to help optimize the increase of students’ conceptual understanding.

Although findings of this study proved that learning at ZPD can optimize the increase of students’ conceptual understanding but further researches are needed to validate this indication. Further researches may use more participants and schools, other innovative learning models and other science themes. It is also needed to develop better scaffolding, especially, to help students to master indicators with high cognitive levels.

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REFERENCES


RECITATION PROGRAM BASED ON MULTI REPRESENTATION NEEDED TO INCREASING THE KINEMATICS CONCEPTUAL UNDERSTANDING

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Abstract—Difficulties of kinematics conceptual understanding and applied to solved problems have found. We report the results of an investigation in to 46 physics students’ understanding of kinematics (position, velocity and acceleration). It’s cause of some problems those are, student do not understand the fundamental concepts of kinematics, the concept isn’t deeply saved in long terms memory, so that they can’t activate the appropriate concept when they are solving the problems, and the students knowledge about contexts is so definite. Other than, the kinematics concept is so extensive but the allocation of time is so definite. From those problems, recitation program expected to become the solution. Recitation program in kinematics concepts is based on offline computer program and it designed interactively. This program designed in order to make student can understand the concept deeply. Kinematics problem in recitation program consist of varied context and in representations format.

Keywords: Recitation Program, Multi Representation, Kinematics Conceptual Understanding

I. INTRODUCTION

Physics is commonly considered to be a difficult subject for students and college students. Students’ understanding of physics concepts have investigated by many researchers [1-3]. In physics teaching, the physics concept investigations at the high school and undergraduate level have shown that a majority of science students have difficulties to understand physics concepts [4-5].

Students usually come to science classes with variety preconceptions [6-7]. It comes from them experience. The experiences gained by the individual form the basis of these self constructed conceptions that is usually not consistent or partially consistent with scientific view, it called preconceptions [8], alternative frameworks [9-10], or misconceptions [11-12], alternative conceptions [13-14] by different authors. Misconceptions in physics develop at very basic levels since physics is a conceptual subject, and research in physics education has shown that students have misconceptions almost in all topics of physics such as mechanics [1, 8, 15-17], optics [18-19], electricity [20-26], and thermodynamics [27-29].

Student conceptual understanding is one of the important purpose in teaching physics. One of the constraint to achieve the student conceptual understanding that is appropriate with science principle. But, some problems are hindrance to achieve it. One of the problem is how to help students difficulties. Else, how to change the students preconceptions is a problem [30-31].

Teaching physics must be designed to facilitate students to develope new concepts and repair them preconceptions [31-34]. So, identification of students difficulties and students preconceptions is a important stage in teaching of conceptual change. Teaching physics is not just giving physics concepts to students, how to activated quickly the correct concept is important too [35].

Students are not only required to understand the concept as a whole, but also be able to apply it when solving physics problems. Multi representation is needed to building conceptual understanding [36-37] and build in-depth understanding of the situation [38]. Multi representations are not only helping students learn the concepts, but also can make a good problem solvers [39]. Multi representation also can help to build the
knowledge and problem-solving [40-45]. Kohl [46] concluded that in completing the test, the student's ability better when students learn by providing representations format. Problem solving ability depends on students knowledge and the character of the problem indicated by the representation format in question [44, 47]. Representation in terms used by students to interpret or understand the problems [48]. Representation in question also provide the information required students to solve problems and determine how to proceed. Error in retrieving information in a matter of making the problem can not be solved [49]. Therefore, the quality of representation that is essential for students to be able to understand a concept and to solving problems.

Over the last decade, many researchers who devote focused at the mechanics learning. In order to successfully understand well the ideas of mechanics, students need to have a solid understanding of the kinematics concepts such as position, velocity, and acceleration and its attributes, both qualitatifkonseptual or in kuantitatifoperasional. Nevertheless, the study shows how difficult to teach it, until students can apply it to solving the problem. Rosenblatt and Hecker [50] found many students had misconceptions about the relationship between the direction of the resultant force, velocity, and acceleration. Champagne and Anderson [51] reported that students, who had previously studied physics, had many incorrect mechanics concept like: a constant force produces constant velocity; magnitude of the velocity is proportional to the magnitude of the force; acceleration is due to an increasing force; a force will produce motion; and in the absence of forces, objects are either at rest or slowing down. Else, Thornton and Sokoloff [52] reported that many students believe that the resultant force direction of the velocity. Other studies have found a lot of students who have trouble differentiating the velocity and acceleration [4, 53]. From Shaffer and McDermott’s [54] study, they reported that only about 30% of students pascasajana (n = 125), only about 5% prospective physics teachers (n = 18), and only about 15% of the students physics doctoral program (n = 22) at the University of Washington and Montana State University, which could well explain the acceleration in the direction of motion of the pendulum, although only approach. Sutopo [55] reported that it has also been experienced by most physics students. It means that the learning experience has not managed to deliver the previous physics students concepts of kinematics well.

Based on the problems described above, we assume that the recitation program can be an alternative to minimize these problems. The purpose of this paper is to identify the difficulties that still occur in students and review the effectiveness of programs based on the multi recitation representation in increasing students’ conceptual understanding.

II. Method

This paper is a part of research that examines the impact of recitation program based on multi representation to kinematics conceptual understanding. Before we use the recitation program based on multi representation, we identify the kinematics conceptual understanding of students first. To investigate students’ conceptions, 20 questions of conceptual test was administered at end of the course. The topics of test is as following Table 1.

<table>
<thead>
<tr>
<th>Test ability</th>
<th>Number of questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyzing of motion digrams in linear motion to describe the verbally, mathematically or graphically velocity and acceleration</td>
<td>1, 2, 13, 14</td>
</tr>
<tr>
<td>Analyzing of graph v(t) in linear motion to determine the object position at t, the object velocity and acceleration in interval time Δt, and to describe the object motion in interval time Δt (verbally-mathematically).</td>
<td>3, 4, 5, 6</td>
</tr>
<tr>
<td>Analyzing the mathematical equations position x(t) to determine the displacement, velocity, average velocity, and direction of motion during a certain interval time.</td>
<td>7, 8, 9, 10</td>
</tr>
<tr>
<td>Determine the velocity and acceleration of the average in the two-dimentional motion diagrams</td>
<td>11, 12</td>
</tr>
<tr>
<td>Describe the various possible relationships between velocity and acceleration and apply in to determine the instantaneous acceleration in motion curving diagram, verbal, and mathematical.</td>
<td>15, 16, 17, 20</td>
</tr>
</tbody>
</table>

There are 46 undergraduate students’ of physics education program in State University of Malang as respondents. All of students have discused the kinematics concept (position, displacement, distance, velocity, speed and acceleration) during 6 meetings lecture. Our analysis students’ conceptual understanding basically
based on them score. We also made a qualitative analysis based on students’ reasons in responding the test. In this paper will only discuss common difficulties that occur in solving problems related to the concept of kinematics.

### III. Results

#### A. Result of Conceptual Understanding Test

In this article, we discuss the students’ conceptual understanding of displacement, velocity and acceleration. The results of the tests that we gave to 46 students of physics education in first year showed by the following Table 2.

**TABLE 2. A List Of The Student’s Choice Option**

<table>
<thead>
<tr>
<th>No.</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>1.</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>7</td>
</tr>
<tr>
<td>3.</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>14</td>
</tr>
<tr>
<td>5.</td>
<td>8</td>
</tr>
<tr>
<td>6.</td>
<td>8</td>
</tr>
<tr>
<td>7.</td>
<td>24</td>
</tr>
<tr>
<td>8.</td>
<td>5</td>
</tr>
<tr>
<td>9.</td>
<td>26</td>
</tr>
<tr>
<td>10.</td>
<td>4</td>
</tr>
<tr>
<td>11.</td>
<td>14</td>
</tr>
<tr>
<td>12.</td>
<td>21</td>
</tr>
<tr>
<td>13.</td>
<td>4</td>
</tr>
<tr>
<td>14.</td>
<td>7</td>
</tr>
<tr>
<td>15.</td>
<td>9</td>
</tr>
<tr>
<td>16.</td>
<td>4</td>
</tr>
<tr>
<td>17.</td>
<td>6</td>
</tr>
<tr>
<td>18.</td>
<td>29</td>
</tr>
<tr>
<td>19.</td>
<td>10</td>
</tr>
<tr>
<td>20.</td>
<td>1</td>
</tr>
</tbody>
</table>

*The shading gray : answer key

From students’ conceptual understanding score, descriptive statistics of achievement is summarized in Table 3.

**TABLE 3. DESCRIPTIVE STATISTIC OF STUDENT CONCEPTUAL UNDERSTANDING SCORE**

<table>
<thead>
<tr>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid N (listwise)</td>
<td>46</td>
<td>46</td>
<td>0.00</td>
<td>75.00</td>
<td>36.30</td>
</tr>
</tbody>
</table>

From Table 3, we can see that a student cannot answer the questions correctly, so that get score 0. The maximum score is 75. Its mean that the students’ can answer correctly 15 from 20 questions.

The mean of kinematics conceptual understanding score is 36.30. The data showed that on average only about 7 questions answered. Students are still many difficulties in understanding the concept of position, velocity and acceleration. The kinematics conceptual understanding is rated poorly.

#### B. Interpretation of Kinematics Graphs

Many students’ cannot use graphs to represent physical reality. This problem have been carefully examined and categorized [56-57]. 3 questions have used to investigate the students’ abilities in interpreting physical reality to kinematics graphs. Its listed in Table 4.
TABLE 4. STUDENTS’ ABILITIES IN UNDERSTANDING GRAPHS-KINEMATICS

<table>
<thead>
<tr>
<th>Given</th>
<th>The student will</th>
<th>No. item</th>
<th>Percent correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenomena of reflection ball</td>
<td>Interpreting velocity-time graph</td>
<td>8</td>
<td>19.56</td>
</tr>
<tr>
<td>Motions diagrams with scale</td>
<td>Interpreting velocity-time graph</td>
<td>13</td>
<td>73.91</td>
</tr>
<tr>
<td></td>
<td>Interpreting acceleration-time graph</td>
<td>14</td>
<td>45.65</td>
</tr>
</tbody>
</table>

From table 4 we can see that only 19.56% students’ can interpreting velocity-time graph when given the phenomena of reflection ball. In this case, given a phenomena when a ball released form certain height. A common difficulty is to ignore the sign on velocity and difficulty in interpretation of the graph despite understanding the context of the issue. Option B was chosen by 50% students. This graph represents the speed of the object that is diminishing, then the speed is increasing when the ball moves up. This may occur because students can not read graphic.

From the diagram presented the motion as much as 73% of students answered question number 13 and 45.65% of the students answered question number 14 correctly. Students mistake in answering question number 13 is thought when object is slowing down means its speed is negative and toward zero. In answer question number 14, students are less able to interpret the diagram of motion to interpret a graph v-t. But most errors occur because less scrupulous in understanding the interval when the acceleration and deceleration.

C. Describe the Motion Concept

Sutopo [55] was observe the students’ during in physics course. He says that many students’ held the following misconception, those are (1) acceleration and velocity is always in the same direction, (2) the magnitude of acceleration is proportional with velocity, (3) acceleration always in the direction to which the object tends to move, (4) if an object moves in a frictionless track, its acceleration is zero, (5) if an object is in under influence of gravity then its acceleration is equal to the gravitational acceleration (g). From other researchers, Antwi, et al [58] says that some students cannot differentiate between ‘displacement’ and ‘distance’. He says that some students cannot differentiate between ‘velocity’ and ‘speed’ too. Many students’ have a conception that each pair have same meaning and can be used interchangeably [59-60]. From our search, we see that many students’ cannot describe the motion concept correctly. Table 5 shown the percent correct of students’ answer in each of question.

TABLE 5. STUDENTS’ ABILITIES IN UNDERSTANDING KINEMATICS CONCEPT (VERBALLY)

<table>
<thead>
<tr>
<th>Given</th>
<th>The student will</th>
<th>No. Item</th>
<th>Percent correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position as function of time</td>
<td>Describe the displacement, speed and direction of motion.</td>
<td>11</td>
<td>15.22</td>
</tr>
<tr>
<td>Direction of velocity and acceleration object during move</td>
<td>Describe the trajectory of object</td>
<td>17</td>
<td>8.69</td>
</tr>
</tbody>
</table>

From Table 5, we can see that 15.22% of students’ choose the correct answer to describe the displacement, speed and direction of object motion, 8.69% of students’ choose the correct answer to describe the trajectory of object.

In question number 11, option A represents the conception in defining x (t) as displacement in interval time t. In addition there are 12 students (26.09%) justify the option D that represents if negative acceleration indicate that the speed of the object is always reduced. Mistake in defining sign in acceleration is a common mistake.

In question number 17 only a few students who answered correctly. There are 4 students’ (8.69%) who answered correctly. This matter indicates that the student is still having difficulty in estimating the trajectories of objects from the information relations of direction velocity and acceleration.

D. Determining the position, displacement, velocity and/or acceleration concept

Many students still have difficulty in determining position, displacement, velocity and/or acceleration. The difficulties shown by the low score of students’ conceptual understanding as shown in Table 6.
TABLE 6. STUDENTS’ ABILITIES IN DETERMINING POSITION, DISPLACEMENT, VELOCITY AND/OR ACCELERATION

<table>
<thead>
<tr>
<th>Given</th>
<th>The student will</th>
<th>No. Item</th>
<th>Percent correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Velocity-time graph and initial position</td>
<td>Calculate the position at ( t )</td>
<td>3</td>
<td>36.96%</td>
</tr>
<tr>
<td>Velocity-time graph</td>
<td>Calculate the average velocity</td>
<td>5</td>
<td>17.39%</td>
</tr>
<tr>
<td></td>
<td>Calculate the average acceleration</td>
<td>6</td>
<td>54.35%</td>
</tr>
<tr>
<td>Phenomena reflection of ball</td>
<td>Calculate the average acceleration</td>
<td>7</td>
<td>10.87%</td>
</tr>
<tr>
<td></td>
<td>Calculate the average velocity</td>
<td>9</td>
<td>56.52%</td>
</tr>
<tr>
<td>Position as function of time.</td>
<td>Calculate the average velocity</td>
<td>12</td>
<td>45.65%</td>
</tr>
</tbody>
</table>

The results showed that the students are still difficult to interpret graphs \( v-t \). It is shown from the results obtained. Only 36.96% of the students were able to determine the position at \( t \) of objects from graph \( v-t \). On Question 3, there are 16 students chose option D. Option D represents the conception of students that determines the position \( x(t) = \int_{t_1}^{t_2} \vec{v} \; dt \). The student does not use the information initial position. Difficulties students can be seen from the percentage of students who answered correctly in determining the average speed and average acceleration from a different context. Some of the difficulties that occur because students are not using positive and negative signs correctly on the vector. In addition, students are still experiencing difficulties due to mistaken in defining velocity and acceleration mathematically.

E. Can Recitation Program Increasing Kinematics Conceptual Understanding?

Kinematics conceptual understanding score is related poorly. Many students’ have difficulties to understand the kinematics concept and solve the kinematics problems. They cannot solve the kinematics problem is caused by many factors. One of cause is the physics concept is not deeply record in long term memory [35]. One else from resource theory or knowledge in pieces [6] say that students’ difficulties is caused by students’ knowledge stucture in pieces. Students’ knowledge stucture is not intact, so they can making sense of them knowledge.

The kinematics concept to solving problems in diverse contexts is importance. It takes a long time to help students understanding the concepts well. However, the allocation of limited instructional time became an obstacle in conveying the concept to be controlled either by the student. To overcome this, recitation program can be used as an alternative to overcome the problems [61].

This recitation program contains practice questions accompanied feedback for each option either right or wrong answer. Feedback is useful to have a positive effect and reduce the negative [62]. Moreover feedback on each answer option is very important to strengthen the concept of students and improve conception if students are experiencing misconceptions. Feedback constructed to repair the students’ misconceptions and to help the students’ difficulties. The accurate information in a important aspect in feedback [63]. To providing feedback is a vital aspect of supporting in practice [64].

Problems are given without feedback were concerns that it would reinforce misconceptions. This will happen if the answer to the misconceptions provided in the answer options. The amount of the provision matter will have no effect either on mastery of concepct [65] say that students are still having difficulties in solving problems despite having completed about 1000 questions.

To allow students to explore the concept independently, and can be done outside lecture then this recitation program designed with computer-based. In addition to be used independently, recitation program based offline computer program can be used at any time and can be repeated by the students. From the study that have been done by Afwa, et al [35] concluded that the practice questions with a variety of different contexts and accompanied inverse kinematics can increase students conceptual understanding. Jayanti, et al [61] have found that the recitation of computer-based program that contains questions and feedback for each option can improve the style and increasing the students conceptual understanding.

IV. CONCLUSIONS

Based on the findings and discussion exposure can be inferred that many students have difficulties in kinematic concept. It cause of physics concepts’ is not deeply record in long term memory and students’ knowledge stucture in pieces. Recitation program can be a alternative way to solve it.
V. ACKNOWLEDGEMENT

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REFERENCES


CHARACTER BUILDING THROUGH THE INTEGRATION OF ISLAMIC VALUES IN BIOLOGY TEACHING AND LEARNING

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Abstract--The advancement of science and technology in globalization era has profoundly affected the complexity of human behavior and perspective towards society and environment. One of the negative effects of globalization is demoralization which happens in many aspects especially in young generation. Demoralization can actually be solved by implementing character education in school. Character education can be implemented as an integrated model which can be thought in various subjects such as Biology. This paper aims to provide theoretical framework for developing learning instructions by integrating Islamic values in Biology teaching and learning including the principles and its implementation in a form of the integration of science matter and religious matter altogether. It emphasizes on the moral, values, and ethics in Islam that can be integrated in Biology in order to build student’s character.

In conclusion, the integration of both can be implemented to build the student’s character in the form of religious, environmental awareness and responsibility, develop a sense of community, and more importantly preserve the nature for the sustainable living by increasing the student’s character towards environment.

Keywords: Character Building, Islamic Values, Biology Teaching and Learning

I. INTRODUCTION

The advancement of science and technology are a double-edge sword. It profoundly affects how human think towards society and environment that can be positive and also negative. In the positive side, people tend to be productive in using sources to fulfill their need. In the contrary, it is the demoralization that happens in young generations. It is caused by many factors, such as families nowadays often provide less supervision and moral guidance than previous by leaving children less capable young citizen as they often lack the skills they needed to contribute in society.

The lack of character in young generation is such a concern to educator, so that it needs to be tackled by character building. The character building itself has become public discourse as media social tells us so. Demoralization can actually be solved by implementing character education in school through education, because it is a tool in preventing demoralization in young generation. Education can be used as a tool to tackle demoralization in young generation by implementing character education in the school, so that the demoralization can be prevented as early as possible.

This paper aims to integrate the Islamic values in character education through Biology education. This paper provides theoretical framework for developing learning instructions by integrating Islamic values in Biology teaching and learning including the principles and its implementation in a form of the integration of science matter and religious matter altogether. This paper also emphasizes that the integration of Islamic values can be implemented in religion based school. The integration emphasizes on the moral, values, and ethics in Islam that can be integrated in Biology in order to build student’s character.
II. Method

Data was collected through literature study. In order to know the integration of Islamic values in Biology teaching and learning to build student’s character in the form of religious, environmental awareness and responsibility, developing a sense of community, and also preserving the nature for the sustainable living, data was obtained from books, scientific journals and articles, and other sources from internet.

III. Discussion

1. Character Education

Character comes from Greek word meaning to mark or mark. It focuses on applying virtues in the form of action or behaviour. Character is personality that are formed from the internalization of believed- virtues and used as a basis for perspective, think, behave, and act. The nation’s character is identified from many sources such as religion, Pancasila, culture and the educational purposes. Indonesia is a religious nation so that many values are derived from each religion. In addition, Pancasila aims to prepare students becoming better citizens who have willingness to apply the values of Pancasila in daily activities. Culture has also an important role in building student’s character because it becomes the source of values in the education of the nation’s character. In addition national education purposes aim to build the character through teaching and learning activities [1].

Character is the culmination of habits, resulting from the ethical choice, behaviour, and attitudes an individual makes. Character is also defined as the moral excellence an individual exhibits when no one is watching. It includes an individual’s desire to do one’s best, concerns for others’ well being, cognition of critical thinking and moral reasoning, and the development of interpersonal and emotional skills that allow individuals to work effectively with each other in every situation [4].

Character education can be referred as teaching children about basic human values including honesty, kindness, generosity, courage, freedom, equality, and respect. It is an umbrella term used to describe many aspects of teaching and learning for personal development. Some areas under this umbrella are moral reasoning/cognitive development, social and emotional learning, moral education or virtue, life-skills education, caring community, health education, violence prevention, conflict resolution or peer mediation, and ethical or moral philosophy [2].

Character education is about the acquisition and strengthening of virtues (qualities), values (ideals and concepts), and the capacity to make wise choices for a well-rounded life and thriving society. The board aim of character education are to build a foundation for lifelong learning, support successful relationships in community, in the work place, and at home, and develop the personal values and virtues for sustainable participation in a globalized world. In addition character qualities will invariably be applicable to a wide range of professions [3].

Character education is essential for building a moral society and it is the conscious effort to cultivate virtue [8]. Character education encompasses the cognitive, affective, and behavioral aspects of morality such as moral knowing, moral feeling, and moral action [8]. Character education can be described as moral excellence and firmness where integrity refers to a firm adherence to code of moral values [9]. There are many characters that considered as good character such as wisdom, honesty, kindness, and self discipline. It is provided by virtues.

Character building is more than developing good behaviour but it cultivates a set of skills that provide framework to build and execute ethical behaviour and build community [5]. Government has taken responsibility in character education in teaching and learning, so that the standard and purposes of its implementation should be clearly understood, transparent, and accountable. Teachers competencies have also to be improved. In addition, parents roles and also community are supported to character education.

2. Character Education in 2013 Curriculum

Undang- Undang No. 20 of 2003 Chapter II, Section 3 of the National Education System aims to develop student’s potential becoming human with faith in God, noble, helathy, knowledgeable, skilled, creative, independent, and be citizen of a democratic and responsibility. Character education integrated into the school community is a strategy to help re-engage our students, deal with conflict, keep students on task in the learning environment, and reinvest the community with active participation.
Curriculum 2013 emphasizes on three aspect: attitude, knowledge, and skills. These aspect will be achieved as Standar Kompetensi Lulusan (SKL) which is derived into four competences called as Kompetensi Inti. There are four Kompetensi Inti: Kompetensi Inti 1 (KI 1) which emphasizes on attitudes toward God the Almighty, Kompetensi Inti 2 (KI 2) which emphasizes on social aspects, Kompetensi Inti 3 (KI 3) which emphasizes on knowledge aspects, and Kompetensi Inti 4 (KI 4) which emphasizes on skills.

There are many characters developed through the implementation of Curriculum 2013; religiously, honesty, tolerance, discipline, hardwork, creative, independent, democratic, curiosity, nationality, loving the homland, appreciating the achievement, peace, reading, environment awareness, responsibility.

Good character education programs emphasizes on the choices and supports for the need of students. It is important for teachers, staff members and school counselors, to promote character education to create an optimal learning environment, create a school culture welcoming of diversity, and provide safe schools. Good character education programs may inspire students to continue achieving academically while reducing unwanted behavior. Classrooms need to be a place where students, teachers, counselors and others live and grow together and it needs to be a place where all students can grow academically, emotionally, physically, and socially.

Teachers have struggled and many of them been successful in integrating character education in teaching and learning process. It makes the process more active than others which have not yet implemented it [6].

3. The Integration of Islamic Values in Biology Teaching and Learning

Value is something that is believed to be true and adopted and also made as a reference of individuals and communities. It determines something considered good, true, valuable and precious. Values are part of individual personality that affect the way in choosing actions of alternatives and lead to well- mannered and satisfaction in daily life [7]. There are four levels of values based on Max Scheler, namely: (1) the value of enjoyment; (2) the value of life; (3) the value of psychosis; and (4) the value of spirituality. Based on the hierarchy, spiritual value is the highest value that was born of the values of divinity [13]. The resuscitation of religious values in Islamic prespecions is differentiated into three values; (1) aqidah, (2) the values of worships, and akhlaq [7]. Islamic values also contains the roles of relationship between human and God, relationship between human and human, and also relationship between human and the whole universe.

Education is an important aspect in developing student’s potential and student’s knowledge. Education has important roles in building student’s character and student’s attitude. So, education has to be continuously evolved and built in order to reproduce the good generation. Education is a conscious effort to develop student’s self potential in order to have spirituality, self control, attitude, intelligent, and skill that needed by themselves, society, and nation. According to Permendikbud No. 20 2016, senior high school students have to have competencies in attitude that reflects their religiously towards God, character, honesty, and carring, responsibility, life long leaner, and healthy based on their self development. The re-emergence of values in science education requires the consideration of different national and cultural contexts, understanding of the interactions between values and science in those contexts, and their impacts on the society or culture [8].

The form of integration Islamic education on the Biology teaching and learning are by developing syllabi and lesson plans including the activity to pray before the class begin, shake hands. Islamic character can also be embedded in sparring group between boys and girls during specific material such as reproductive system. Teacher also can use active learning approach such as cooperative learning, peer assessment. Most importantly, teacher should connect biological material with moral values [14].

The implementation of character education program has to be integrated in school as a school-wide approach, student’s education approach, student’s education, and positive moral development. It is also important to understand the positive support these programs offer to students [2]. There are six steps in implementing character education in school 6thounsellin, first examining and describing the competence of every each subject, and then identifying aspects and character education materials that will be implemented in every each subject. The third step is integrating the character education into relevance basic competence and followed by conducting the teaching and learning process. Teachers also have to make the evaluation and learning resources for supporting the implementation of character education in the school curriculum [11].
Charater education focuses on moral concepts, manners and civili, and shapes student’s personality, values, attitude and habits in their developments. In science education, morals, values, ethics and character education cannot be taught as a separate curriculum. But all these essential elements should be entwined in all science curricula, and ranges of different but appropriate teaching techniques are required to apply in teaching them [1] [10].

In Islamic character education, teachers are always consided as student’s role model. The application of role models has profound impact in teaching morality and implementing character education. The teacher, however, find it ambiguous in understanding how modeling can be an effective contributor to students’s moral and character development [8]. It is can be explained by obstacles that usually found in confronting character education. It is sometimes hard to clarify what character and character education are. It is also difficult to identify which form of character education are effective and what outcomes and develop. It is also caused by the difficulties in developing focal expertise in teacher training institution [10].

Many studies has proven that one of the factors that influence learning achievement is the psychological factor. When good student with a psychiatric condition the influence of activity memorizing the Quran, then influence on academic achievement. In the other hand, interviews with students A1 (students who remember 1,5juzz) have a high biological achievement but lower than A2 (students who remember 2 juzz) students about the influence of Al-Quran toward achievement of learning will be impacted if there is a balance between the activities of Al-Quran with effort in learning [14].

The integration of the value in learning is a guidance process through teacher role models which orienting to internalization of values including religious values, culture, ethics and aesthetics towards the formation of learners who have religious intelligence, self-control, personality intact, noble, and skills needed him, including the community and the nation [12]. The value integration in education is an aid to students in order to realize and experience values and place them integrally in his whole life. Character education is not only a special program is taught through number of subjects, but also includes the entire educational process [13].

In another explanation, the integration of Islamic values and science teaching and learning including Biology can be applied in the form of science matter integrated with religious matter which integrating subject matter in Biology with the Islamic values taught in Isamic education or vice versa. By learning Biology through the integration of Islamic values, students not only will improve the understanding in Biology knowledge but also in their religiously.

The integration of Islamic values in Biology can be integrated in various matterial, such as Ecology. It has been written in Al- Baqarah 261- 262, Al- Anbiya: 107, Arr-Rum; 41, Al-Qashash: 77 which explains about conservation and environmental preservation. Another example of the integration of Biology and Islamic values is that teacher can explain the senses. It can be explained that senses is a gift from the God and it can increase their religiously.

IV. CONCLUSION

The integration of Islamic values in Biology teaching and learning can build the student’s character in the form of religious, environmental awarness and responsibility, develop a sense of commnunity, and more importantly preserve the nature for the sustainable living by increasing the student’s character towards environment

REFERENCE


THE DEVELOPMENT OF INTEGRATED SCIENCE TO OPTIMIZE THE SCIENCE PROCESS SKILLS, ENVIRONMENT CARE ATTITUDE, AND CONCEPTUAL UNDERSTANDING

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Abstract—Entering the 21st century, the education in Indonesia is faced some challenges and opportunities. There is so many penetration has done by government such as the implementation of 2013 curriculum. In development of its implementation the students is demanded to be more active, creative and innovative in learning process in order that the students are able to perceive to the phenomenon and social changed, starting from local level, national and global. Integrated science learning is the demand of implementation curriculum 2013 that expect the science learning must be meaningful make the students be able to apply concept of science and think high level and exercise to get the concepts that have studied holistically, meaningful, authentic and active. According to Fogarty, integration learning model is known as learning webbed models, is applying thematic approach by determining some theme. The theme that has decided should be develop to be subthemes by observing the interrelatedness between lesson and determine learning activities. The strength of this model gives the ease to the students to explore their different ideas so that develop the students’ science process skills in learning and grow up environment care attitude and build the conceptual understanding totally.

Keywords: Conceptual Understanding, Environment Care Attitude, Integrated Science Webbed Models, Science Process Skills

I. INTRODUCTION

Study is an students’ effort to develop himself, physical and psychological. Study also means to develop all intelligence aspects so that the students will be a totally human, clever intelligently, clever emotionally, clever his psychologist and have meaningful life skills to himself [1]. The goal of national education in the constitution Republic of Indonesia number 20 of 2003 about national education system mention that the goal of national education is to develop the students’ potential to be devout human to God, have a sublime character, healthy, full of knowledge, creative, stand alone, be a democratic society and responsible.

To bring the goal of national education into reality need a basic quality standard as reference in developing learning plan. In context of education quality concept is relative, education qualities in science means that education gives science education experience to the students, can be say that there is quality if the specification or standard is fulfill. In general science understood as born knowledge and grow by steps of observations, formulation of the problem, hypothesis arrangement, proposing hypothesis by experiment, getting conclusion and finding theories and concept. It can be said that science essential is a knowledge about natural fact to fulfil and continue deeply to know its explanation and regularity. Beside that case, science learning is expected to develop scientific skills process that build on scientifically an the result can be real as scientific product that arranged on three important components such as concept, principle, and universal theories.
II. DISCUSSION

A. Science Learning

Science learning is learning activity integrated to optimize conceptual understanding intactly. The integrated science learning activity will give meaningful experience to the students, because in science learning the students will understand the concept they learn by direct experience and relate to another concepts that understood based on the students’ need.

Reference [2] describe science as a way of thinking, a way of investigating, a body of knowledge, dan science and its interaction with technology and society. It can be conclude that there are dimensions of thinking method in science, investigate method, knowledge building and its relation with technology and society. Moreover [3] had a notion that “Science is not just about concepts; it also about process, and skillful scientific observation plays a central role in that process”. Its relevancy in this case that science is not only study about concepts but it related with skills process and scientific observation that have sentral role into the activities.

Reference [4] illustrate that Science is the way for asking and answering the questions about nature. It is not horde of knowledge, but a continues process to learn our surroundings phenomenon. The essence of Science learning including four main elements, first, attitude: the curious about things, phenomenon of nature, living thing, and causal relationship that appear the new problem that can be solve with good procedural; second, process: the process of solving problems with scientific method, scientific method include hypothesis arrangement, design of experiment, evaluation, measurement and concluding; third, product: its about fact, principle, theory an law; and the last (forth), application: applying scientific method and science conceptual i daily life [5].

Integrated scince learning is combine learning or make related one to another concepts in one topic into intact unity in order that the goal that have decided before is achieve [6]. Integrated learning is an approach in learning that witting to relate some aspects even into lessons and between lessons. With the combination the students will get skills and knowledge. Integrated learning as a process explain the characteristic of integrated learning as below [7]:
1. Learning centered on student
   Basically integrated learning is a learning system that give freedom to the students individually and cooperatively to delved and to get its concepts and principles development.
2. Emphasize the formation of comprhension and meaningfull
   Learning is emphasized to the students’ ability to apply their result of study to problem solving in their life.
3. Learn throuh direct experience
   Learning is involved the students directly to the concepts and principles to be learned and enable them to learn to do an activity directly.
4. Observing the process is a prior than the result
   In integrated learning, the discovery inquiry approach is developed that involve the students actively in learning process, start from planning, implementation, and the last is evaluation.
5. Full of relevance contents
   Integrated learning is focus to observation and investigation some phenomenon from several lessons all at once.

The process of science learning that rely on the process and product will be better than relay on the result, beside the students drilled thinking skills to solve their daily problems, they also more confident to face the challenge in their life. To give an enough skills to the students to face the challenge need some model to help them to achieve the goal, such as the teacher should be brave to change their conventional models.

B. Science Process Skillss

Science process skills is a special skills that facilitate the students to learn, activate the students, develop the students’ responsibility, increasing the students’ result in studying and teach the student is some research method. Its relation here is to make science process skills more important and meaningful in learning. Its
caused by continuous of long life learning to get, to predict and to assess the proofs that have faced in different condition [8].

According to Abungu et al., explain that science process skills is the students’ activity to use scientific activity in investigation to make possible the scholasticism and skills acquisition [9]. Science process skills enable the students to involve directly the material object when use practical approach to solve the problem and it can be facilitate them to be active so that the learning is meaningful. Skillfulness and frequency in using science process skills help the students to solve their problems, study alone, appreciate the science [10].

Science process skills is focusing in mindset that the scientist use to construct knowledge, to describe idea and to communicate information. Science process skills help the students to process questions, formulate the problems, observing, classified the data, making inference, making hypothesis, communicate invention and make an experiment.

C. Environment Care Attitude

Hebel et al., defining the environment care attitude as the accumulation of beliefs that influence the behaviour and intentions of someone about activities related to the environment. A care attitude to the environment related the values, perceptions, awareness and someone’s perspective on the existence of an object [11].

To develop the environment care attitude in the learning activities can be effective through environmental education in school. Attitudes necessary to understand and appreciate the relationship between the human, cultural and physical environment. Knowledge and awareness about the existence and scope of environment issues is very important because it can raise awareness and concern to the environment. Emphasis should be on knowledge about the causes; knowledge of the effect; and knowledge of strategy to be changed when faced the environment problems [12].

The attitude of care to the environment is a good ability to understand environmental problems and tend to accept environmental problems as a serious problem that always agree to the environmental policy and show a willingness to contribute to reducing the environmental damage. Environment care attitude can be increase through learning process.

Environment care attitude enchanced through the learning process not only focused on the concepts, but also involves the surrounding environment as a natural object of study. There are interactions with students’ environment and not only understand and mastering the concept, but also can develop their ideas in finding solutions to environmental problems that exist.

D. Conceptual Understanding

Winkel describe the concept as a unit of meaning that represents a number of objects that have characteristic in the form emblem that full of ideas [13]. The concept is a label given to features seen on an object or event. In other words, the concept is an abstract form of a principle or theory that is commonly understood and articulated, either implicitly or explicitly. The concept arose from the result of human thought with more than one object, even or the fact and it is a generalization of the fact that change.

Conceptual understanding has a large scope as revealed Ander and Krathwohl who asserts that “student understand when they built connection between the ‘new’ knowledge to gained and they prior knowledge” [14]. This quote confirm that students understand when they were able to connect between new knowledge and old knowledge they already have before. The students is said understand if they have the ability to think to construct meaning from materials in form of spoken, written and visual.

Conceptual understanding includes knowledge about category, classification, and a relationship between two or more categories or classification. Conceptual knowledge includes schema, mental model. Knowledge of classifications and categories become an important aspect in developing the skillss and developing the science aspect. The classification of information and experience into the right category is a success in learning and skills development.
In bloom taxonomy outlines that there are six levels of understanding of concepts that includes: remember, understand, apply, analyze, evaluate and create. From the results of this taxonomy concluded that conceptual understanding is whole students’ ability strating from the lowest level to the highest.

E. Integrated Science Of Webbed Models

According to ref [15] webbeb model is a pattern of teaching and learning in the use of intergrated learning by using topic or theme to intergrate and associate several interrelated concepts to be a set of learning package. The central theme can be took from the interesting everyday life and challenging the students’ life to study more, it is should be large and supplies the students to study more. Futhermore Daryanto explain that the webbeb model opposite from thematic approach as guiding materials and learning activities [7]. In this connection, the theme can bound learning activities either in a particular subject or many subjects.

Webbeb model is designed to integrate curriculum materials in form of subjects (subject matter) or scientific. Trianto notion that the excessce of webbeb model in intergrated science learning include: the selection of themes according to interest and motivate children to learn, easy to do by unexperience teacher, easier planning, thematic approach can motivate students, make it easy for students to see activity and the different ideas that are interrelated [16]. The integration is done by appearing a theme of approach that can involve a variety of the differences of subjects, show in picture 1. As a form of of the closer of various scientifics.

![Figure 1. Webbeb Model](image_url)

The theme chosen can be based on a similar concept, topic, or idea. This model is need the primary activities such as careful planning and very long time. This integrate also potentially be used in learning with teams. By the proportional time, the teachers as a team will have enough time to choose a theme and define quality criteria. This model is a very good model to test an interdisciplinary unit.

III. CONCLUSION AND SUGGESTION

Learning science should be focused on giving experience to the students directly in employing and applying the concept, principles and facts of science, so that science learning carried out integrated to grow the ability to think, work and scientifically and communicate as the life skills. integrated science learning through thematic approach allows learners to get knowledge and skills, so that learning becomes more meaningful for students. The demand of 2013 curriculum implementation requires the teachers are more enthusiastic to develop innovative learning model that can be facilitate the students to develop the science process skills, environment care attitude, and conceptual understanding.

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REFERENCES


DEVELOPMENT OF STUDENT’S TEXTBOOK TO TREAT COMPLEX SYSTEMS REASONING ABILITY IN PLANT DEVELOPMENT STRUCTURE CONCEPT

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Abstract—Reasoning of complex systems needed to understand the various components and how the behavior and interactions that occur on the system or between systems, which is characterized by hierarchical and heuristic thinking about the interaction between the various levels of the organization. The structure and development of plant has the study object about the system structure of living things and its development as a result of interaction with the environment to form a complex system, so the implications for the emphasis on using a complex system of reasoning in assessing these concepts. It also has implications for the need of student’s textbook to promote the reasoning of complex systems. Research and Development study carried out for developing student’s textbook that acquire the complex system reasoning on the concept of plant development structure. Feasibility test of the student’s textbook design conducted by the expert appraisal of the student’s textbook validity. Eligibility to legibility done by the student’s textbook response. The analysis result showed decent textbook used to treat complex systems reasoning.

Keywords: Reasoning Complex Systems, Student Textbook Development, Plant Development Structure Concept

I. INTRODUCTION

Biology has the object of study that related to the phenomena of life. Object of Biology differentiated into four levels of representation to understand the phenomenon, namely: macroscopic level where biological structures visible to the naked eye, the microscopic level where biological structures can only be seen under a microscope, the molecular or submicroscopic level, such as involving the structure of DNA, proteins and biochemistry, as well as the level of symbolic that provides a mechanism explanation of the phenomenon represented by the symbols, formula, chemical equation, pathways, numerical calculations, genotype, the pattern of inheritance, the phylogenetic tree in evolution, and so on [1]. In order to understand the function and structure, it must examine the structure on a microscopic level consisting of cells and organelles and molecules that are differ, to understand the level of macroscopic without the microscopic structure knowledge will lead to a deficiency of processes understanding such as the transformation of matter [2]. Therefore, based on the perspective of a multi-level representation, study of the plant development structure, involving representation of a microscopic and molecular level to understand the phenomenon at the macroscopic level.

The relationship between the microscopic and molecular structure and the macroscopic phenomena have implications on how to understand the phenomenon of plants structure. Interpretation of the various functions of plant structure rests on knowledge of cells and tissues related to these functions [3], explanation of plant structure development can be understood based on the relationship between the structure of plant body, such as the relationship between cells, cell functions and duties as a constituent of the living body and the functions of other cells [4]. Studies the plant structure involves a relationship with the molecular and cellular mechanisms of plant structure and changes in the structure and functioning of plants as a result of plant interaction with the environment on a time scale of past and future [5]. On the other hand the mechanism of the development system is controlled by evolutionary pressure to allow changing various structures and
behaviors to survive [6]. The behavior of structure matter and the plant growth showed that the structure of the plant is the result of a long evolution that took place as a form of adaptation to the environment. Thus the study of the structure development of the plant involves ability to identify and to interpret the structure, explain and predict system behavior of plants at the level of macroscopic based on the structure, function and mobile behavior, explain and predict how the system components interact with each other, as well as the ability to think temporally to explain past events based on the structure of plants and predict the likelihood of changes in the structure and function due to adaptation to the environment.

These abilities are relevant for assessing complex system. Biology is a complex system consisting of various levels of the system and each has its interacting components [6]. Characterize the complex system as a system with a hierarchical structure consisting of components of subsystems, components subsystems behave causally affect other subsystems as well as the influence of causation creates a chain of events in the mechanism of the system and cause behavioral changes in structure and function as a whole, and a series of such events affect changes in temporal and spatial dimensions [7]. Thus the reasoning system is complex with the concept of the structure and development of the plants include reasoning to identify the components of the structure, explain the dynamic causal, think non-linear, thinking hierarchical structure among the various levels of the system, reflective thinking using the temporal dimension [8] [9] [10] [11] [12] [13] [14].

Determination of complex systems has implications for teaching and learning difficulties. This is due to think in complex systems (systems thinking) as well as other cognitive capabilities, require the development of formal education [2]. However students have difficulty understanding the heuristic build of complex systems and understand complex causal relationships and mechanisms that abstract and dynamic [11]. Difficulties students related to the complexity of the system, because students only focus on the behavior of individual entities, ignoring the surrounding environment entities that interact with them, they are difficult to keep track of multiple causality outside connections, and does not recognize the feedback spontaneously, but using long-term cycles to illustrate the sequence events in balancing or reinforcing feedback as deficient understanding of diverse factors that act in the phenomenon [15]. It is alleged that during the influence of biology learning is fragmented [6].

At various levels of the education unit, including the presentation of the material universities rely on the use of textbooks. Biology textbooks, including the structure of plant growth utilizing visual representation as decoration, illustrations, explanatory and supplementary information [16]. On the other learning by presenting the phenomenon at the organism level may result in the acquisition of curiosity and motivation [17], learning involves different levels of organization system is done gradually by navigating between the different levels of biological organization which is explicit and puts the organism level as the starters, if not quite the elaboration of specific organizational level can lead to conceptual difficulties arise at the level of other organizations [18]. Thus the presentation of the material in the textbooks should facilitate students to explore the relationships between the various levels of the organization structure of plant development as a complex system. The structure on the macroscopic level is a concrete representation is familiar with everyday life. It has to be supported by visualization of microscopic and molecular representation as explanatory relationship between the system components plant growth structure as a complex system based on the temporal dimension, spatial and complexity dynamics.

The results of the textbooks analysis, representational images most often encountered in biology textbooks [18]. However the elements of textbooks, including the structure of the text, captions, and visualization of images, and the relationship between them would affect the interpretation of the reader and change its role in the text [19]. The use of diagrams as a form of visual representation in textbooks can also cause the formation of misconceptions, the diagrams evolution which are confusing and may lead to alternative conceptions of macroevolution, and although the diagram is widely used in textbooks, but can hardly explain the structure and theoretical [20]. Thus, to represent a complex system on textbooks need to be presented in the form of a complex process diagram. The use of a complex process diagram is the nature and structure in biology that are different from other science and can present unique challenges for pedagogical presentation of biological material [21][18]. On the other hand involves the diagram will treat ability to understand diagram, where the key competencies that should be possessed by students to coordinate information from multiple representations [22].
Understand many phenomena involved in a complex system requires another mode. Some researchers use the mode form as models to study complex systems. The researchers found the use of the modeling of complex systems able to promote students’ ability to connect between the different levels and complex phenomenon, which is not immediately comprehensible, as well as promoting the scientific thinking [24]. On the other side of the complex system has a temporal dimension, the various entities of the measure, concrete-abstract-explicit and implicit, macro-micro level, and simultaneous linearity, causality and equilibrium, as well as simple and complex [2]. Suggested criteria image as a visual representation on the book considerate with the complex system, namely mode for representing biological entity can be an image or icon metaphor, representing the three-dimensional shape with shading, layering or parallax, while the time or sequence represented by arrows, the placement of the order read, as well as the steps numbered, as well as to represent a multi-level organization with telescoping, scale and image zoom in [18].

Based on the description above presents the material structure of plant growth as part of a complex system of representation in textbooks, need to be designed to present an explanation of macroscopic representation by utilizing a microscopic and molecular structure representation, involving the relationship between text and visual representation. The visual representation to visualize complex relationships using a complex process diagrams, by combining several images of both photographs, iconic or schematic [18]. However, the design needs to be equipped with a test of reasoning and knowledge to facilitate the practice student’s reasoning in complex systems as well as attempts to test the understanding of the concept. Based on this it is necessary to test the results of the student textbook development. Tests conducted to determine the validity of a textbook based on current knowledge and the need to promote the presentation of material reasoning of complex systems, as well as the level of the logic and consistency of the design characteristics of the student textbook reasoning complex system. In addition, because the design of textbooks involves multi-representation, it is necessary tested to determine the level of practicality legibility of text books for the students.

II. RESEARCH METHODS

This study aims to find empirical characteristics and product textbooks of plant development structure for students who are theoretically able to promote the reasoning developed complex systems. Research with the goal of building an empirical basis to create instructional products and tools as well as non-instructional and new model by adjusting its development as a research development, namely a study systematically through the design, development and evaluation process [24]. The steps in this research procedure involves defining content, textbook development, validation and review by experts, readability test, and evaluation.

A. Defining Content

Research procedure starts with identifying the content. The main purpose of the identification of the content is to select concepts and linkages that can be used for complex systems to treat reasoning. The main source for the identification of the content is a book related to the concept of the structure of plant growth. The identification results elected six topics, which include the structure of cells, meristem tissues, parenchyma tissue, strength tissue, the carrier’s tissue, and epidermis. Selection of concepts on these topics based on the characteristics of the plants development structure that can be represented by the development of the structure and function due to interaction with the environment microscopically by understanding these topics [2][5].

B. Development of Textbooks

Plant growth structure textbooks was developed based on the basic concepts of plant anatomy. The textbooks were developed equipped with diagrams and pictures to provide visualization of the plants structure, making it easier to relate the macroscopic phenomena with the microscopic structure, predict patterns of structural development, thinking and dynamic multi-causal hierarchy between the structural components of plants as well as facilitated to thinking with dimensions temporal. Presentation of the visual representation of entities pay attention to the size, the shape of three-dimensional, multi-level structure of the relationship [18][26] and the multi-function representation by Ainsworth (2006). To strengthen the visualization and reasoning development of complex systems use a variety of macroscopic phenomena that can be observed in daily life as well as the adaptation.

C. Validation and Review by Expert

The next stage of development plant development structure textbook is the validation and review by expert. Three experts validate and review the results of the textbooks development. Validation and reviews
conducted by the appraisal checklist against a number of statements contained in the instrument validation [23]. Aspects of assessment include the logic and consistency of the textbook design, structure or format of text books, validity and recency of textbook material, language textbooks, consistency of material presentation with the ability to think, consistency in supporting learning. Scores of validation as quantitative data were analyzed descriptively to determine the validity of a textbook, while the verbal feedback is qualitative data used to assess the quality and input in the revision of textbooks.

D. Readability Test

Twenty-four students who have followed the course of plant development structures involved in testing the readability. Testing is done by asking students to read textbooks. During reading they were asked to mark a sentence, a term that is not understood as well as revise the writing which is wrong. Response instrument was given to measure the response of students to textbooks. Some of the statements in instrument legibility developed based on aspects of the format and performance of textbooks, understanding of the terms and describing the content of the book, the understanding of illustrations, linkages with the contents of a complex system reasoning, understanding and knowledge reasoning test charge. Scoring is based on a quantitative answer with a choice of yes: 3, less: 2, and are not: 1. The results were analyzed descriptively quantitative scoring to determine the level of textbooks readability. Qualitative data were verbal responses which analyzed descriptively qualitative and used as feedback to provide input revision of textbooks.

E. Evaluation

Based on the results of validation, expert reviews and readability testing by users of textbooks then be evaluated. The evaluation was done for the aspects that must be revised, so that the resulting book test results of development that can be used as a textbook to treat complex system reasoning existing plants development structure concept.

III. RESULTS AND DISCUSSION

The results of textbook development in the form of textbooks that can be used to train complex system reasoning with material plant development structures. The parameters used in the development is the validity and legibility of text book. Validation aspects of textbook development results include the logic and consistency of the textbook design, structure or format text books, validity and recency of textbook material, language textbooks, consistency of presentation material with the ability to think, consistency in supporting learning. Validation results are presented in Table I.

<table>
<thead>
<tr>
<th>No</th>
<th>Observation Aspect</th>
<th>Cell</th>
<th>Meristem</th>
<th>Parenchyma</th>
<th>Mechanic</th>
<th>Transport</th>
<th>Epidermis</th>
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</thead>
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<tr>
<td>1</td>
<td>Logically and consistency design of textbook</td>
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<td>Structure or format of textbook</td>
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<td>4.38</td>
<td>4.33</td>
<td>4.48</td>
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<tr>
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<td>Relevancy material of textbook</td>
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<tr>
<td>5</td>
<td>Consistency of material presentation with thinking ability</td>
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<td>4.67</td>
<td>4.75</td>
<td>4.75</td>
<td>4.75</td>
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</tr>
<tr>
<td>6</td>
<td>Consistency in supporting learning</td>
<td>4.67</td>
<td>4.67</td>
<td>4.67</td>
<td>4.47</td>
<td>4.80</td>
<td>4.47</td>
</tr>
</tbody>
</table>

Score: 1 > x ≥ 1.80 = no valid; 1.80 > x ≥ 2.60 = lack; 2.60 > x ≥ 3.40 = enough; 3.40 > x ≥ 4.20 = valid; 4.20 > x ≥ 5.00 = very valid

The level of validity as presented in Table 1 demonstrate the validity of the range at 4.50 ± 0.23, with very valid criteria. The results of the validity level analysis in terms of the average value of the validity of textbook on every topic and every aspect presented in Figure 1.
Based on the validity, it shows that textbooks are developed in terms of design aspects, structure or format, validity and recency has met the elements of the logic and consistency to support learning in order to treat student thinking skills, complex systems reasoning. Reading level is a measure of the user’s understanding of textbooks, in this research is the students’ textbooks. Measurement of understanding the response of students to textbooks include aspects of representation format and appearance, the use of the terms and structure of the sentence describing the content of the book, the representation of a picture or diagram, linkage contents of the book with a complex system reasoning, reasoning and knowledge of test features. The analysis results of the legibility level are presented in Table II.

**TABLE II. READABILITY TEXT BOOKS ON EACH SUBJECT**

<table>
<thead>
<tr>
<th>No</th>
<th>Observation Aspect</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cell</td>
</tr>
<tr>
<td>1</td>
<td>Format representation and performance</td>
<td>2.42</td>
</tr>
<tr>
<td>2</td>
<td>Term using and sentence structure</td>
<td>2.80</td>
</tr>
<tr>
<td>3</td>
<td>Figure representation or diagram</td>
<td>2.94</td>
</tr>
<tr>
<td>4</td>
<td>Relation between content and complex system reasoning</td>
<td>2.83</td>
</tr>
<tr>
<td>5</td>
<td>Figure representation of reasoning test and knowledge test</td>
<td>2.81</td>
</tr>
</tbody>
</table>

Description: Score: 1 > x ≥ 1.67 = bad; 1.67 > x ≥ 2.33 = sufficient; 2.33 > x ≥ 3.00 = good

According to Table II, readability level value ranges at 2.76 ± 0.15, with good criteria. The analysis results of the readability level in terms of the average value of text books readability on every topic and every aspect is presented in Figure 2.
Based on the value of reading level indicates students showed levels of legibility by either category. Thus the terms of the textbook, material representations, drawings and diagrams, describing the relationship of matter and complex system reasoning and features the reasoning contained in the textbook developed can be understood by students.

The book is a major component in the learning process in class in the chain achieve learning objectives [27]. On the other hand the textbooks for students will affect how learning are conducted [28]. Therefore, based on the level of validity and readability of text books which developed, indicating that the book can be used to facilitate learning the plant development structure as well as to treat complex system reasoning. It is because of this book as well represented mediate between teachers with learning plans [29], as well as with students and teachers in the learning process [30].

Presentation of the material in the textbooks are developed, designed to show the relationship between the various organization levels of plant development structure as well as complex system uses a microscopic representation to explain the phenomenon at the macroscopic level of representation. The implications of the presentation material representation with the design so that the validity of the logically aspects design demonstrate the value of 4:16, with a valid criteria. While the aspect of suitability format and presentation of the material with a complex system reasoning shows the value of 4:40 and 4.72 with very valid criteria. Representation presentation of the material also has implications for the level of legibility on the aspect of representation of the content relationships with a complex system reasoning, which totaled 2.73, and understanding aspects of the features of the reasoning test and knowledge test reached 2.80. Both the readability score achievements show both criteria. Based on that, how to represent the material in the textbook can be understood by students and can facilitate students to learn and to make sense of the complex system. The book can be used to facilitate and to improve the learning process [31].Thus when textbooks have developed are used in learning, the learning process will involve the presentation of the phenomenon at the organism level that would result in the acquisition of curiosity and motivation [17], and may help elaboration gradually to navigation between different levels of biological organization [14].

The elements of text books including the structure of the text, captions, and visualization of images, and the relationship between them would affect the interpretation of the reader and change its role in the text [19]. However, textbooks developed indicating the level of legibility on the representation aspect of the terms use and sentence structure reached a value of 2.71 and understanding representation aspects of pictures and diagrams reached a value of 2.73. The second achievement of these values show good criteria. It describes the use of text representations and images in the book can be understood by readers. Thus developed the book is expected to be used to facilitate understanding of the capabilities to treat between modes of representation. Understanding of the various modes of representation in textbooks will treat ability to understand representation, namely the core competencies that must be possessed by students to coordinate information from multiple representations [22].
However, to enhance the development of textbooks, there are several things that need to be revised. Based on the advice of a validator or reader of some things that improved include the inclusion of literature sources, the addition of a reference picture or diagram, the use of foreign terms to follow the terms uptake in Indonesian, as well as the use of the book is accompanied with additional explanations from the instructor.

IV. CONCLUSION

Based on the description above book developed in aspects of the design, structure or format, validity and recency has met the elements of the logic and consistency to support learning in the context to trait reasoning of complex systems. Based on the study readability, representation of aspect matter, drawings and diagrams, describing the relationship of matter and complex reasoning system and features of the reasoning contained in the textbook developed can be understood by students. Thus the textbooks that have been developed can be implemented to facilitate the learning process plants and the development structure with the aim to trait reasoning abilities of complex systems.

ACKNOWLEDGMENTS

We would like to thank to Endang Susanti, Saiful Ridho and Fenny Roshayanti that in this study contribute to validate the textbooks, as well as to the students of biology education UPGRIS who have been volunteering in a test of legibility, thanks a lot also go over good Ipah Budi Minarti that has reviewed and suggested improvements in translation on the draft of this article.

REFERENCES


PROMOTING METACOGNITION AND STUDENTS’ CARE ATTITUDE TOWARDS THE ENVIRONMENT THROUGH LEARNING PHYSICS WITH STEM

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Abstract— The importance of building soft and hard skills in high school learners regarding sometimes intrapersonal and interpersonal skills in order to improve their life in preparing human resources who are able to become a technician and designer dealing with developments and changes in the era of globalization. The learners provide a capability to solve problems, think critically, and creatively desperately needed by the generations of the 21st century. One of the aspects that requires in promoting hard and soft skill was the students’ cognition and attitude care towards the environment. Metacognition is an awareness of something that known and unknown which it manifested in the form of ability to organize and control the activity of their cognition in learning and thinking. The unbalanced relationship between the patterns of thinking and an attitude was one factor that causing of declining environmental quality. The involvement of environmental care attitude manifested in media persuasion and understanding of environment care for the environment will foster awareness and concern for environmental sustainability. In the building of thinking awareness and an environment care attitude, it needed an approach that can respond to the challenge of science, strategy thinking, attitude development, empowerment and engineer skill. The approach that integrates several aspects and skills is the STEM (Science, Technology, Engineering, and Mathematics). Learning physics with STEM is interconnected learning in science, technology, engineering and math in the learning process that encourages learners to develop thinking skills that can help stimulation of the metacognition knowledge and attitude matter environment learners. This is certainly a challenge for education in particularly for the physics, to be able to develop STEM learning by building a knowledge attitude and metacognitive care for the environment to meet the era.

Keywords: Metacognition, Attitude Care for The Environment, STEM

I. INTRODUCTION

The role of science and technology in the life of the 21st century have a significant influence on the world of education, especially in physics education that requires learners are able to improve his skills in preparing human resources technicians and designers become operator of a civilization to deal with developments and changes in the era of globalization. Learners are given the ability to solve problems, think critically and creatively and to build and develop the skills soft skills and hard skills relating to intrapersonal and interpersonal ready to face the challenges of the 21st century.

Government Regulation No. 17 of 2010 regarding the management and delivery of education argue that students at the secondary level is expected to transform and develop knowledge and skills to design, implement, control and evaluate what has been done. Awareness of what is known and what is unknown which is manifested in the form of ability to regulate and control the activities of cognition in learning and thinking is the understanding metacognition. In the process of learning metacognition is the ability of a learner in organizing the learning process from the beginning to the end of the learner to plan what to expect, determine the right strategy in accordance with the problems being faced, evaluating the learning process and to correct errors that occur while to understand the concept. Learners are able to master the ability of metacognition will be more example of confidence and openness in thinking as capable learners in dealing with a problem.
Metacognition is a knowledge, self-awareness and control of a learner in the process of cognition. Metacognition has two components, namely the knowledge and skills of metacognition. Knowledge and understanding of the thought process is the definition of metacognition knowledge. Control of the thought process called metacognition skills. Meanwhile, the three components of procedural knowledge of metacognition that declaration, procedural, and conditional and four skills component metacognition predict, plan, control and evaluation so as to be important in preparing learners knowledge, because knowledge of metacognition helps learners to understand the science, skilled in solving problems and critical thinking. Metacognition ability possessed can foster a caring attitude in this respect the attitude of care for the environment due to the establishment of metacognitive learner can build knowledge, applying concepts and create something useful to its surroundings.

The formation of the characters need to be instilled from an early age, without a good character learners will be easy to do as they wish. To carry out the safe, just and prosperous nation and the country needed human resources strong character. In the formation of character needed the support and cooperation of all the components of a good family environment, society, education and government. Character formation involving all elements so that this role fits together and linked to create line with what is expected. Characters are cultivated by teachers to students is the attitude of environmental care. The attitude of care for the environment is a fundamental inner attitude of a learner, start loving and caring environment would create other characters certainly good anyway. When learners are able to raise awareness of environmental care environment clean, safe, and comfortable both within the home, school, and other environments.

II. DISCUSSION

One of the cognitive abilities of learners is metacognition. Think about a way of thinking that is consciousness when thinking and knowing the right strategies to think, to know what we know and do not know that learners are aware of the study and how to control it is the sense of metacognition [1]. So that metacognition is awareness of cognitive and how to organize it.

Metacognition component according to [2] is the knowledge of cognition and Regulation of cognition. Knowledge of cognition includes knowledge about themselves as learners and about the factors that affect a person's performance. This knowledge is broadly separated into two. The first is Declarative knowledge. It consists of knowledge, skills and strategies essential function to complete tasks in various conditions. Secondly, the Procedural knowledge is defined as knowledge of “how to do things”. Conditional third is knowledge. Knowledge is more in touch with the “why and when” procedural knowledge or knowledge that is used. Metacognition knowledge can be developed in learning through several aspects such as awareness of the knowledge, awareness of thinking, and awareness of thinking strategies.

Awareness of thinking and awareness of critical thinking strategy for the development of character for the younger generation, especially the ability of understanding the environment that led to the character concerned about the environment [3]. The values developed in character education in Indonesia there are 18 values, namely (1) religious, (2) honest, (3) tolerance, (4) discipline, (5) hard work, (6) a creative, (7) independently, (8) democratic, (9) curiosity, (10) the national spirit, (11) love of the homeland, (12) the achievements, (13) friends/communicative, (14) love peace, (15) likes to read, (16) care about the environment, (17) social care, and (18) responsibility [4], A description of the value presented in the following Table I [4].

<table>
<thead>
<tr>
<th>No.</th>
<th>Values</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Religious</td>
<td>Religious: following its doctrines and commandments of their religion</td>
</tr>
<tr>
<td>2.</td>
<td>Honest</td>
<td>Does not lie in an attempt to make himself as a trustworthy person</td>
</tr>
<tr>
<td>3.</td>
<td>Tolerance</td>
<td>Respect for differences of race, ethnicity, religion, and opinions of others</td>
</tr>
<tr>
<td>4.</td>
<td>Discipline</td>
<td>Subservience to the rules</td>
</tr>
<tr>
<td>5.</td>
<td>Hard work</td>
<td>Earnest efforts to overcome the problems and additionally received something to be desired</td>
</tr>
<tr>
<td>6.</td>
<td>Creative</td>
<td>The ability to create something</td>
</tr>
<tr>
<td>7.</td>
<td>Independently</td>
<td>Do not depend on others</td>
</tr>
<tr>
<td>8.</td>
<td>Democratic</td>
<td>An attitude that promotes equal rights and equal obligations for all citizens</td>
</tr>
<tr>
<td>9.</td>
<td>Curiosity</td>
<td>Attitudes, behavior that always wants to know more than anything seen or heard</td>
</tr>
<tr>
<td>10.</td>
<td>National spirit</td>
<td>Actions that come first nation and country above their own interests and groups</td>
</tr>
</tbody>
</table>
Characters care for the environment is a concern for the environment is manifested in a positive attitude in keeping and maintaining the quality and environmental sustainability. As social beings, humans can not be separated from the environment so that the awareness of learners to develop a caring attitude is the attitude of the environment interact to understand, feel and behave in the surrounding environment. The efforts of these roles, the educators, parents and the government take an active role promoting the planting of a caring attitude towards the environment needs to be a suitable method so that learners are motivated to do such as taking out the trash in its place, watering plants with water-saving and planting trees or plants around home or school.

Foster self-conscious of environmental care becomes a necessity for every aspect of life that can be exploited in a sustainable manner. Therefore, it needs a regulation to help everyone, especially the students for learning control (regulation of cognition). Three important ability is planning, monitoring, and evaluating. Planning includes the selection of strategies and allocation of resources that affect performance. Monitoring may include controlling the process. Evaluating includes assessment of the product and the efficiency of the one being studied. Regulatory process of cognition that can be done in learning in the following Table 2 [5]

<table>
<thead>
<tr>
<th>No.</th>
<th>Values</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.</td>
<td>Love homeland</td>
<td>Attitudes, behaviors that demonstrate caring in social diversity, culture and nature</td>
</tr>
<tr>
<td>12.</td>
<td>Rewarding achievements</td>
<td>Attitudes and actions that drove him to produce something useful for society and recognize and respect other people's success</td>
</tr>
<tr>
<td>13.</td>
<td>Friendly</td>
<td>Actions that show as much fun as friends and cooperate with others</td>
</tr>
<tr>
<td>14.</td>
<td>Love peace</td>
<td>Attitudes do not want to create unrest in society</td>
</tr>
<tr>
<td>15.</td>
<td>Like to read</td>
<td>Behavior that always make time for reading</td>
</tr>
<tr>
<td>16.</td>
<td>Environmental care</td>
<td>Attitudes, behavior watching and participating in preserving the environment</td>
</tr>
<tr>
<td>17.</td>
<td>Social care</td>
<td>Attitudes, behaviors noticed situation and wanted to help others in need</td>
</tr>
<tr>
<td>18.</td>
<td>Responsible</td>
<td>Behave in bear all the duties and obligations</td>
</tr>
</tbody>
</table>

Component metacognition (knowledge and regulation) and character education into the hottest issues in the development of learners. The ability of students to learn to look at handling problems and solutions are expected to evolve with increasing problems in the world. STEM is a learning approach that focuses on finding solutions for the problems in daily life [6]. in STEM approach attempting how to connect science, technology, environmental and mathematics in learning, so that's why STEM known as applied learning that uses an interdisciplinary approach.

Science and technology into two branches of different but sustainable, the development of science and technology gave birth to reverse the development of technology to help the development of science. The rapid use of technology in the science building environmentally conscious thoughts will be with the development of green occupation and media persuasion. The amount of media that can be used and the development of technology facilitators of the growing concern for the environment, good social environment and the physical environment [7]. We see how the other aspects of the Environmental STEM integrated with technology as a solution to overcome the environmental problems that exist.

One of the basic development of STEM at the moment is how to bring conviction to build STEM concept, principles and techniques in an integrated manner, thus providing an opportunity for teachers to design, organize and implement learning [8]. Teachers are also given the opportunity to show students how STEM concepts, principles and processes can be used in developing the concept of thinking and thought processes so as to produce a product that can be used in everyday life. This is how the STEM education in improving the cognitive abilities of students so as to provide a large selection of the best way to integrate the various disciplines more efficient and effective [6].
To realize the goal of STEM we need to facilitate teachers in developing the skills of teachers by providing pre-service teacher education programs focus on nurturing the development of:

1. The balance between within-discipline and trans-discipline STEM knowledge;
2. The balance between theoretical knowledge and practical knowledge to plan, prepare and implement the STEM educational; and
3. Development positive attitude and disposition toward teaching. [9]

III. CONCLUSION

Learners need to be equipped with knowledge, skills and a good attitude to face the challenges of the 21st century. Metacognition become one of the important knowledge to have learners so as to have a good knowledge of metacognition, the learners are able to have an understanding, problem solving and critical thinking skills are good so that learners are able regulation on him. In addition to character education Metacognition become hottest issue in the development of learners, Character care for the environment is a concern for the environment is manifested in a positive attitude in keeping and maintaining the quality and environmental sustainability. As social beings, humans can not be separated from the environment so that the awareness of learners to develop a caring attitude is the attitude of the environment interact to understand, feel and behave in the surrounding environment. STEM is a learning approach that focuses on finding solutions for the problems in daily life. Aspects of STEM namely Environmental integrated with technology as a solution to tackle the environmental problems that exist, Master gives the opportunity to students how the concepts of STEM, principles and processes can be used in developing the concept of thinking and thought processes so as to produce a product that can be used in everyday life. Through STEM metacognition and concern the environment will be well established so that students in enhancing its ability to provide a large selection of the best way to integrate the various disciplines more efficient and effective.

REFERENCES

QUALITY OF PROSPECTIVE TEACHER’S ARGUMENT WITH THE DEVELOPMENT OF BLENDED LEARNING ASSISTED ARGUEWEB

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Abstract—The demands of the 21st century require human resources that have higher order thinking. Therefore, the argument becomes very important discourse to treat higher order thinking skills. The strategy can be applied to develop the student’s argument skills is with the development of blended learning models lectures. Model lectures blended learning is done off line and on line by using LMS (learning management system) through argueweb. With this kind of model lectures, students have a high feasibility to learn anytime and anywhere, because the information can be accessed without limits of time and place. This study aims to determine the quality of argumentation in discussions offline in formulating indicators of competencies achievement, the development of materials and determination of learning resources. Rate the quality of the arguments made against the second-year student in Human Physiology Anatomy lectures. Analysis of the argumentation quality shows that there are differences in the quality of students between blended learning classroom with conventional learning classroom. Intervention online discussions with LMS facilities argueweb implicated for the quality of argument.

Keywords: Argueweb, Argument, Blended Learning

I. INTRODUCTION

The demands of the 21st century to encourage the world of education to prepare the Human Resources who is reliable, capable of facing global problems and challenges. Human resource should be prepared to face the challenges of the 21st century are those who have the creativity and innovation, critical thinking and problem solving as well as communication and collaboration (Partnership for 21st, 2013). Ministry of Education, Singapore (2010) adds the characteristics of human resources prepared to face the 21st century are those who have life skills and able to develop content competency 21st century, control of field expertise, have higher order thinking skills, as well as ICT literacy. Preparation of human resources according to the needs of the 21st century needs to be carried out on all disciplines, including science.

Science is a knowledge of epistemology (method) of science, the process of science, or the values and beliefs inherent to developing science [1]. Science for many prospective teachers is a body of knowledge that contains a collection of observations and research that explains the what, why, and how a phenomenon occurs, as well as how to interpret the results of research and then communicating the results [2]. Currently the attention of experts on science education experienced a shift from the previous focus on student centered inquiry-based process to become more focused on the role of language and communication in classroom practice [3].

The scientific work of the scientists in building the knowledge then becomes the rationale for science lessons [3]. Scientific work conducted by scientists is not only limited to reviewing the activities of a natural phenomenon and do the testing. Activities that are not less important is how the scientists were able to communicate and be able to convince the scientific community about the correctness quality of its findings. At this moment a scientist must be able to present strong support as justification for its findings. In the last two decades of science education experts began to study the science learning as a means to build knowledge through a social process; here the role of language and communication in science learning began to receive attention [4].
The paradigm shift of education to prepare the next generation of the 21st century, requires human resources who are capable of educating and learning knowledge as well as the ability to think. It implies learning requires complex learning environment, both to facilitate social interactions, interactions with a variety of learning resources, facilitating a variety of interests, potential and associated high accessibility and the infinity of time. It is a challenge to develop a learning structure that is able to accommodate these demands.

The revolution of science is proof of how social processes play an important role in building knowledge [5]. The inquiry-based science learning, communication skills to seek the support of very important process [6]. In general science learning in the classroom more emphasis on practical work rather than engage students in the process of thinking through a series of scientific discourse such as discussions, arguments, and negotiations [7]. The statement was supported by Lemke that learning science means learning to talk about science, which means to learn the special language of science required good science in various types of scientific discourse and in daily life [8].

Further Lemke suggested that learning science means learning to talk about science, which means to learn the special language of science required good science in various types of scientific discourse and in daily life [8]. To be able to use language to communicate scientific or scholarly then students need to be given the opportunity to be actively involved in scientific discourse as develop hypotheses and arguments. Therefore, science learning need to focus on the language skills which is not only provide an understanding nature of science, the scientific method and how scientists work as suggested [9] during this time. Education experts came to believe that the core of the way scientists think is how he was able to present evidence as the basis for an argument or claim related to the facts through a premise [10].

Research on the skills of argumentation in science learning have been done before, ranging from elementary school [11], Junior Secondary School [7], High School [12] to university[13]. Research results show that each level has different characteristics argumentation discourse. Research conducted Roshayanti on the student sixth semester, the result that the profile of students argumentation skills were measured using a model AASSC showed good progress in discourse arguments in writing and discourse of oral argument, however, for some aspects still need further development through increased student involvement in the discourse of the argument. In general it can be concluded also the tendency that the quality of the student oral argument is better than the quality of their written arguments [3].

Based on research Roshayanti required the existence of a specific strategy in the implementation of learning to accommodate the entire student argumentation skills, both oral and written [3]. Therefore, in this study developed blended learning in courses to improve the skills of the student's argument. Model this course introduces students to conduct lectures by utilizing IT. Blended learning is a combination of real and virtual experiences to produce a unique community of inquiry that is not bound by time and location. Blended learning is a basis in the redesign of the course that combines face-to-face and online learning as a new approach [14]. More, Hayat, et al., suggested that one of the characteristics of the blended learning model is to encourage students to do the learning on line by using LMS (learning management system) [14]. With this kind of model of lectures, students have a high feasibility to learn anytime and anywhere, because the information can be accessed without limits of time and place.

Lecturing activities offered to serve as regular lectures; delivery of content, learning in a community with scientific communication, engage in self-assessment, provide feedback to their peers; giving assignments and announcements to students; assist students in developing coherence and theoretically has encouraged scientific investigation using information technology [15]. Through blended learning model lectures expected activities can be recorded with clear arguments, because the arguments developed assessment based coding [14]. This model offers an alternative learning can bridge the problem of low skills written arguments student [3].

The design of the blended learning models course have been developed in the form of Learning Management System (LMS), in the form of web-based media argument, hereinafter called the Argueweb. Argueweb developed based on preliminary study on the low quality of student argumentation, the need to integrate argument assessment in order to monitor and to evaluate the development of the student's argument.
II. Method

This study uses a pre experimental design one shot case study to describe the implications of the argument on line through arguweb to increase student’s argumentation skills. For the purposes of the study, treatment was given to a group of students (n = 18) Biology Education Studies Program of PGRI Semarang University who follow the Anatomy Physiology of the Human Body course.

Implementation data on line arguments obtained through observation of the transcripts coding LOAKp argumentation and discourse on arguweb twice the data retrieval. Transcription observation of arguweb carried out to analyze the impact of using arguweb as media on line arguments used by lecturers in training argumentation skills of students.

Analysis and interpretation of data is done by scoring of the arguments made by the student section has been established, namely: a score of 1 (if only gives the claim / counter claim on the argument); a score of 2 (if only gives warrant to the argument); a score of 3 (if it gives the claim / counter claim + warrant only); a score of 4 (if it gives the claim / counter claim + backing only); score of 5 (if it gives the claim / counter claim + warrant + backing).

II. Result and Discussion

Data from the study as a whole showed an increase in the quality of the arguments shown by the students. The fact is, as illustrated in Figure 1 below.

![Figure 1: Average Score on Line Argument Skills Shown by Students](image)

In Figure 1, explained that the achievement of an average score of student argumentation has increased from one meeting to the second meeting. The mean score in the first meeting is 2, while the average score of 3.72 out of a meeting of two is the maximum score of 5. More details illustration student argumentation skills improvement is shown in Figure 2 below.

![Figure 2: Condition of Students Argument Skills Improvement at Two Meetings](image)

In Figure 2, It was explained that the majority of argumentation skills of students increased from one meeting to the second meeting, ie 66.67% of the total student involved in an on line argument; 33.33% is attixed conditions; and even none at all, or 0%, which is decreased. The data reinforced the conditions of argumentation skills achievement scores indicated students in meeting one and two, as illustrated in Table 1 below.
TABLE 1. PERCENTAGE OF STUDENTS BASED ON ARGUMENT SKILLS CRITERIA

<table>
<thead>
<tr>
<th>Criteria</th>
<th>In Score</th>
<th>In Person (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Claim/ counter claim)</td>
<td>Meeting 1: 7</td>
<td>Meeting 2: 0</td>
</tr>
<tr>
<td>2 (warrant)</td>
<td>Meeting 1: 6</td>
<td>Meeting 2: 2</td>
</tr>
<tr>
<td>3 (Claim/ counter claim + warrant)</td>
<td>Meeting 1: 3</td>
<td>Meeting 2: 5</td>
</tr>
<tr>
<td>4 (Claim/ counter claim + backing)</td>
<td>Meeting 1: 2</td>
<td>Meeting 2: 7</td>
</tr>
<tr>
<td>5 (Claim/ counter claim + warrant + backing)</td>
<td>Meeting 1: 0</td>
<td>Meeting 2: 4</td>
</tr>
</tbody>
</table>

These data were confirmed by observations of student’s argumentation skills directly against Worksheet Observation Group (LOAKp) argumentation and discourse between individuals. The first observations carried out on the material of the immune system with a stand point: Do people who have had chickenpox can have chickenpox returned throughout his life ?, and second observation performed on material with the hormone system standpoint: Does the person injecting the hormone at the age menopause affect pregnancy?. The observation skills of the student’s argument against Worksheet Observation Group (LOAKp) and discourse between individuals argument is shown in comparison of Figures 3 and 4 below.

![Figure 3](image1.png)

**FIGURE 3. RESULTS ANALYSIS OF GROUP ARGUMENT OBSERVATION SHEET (A: THE FIRST DATA RETRIEVAL, B: THE SECOND DATA RETRIEVAL)**

Based on Figure 3 illustrates that the student argumentation skills both quantitatively and qualitatively show an increase. Individually, increase student argumentation skills can be described in Figure 4.

![Figure 4](image2.png)

**FIGURE 4. ANALYSIS RESULTS OF STUDENTS ARGUMENTATION DISCOURSE BETWEEN INDIVIDUALS (A: THE FIRST DATA RETRIEVAL, B: THE SECOND DATA RETRIEVAL)**

The first data retrieval showed that students in general are not familiar arguments discourse involved in responding stand point, especially in a class discussion. Argument involves dialogical between two people or more, so that those have gotten used to engage the arguments, it was difficult to present evidence and evaluate the evidence submitted by the other. In class discussion, argumentation discourse was dominated by only current students. But in an online discussion, individual students were actively involved in discussions
responding stand point posted by lecturers and respond to arguments friend at the counter. The structure of online arguments is dominated by claim statements and warrant, but less supported by a backing.

Implementation of blended learning lectures on subjects of Anatomy and Physiology of the Human Body shows the students in general are already getting used to the discourse involved in responding to arguments stand point. In an online discussion, individual students were actively involved in discussions responding stand point posted by lecturers and friends respond to the argument in the other group, is not limited to the group counter, but also pro to the stand point.

Information technology based online especially arguweb has the potential to give support in learning through inquiry and argumentation. Such support includes tools to synthesize primary sources (Linn, Bell, and Hsi, 1998). Online information technology provides an opportunity to share data and ideas (Feldman et al., 2000), visualize and analyze data (Edelson, Gordin, & Pea1999), and provide scaffolding to promote knowledge (Linn & Hsi, 2000). Learning based online, when properly designed, can be used to promote learning independently, thus reducing the number of lecturer guidance needed in the classroom (Bodzin and Cates, 2003).

Learner involvement in the discourse argument could develop high-level thinking skills ([16]; Marttunen et al., 2005). Students can improve performance and learning outcomes through argument. Some research indicates an increase in performance and science learning outcomes in students who use arguments in learning (Cross et al., 2008; Sampson et al., 2008; Arianne et al., 2007; Marttunen et al., 2005). The development of educational curriculum at this time emphasis on developing critical thinking skills and argumentation can be an important tool for teaching critical thinking skills. (Azilawati 2007; Brudvik, 2006; Marttunen, et al., 2005). Ability to think high level (higher order thinking) can stimulate students to Interpret and analyze a phenomenon found. High-level thinking skills (higher order thinking) used if one accepted the new information and store it for later used or rearranged for purposes of problem solving by situation. High-level thinking skills occur if the student manipulate information and ideas to transfer the understanding and application. In the process transferring, students combine facts and ideas in order to synthesize, generalize, explain, formulate hypotheses, problem solving to find understanding (Lincoln, 2008).

ACKNOWLEDGMENT

We would like to thank to Fenny Roshayanti, Sumarno, Juniadi, and Andreas Budi P. that in this study contribute to validate material and arguweb , as well as to the students of biology education UPGRIS who have been volunteering in this research.

REFERENCES


CHEMONDRO: DEVELOPMENT OF ANDROID-BASED CHEMISTRY INSTRUCTIONAL MEDIA ON CHEMICAL STOICHIOMETRY

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Abstract -- This study aims (1) to determine the characteristics of android-based chemistry instructional media on chemical stoichiometry for high school students; (2) to determine the feasibility of android-based chemistry instructional media on chemical stoichiometry for high school students. This study is a Research and Development (R & D). The development of instructional media was done by adapting the models of Borg & Gall and Dick & Carey modified into five parts: preliminary study, product development, product evaluation, product trials, and dissemination. Product assessment was conducted by a media expert, an expert in the subject matter (chemistry), five peer reviewers and five chemistry teachers. Product trials were done to the 10th grade students of high school with details of 6 students of SMAN 1 Jetis for individual trial, 18 students of SMAN 1 Jetis for small group trial. The results showed that (1) android-based chemistry instructional media has characteristics: relevant, vivid and attractive visualization, and flexible; (2) the developed android-based chemistry instructional media on basic principles and chemical stoichiometry was considered feasible to use in learning by regarding to the assessments in the aspects of materials and media, and the result of trials to students;

Keywords: Instructional Media, Android, Stoichiometry

I. INTRODUCTION

Qualified human resources are indispensable to face global era currently. Creating qualified human resources is the task that must be carried out by educational institutions. Improvement in the sector of education, especially in learning at school is one effort in improving the quality of education whose end goal is to produce qualified human resources.

To increase students' activeness, it needs instructional media easily understood with an addition of interesting material visualization. Attractive instructional media is expected to increase students' interest in the materials (subject matter) and can stimulate students to learn independently. Through learning independently, it will create an attitude of creative thinking which can enhance students' creativity in learning. So, hopefully it will improve students' learning outcomes.

The results of previous researches evidently proved that the use of tools greatly helps in the activities of teaching and learning in the classroom. The utilization of communication technologies for education, educational technology and educational media are necessary in process of learning. By scientific, systematic and rational approach as required by educational technology, the goals of effective and efficient education will be achieved [1].

With Interactive and innovative instructional media, teachers are certainly able to visualize things that cannot be explained just by words. One media which can be developed is an IT-based instructional media. The most visible development in IT is in the field of telecommunication, namely the development of HP (Hand Phone). HP has now become a very indispensable in human life. Therefore, we can frequently see the student or teacher who has an advanced HP with various features in it. Unfortunately, the use of HP for learning purposes is still less optimal. Students tend to use HP just to utilize features of social media and game applications.
In Indonesia, the use of HP and tablet is very popular within the society. Figure 1 explained operating system users in Indonesia. The highest point of android operating system users for both HP and tablet in Indonesia occurred in December 2016 amounting to 74.28%. The high percentage of android operating system in Indonesia showed that most people in the country have a phone which uses android as the operating system. As result, the use of HP as an instructional media in Indonesia is very possible. The advance of technology is rapidly increasing and the use of android-based Smartphone among teens can be used as an instructional media by creating an android software for learning. An instructional media which is attractive and familiar to students can become an appeal to stimulate students' creativity. The use of this attractive instructional media expectedly increases students’ creativity in learning, so that the cognitive learning outcomes will get improved.

This is according to the research conducted by Puardmi (2015) on the development of computer-based instructional media for high school [3]. The research resulted in that the developed instructional media could enhance creative-thinking skills of students. Yogo (2015) and Resti (2015) conducted a similar study on android-based instructional media for high school [4][5]. Result of the research was that the developed instructional media could increase students' motivation and achievement.

The increase of motivation and ability to think creatively is as influences of the instructional media. The purposes of this study are: (1) to determine the characteristics of android-based chemistry instructional media on chemical stoichiometry for high school students; (2) to determine the feasibility of android-based chemistry instructional media on chemical stoichiometry for high school students.

II. RESEARCH METHOD

This research was done by using an approach of research and development. The developed product is in the form of apk software that can be operated in android-based Smartphone and tablets. The model used for the basis of development implemented in this study is the result of adaptation and modification from Borg & Gall, and Dick & Carey [6][7]. Stages in the procedure of development applied in this study are as follows.
1. Preliminary study;
2. Product development;
3. Product evaluation;
4. Product trials;
5. Dissemination.
For more details, line of this research can be seen in Figure 2.
III. RESULT AND DISCUSSION

The final product of this development is in the form of Android-based instructional media on the materials of basic principles and chemical stoichiometry. The product has been successfully developed in the format of Android package (apk) using Adobe Flash Professional CS 6. The resulted product has been through several stages of assessments and validations, which was the validations by a subject matter expert and media expert, as well as peer reviewers and chemistry teachers. In addition, the assessment was also carried out by students through stages of limited and small-scale trial. Those assessments were conducted to determine the quality and feasibility of the developed Android-based instructional media.

Based on the assessments by an expert in the subject matter, media expert, peer reviewers, and chemistry teachers, product of the developed instruction media is very feasible to use. It was concluded from the average score calculated from all of those assessors. The average score for the assessment on materials by an expert in the subject matter, peer reviewers, and teachers was 61.27 (very good category). Meanwhile, the average score for the assessment on instructional media by media expert, peer reviewers, and chemistry teachers was 71.36 (very good category). In addition to the assessments by subject matter expert, media expert, peer reviewers, and chemistry teachers, other assessment also done by students through several stages of trials. The result also showed that the product is already feasible for use by students and teachers. This was seen from the average score of the assessment conducted by students through limited and small-scale trials whose score was 67.75 (very good category).

From the results of those validations and trials, there were some basic characteristics of the Android-based chemistry instructional media on basic principles and chemical stoichiometry, namely:

1. Its learning materials are relevant, meaning that the materials presented in the instructional media are in accordance with the curriculum of chemistry for high school and with students’ characteristics and needs in high school. The relevance of a media is important in making of instructional media[8].

2. Its visualization is vivid and attractive, meaning that the images, animations, and layout in the media were vividly made and becomes an appeal for learners to use it. This is in accordance with Suki & Suki
saying that mobile instructional media should have vivid and good pictures to facilitate learners to understand the material and make an appeal in using the media [9].

3. Flexible, meaning that the media can be used anywhere and anytime. This is consistent with the results of research by Chuang & Cheng that the digital instructional media can facilitate students in learning anytime and anywhere and can increase students' creativity and memory because it can be used repeatedly [10]. Reference [11] also stated that mobile instructional media can be used by learners without being bound to time and place.

IV. CONCLUSION AND SUGGESTION

Conclusion
Based on the results of the research and development of Android-based instructional media, it can be concluded that:
1. The characteristics of android-based instructional media operated on android devices support the material of basic principles and chemical stoichiometry, provide material explanations and exercises in the form of game presented in practical, flexible, attractive and interactive way.
2. The android-based instructional media that has been developed has very-good-quality criteria based on the assessments by an expert in the materials (subject matter), media expert, peer reviewers, chemistry teachers and students.

Suggestion
According to the results of this research and development that has been done, the following points can be suggested.
1. The android-based instructional media on the material of basic principles and chemical stoichiometry has been assessed for its feasibility. So, it is suggested that teachers and students use it as an alternative media for independent learning.
2. The android-based instructional media on the material of basic principles and chemical stoichiometry needs to be developed in other operating systems. Therefore, the chemistry instructional media will not be operated just in android.
3. The android-based instructional media on the material of basic principles and chemical stoichiometry that have been developed can be used further on classroom action research or experimental research on different research subjects.

REFERENCES
THE ANALYSIS OF SCIENCE PROCESS SKILLS TOWARD STUDENTS OF PHYSICS EDUCATION IN ACADEMIC YEAR 2015/2016

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Abstract—This research was a descriptive research to determine the level of science process skills of students in physics education STKIP Taman Siswa Bima Academic Year 2015/2016. The Population of this research was students of physics education in STKIP Taman Siswa Bima Academic year 2015/2016. Sampling was done by purposive sampling. The students chosen in this sampling were those who completed a practical course in academic year 2015/2016. The technique of collecting data was observation sheet. Data analysis performed by using descriptive statistic to obtain the score of observation science process skills, then it further classified based on the criteria of the raw score. Based on the research, it can be concluded that the science process skills that goes on very good category is the simple information recording skill by presenting invariety of forms, meanwhile the science process skills that in poor category is the skill to write a hypothesis and presenting skill discussion of the result investigation /research. The percentages of science process skills in very good category are 1,92%, good 5,92%, enough 42,31% and less 3,85%.

Keywords: Science Process Skills, Physics Education Students

I. INTRODUCTION

Three major dimensions which interrelated in the study of science are the scientific product, scientific process, and scientific attitude. The dimension of scientific product includes materials of science or the knowledge about science. Meanwhile the dimension of scientific process includes the process of doing science, a problem-solving skills in daily life. And lastly, the dimension of scientific attitude includes the characteristic of opinion and attitude towards science [1]. This is supported by Mary which says that the science learning should implemented two aspects, namely science process skills and higher order thinking skills [2].

Physics as a branch of science is basically a set of knowledge, ways of thinking, and investigation. Learning physics relies on the processes of science. According to Mundilarto, learning physics in high school goal is to educate and train the students to develop competence in terms of observation, experiment, scientific thinking, and scientific attitude [3]. Therefore, each physics learner should have science process skills.

In fact, the assessment of Programe for International Student Assessment (PISA) in 2003 shows that the science skills of students related to science subjects in Indonesia is Low [4], and the research of PISA in 2006 with items of assessment are: a) identify scientific issues; b) explaining the nature phenomena scientifically; c) utilizing science data; concluded that the science skills of students in Indonesia is also low [4]. PISA study which conducted in 2009 put Indonesia in the rank 61 from 65 countries. The result of PISA study describes that the science learning in Indonesia is not yet optimal in developing science skills. Whereas the essential purpose of learning is a science process.

Low science process skills in learning science as described above need to be followed up, include in university level. Therefore, it is important for the students to have science skills. As a prospective teacher of physics, physics education students have the responsibility to develop three-dimensional science. Future physics education students are in charge to help the students in understanding the process or skill of how physics works [5].

Learning based on science process skills is essential to be held in campus, it because by directly experience in learning, students can be more responsive in developing science process skills of their students.
in the future. This is confirmed by Cronbach that learning is a changing of behaviour as a result of experience and the best of learning is by experiencing something using the five senses [6].

In addition, the demand of curriculum 2013 requires the teachers to master science process skills. The most fundamental change in curriculum 2013 was learning based science, or better known as scientific approach. The aspects of scientific approach are integrated in process skills approach and science method. Therefore, as teacher candidates, especially the physics teacher, the candidates should have a better understanding and skill about science process skills. It is intended that in the future when they become the real teacher, they are expected to have an adequate understanding and proficiency of science process skills and being able to apply a scientific approach in their teaching duties [7].

STKIP Taman Siswa as one of campus which has physics education program is needed to teach physics education students about science process skills. Physics education program in STKIP Taman Siswa Bima has physics laboratory, hence a bit more scientific skill is usually done by the students in subject which require lab work or investigation.

Based on the observation and interview with the lectures of physics education in STKIP Taman Siswa Bima, science process skills of physics education students is not investigated yet. Therefore, this research entitled the analysis of science process skills toward students of physics education in academic year 2015/2016.

II. LITERATURE REVIEW

A. Physics Education

Physics is a branch of science that is widely used as a basis for other sciences. Physics studied the symptoms and events or natural phenomena by means of discussions, investigations, and work together to find the concepts, principles and practice the skill.

According to Martin & Norman, as part of science education, physics education has three elements: knowledge, processes and attitudes. First, physics education helps students to observe natural phenomena, laws of nature and the underlying theory. Second, physics education helps students to understand the process or skill and method of physics. Third, physics education helps students to develop an attitude of physics studied such as honesty, discipline, rigorous, objective, loyal, durability with the existing problem, and cooperative with others [5].

One element of science learning that focus in this research is the process. According Jeenthong, learning using hands-on activities are used to support the construction of knowledge and experiment ability [8]. This indicates that the process related to the skill or the way to gain knowledge is called science process skills. In carrying out the process of learning through this process skills, a teacher should understand, master and being able to perform the skill in investigation process. If a teacher does not understand properly or not mastering the process skills, how does this process can be applied and developed in learning process.

As prospective teachers, especially for the physics teacher candidates, they suppose to have a good understanding and skill about science process skills. It means, after being a teacher later, they are expected to have an understanding and adequate proficiency of science process skills in learning Maintaining the Integrity of the Specifications.

B. Science Process Skills

Science process skills are emphasizing on the skill formation of acquiring knowledge, and communicate the finding. Skills mean the ability to use mind, logic, and an effective and efficient act to achieve a specific outcome, including creativity. Science process skills approach means the treatment set in learning process by using the power of thought and the creation of efficient and effective way to achieve the goal.

According to Barba, science process skills can be divided into basic process skills and integrated process skills. Basic process skills include: observation, classification, measurement, communication, concludes, prediction, use the place or time relationship, the use of number and identification variables. Meanwhile the integrated process skills include: formulation of hypothesis, controlling variables, investigate, operational definition and experiment [9].
Some experts develop the indicators of science process skills include Burn mentioned that the indicator of science process skills include: identifying variables, formulating hypothesis, designing experiments and research or presenting or data interpretation [10]. Whereas, according to Bryce et. al. (1990) developed by Subali [11] indicators of science process skills as follows:

1. Basic Skills
   a. observing skill
   b. noting skill/recording data and information
   c. skill to follow the order/instructions
   d. skill of measurement
   e. skill to manipulate the movement
   f. skill to implement the procedure, techniques or the use of equipment

2. Skills of Processing (process skills)
   a. skill of prediction
   b. skill of inferential
   c. skill of selecting the procedure

3. Skills to investigate
   a. skill of designing the investigation / research (nonexperiment/ experiment)
   b. skill of undertaking the investigations / research (nonexperiment/ experiment)

Attempts to know the science process skills of physics education students at STKIP Taman Siswa Bima, science process skill indicator used in this study is based on the theory of Bryce et. al. developed by Subali [11].

C. Assessment of Science Process Skills

Assessment is an important part of the activities which carried out to determine the quality of value and significance of the event based on the specific considerations and criteria to make the decision. The assessment procedure of science process skills capability can be done in two ways:

1. Observation
   Performed at each classroom, laboratory, and field observations using the format.

2. Written test
   Written test is done by using objective and description test. To know the process of scientific work is really assess and the students understand the concepts well, in each objective test the students are required to present the reasons why they chose the answer, so it can be interpreted whether the student is guessing, misconception and process skills, or master the concept and process skills

The assessment of science process skills in this study by using observation sheet developed by Subali in his previous research [11].

III. METHODS

A. Types of research

This research aims to know how the science processes skills of physics education program. Therefore, this research uses descriptive research.

B. Population and Sample

Population of this research was students of physics education at STKIP Taman Siswa Bima in Academic year 2015/2016. Sampling was done by purposive sampling, the sample chosen in this sampling were those who completed a practical course. The sample was 2015 year students totaling 8, students of class 2014 totaling 17, student of class 2013 totaling 24, student of class 2012 totaling 3.

C. Techniques and Data Collection Instrument

Data collection technique in this research by using non-test technique. Non-test technique is selected because it describes student performance of science process skills that is observation science process skills of students during the investigation on the learning process.

An instrument in this research was the observation sheet. The observations were done by the observers who had previously directed. In the observation sheet, the value of 1 to 4 for the appearance of each indicator
of science process skills. The following is an indicator of science process skills developed modification of Subali [11]. The indicators observation sheet of science process skills can be seen in Table 1.

TABLE 1. OBSERVATION SHEET OF SCIENCE PROCESS SKILLS

<table>
<thead>
<tr>
<th>No</th>
<th>Indicator</th>
<th>Sub Indicator of science process skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Basic skills</td>
<td>Observation skill</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Noting/ recording skill of data and information</td>
</tr>
<tr>
<td></td>
<td>Basic skills</td>
<td>Skill to follow order/instructions</td>
</tr>
<tr>
<td></td>
<td>Basic skills</td>
<td>Measurement skill</td>
</tr>
<tr>
<td></td>
<td>Basic skills</td>
<td>Skill to manipulate the movement</td>
</tr>
<tr>
<td></td>
<td>Basic skills</td>
<td>Skill to implement the procedures, techniques or the use of equipment</td>
</tr>
<tr>
<td>2</td>
<td>Processing/Processing Skills</td>
<td>Prediction skill</td>
</tr>
<tr>
<td></td>
<td>Processing/Processing Skills</td>
<td>Skill of selecting the procedure</td>
</tr>
<tr>
<td>3</td>
<td>Investigation skills</td>
<td>Skill of designing the investigation/research</td>
</tr>
<tr>
<td></td>
<td>Investigation skills</td>
<td>Skill of reporting the results of investigation</td>
</tr>
</tbody>
</table>

D. Data analysis technique

Data analysis by using descriptive statistics. This analysis was conducted to obtain a score of observation science process skills then further classified based on the criteria of the raw score.

To know the percentage observation of science process skills of physic education students, the data from observation sheets are described and decided the specific criteria. Criteria of science process skills of students can be seen in Table 2.

TABEL 2. THE CONVERSION OF ACTUAL SCALE TO SCALE FOUR

<table>
<thead>
<tr>
<th>Interval Score</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mi + 1.5 Sdi ≤ M ≤ Mi + 3 Sdi</td>
<td>Very High</td>
</tr>
<tr>
<td>Mi + 0 Sdi ≤ M &lt; Mi + 1.5 Sdi</td>
<td>High</td>
</tr>
<tr>
<td>Mi − 1.5 Sdi ≤ M &lt; Mi + 0 Sdi</td>
<td>Enough</td>
</tr>
<tr>
<td>Mi − 3 Sdi ≤ M &lt; Mi − 1.5 Sdi</td>
<td>Low</td>
</tr>
</tbody>
</table>

Information:
Mean (Mi) : Mi = \( \frac{1}{2} \) (maximum score − minimum score)
Standard deviation (Sdi) : Sdi = \( \frac{1}{6} \) (maximum score − minimum score)
M : Total score of students

Total item of indicators in observation sheet used in the research was 12 item. Ideal maximum score per item is 4 and the minimum score per item is 1. The maximum total number of scores obtained was 12 x 4 = 48. The minimum total score obtained was 12 x 1 = 12. From the calculation formula obtained Sdi and Mi, Mi = 30 and Sdi = 6. By Using the raw scores formula in Table 2, the score in four categories have been converted into raw scores can be seen in Table 3.

TABEL 3. THE CONVERSION OF ACTUAL SCALE TO SCALE FOUR OF ALL DATA INDICATORS IN SCIENCE PROCESS SKILLS

<table>
<thead>
<tr>
<th>Interval Score</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>39 ≤ M ≤ 48</td>
<td>Very High</td>
</tr>
<tr>
<td>30 ≤ M &lt; 39</td>
<td>High</td>
</tr>
<tr>
<td>23 ≤ M &lt; 30</td>
<td>Enough</td>
</tr>
<tr>
<td>12 ≤ M &lt; 23</td>
<td>Low</td>
</tr>
</tbody>
</table>
In addition, to analyze the overall science process skills, the results of observation are also analyzed on each item aspect of science process skills. To get a detailed description of each item science process skills, the data conversion can be seen in Table 4.

### TABLE 4. CONVERSION OF ACTUAL BEING SCALEFOUR TO ENTIRE DATA INDICATORS SCIENCE PROCESS SKILLS

<table>
<thead>
<tr>
<th>Interval Score</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>$169 \leq M \leq 208$</td>
<td>Very High</td>
</tr>
<tr>
<td>$130 \leq M &lt;169$</td>
<td>High</td>
</tr>
<tr>
<td>$91 \leq M &lt;130$</td>
<td>Enough</td>
</tr>
<tr>
<td>$52 \leq M &lt;91$</td>
<td>Less</td>
</tr>
</tbody>
</table>

### IV. ANALYSIS AND DISCUSSION

#### A. Data Research
This study aims to determine the level of science process skills of physics education students at STKIP Taman Siswa Bima. Science process skills measured are containing three indicators namely: basic skills, the skill to process/processing and investigating skills. The following is the analysis of science process skills possessed by the students.

1. **Data Analysis of Science Skills Process each Indicators**
   a. Basic Skills

### TABEL 5. DESCRIPTION OF SCIENCE PROCESS SKILLS INDICATORS OF BASIC SKILLS

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicators of Basic Skills</th>
<th>Score</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Item1</td>
<td>128</td>
<td>Enough</td>
</tr>
<tr>
<td>2</td>
<td>Item2</td>
<td>170</td>
<td>Very Good</td>
</tr>
<tr>
<td>3</td>
<td>Item 3</td>
<td>135</td>
<td>Good</td>
</tr>
<tr>
<td>4</td>
<td>Item 4</td>
<td>126</td>
<td>Enough</td>
</tr>
<tr>
<td>5</td>
<td>Item 5</td>
<td>129</td>
<td>Enough</td>
</tr>
<tr>
<td>6</td>
<td>Item 6</td>
<td>162</td>
<td>Good</td>
</tr>
</tbody>
</table>

Information:
- Item 1: Identifying types of data that can be collected in observations by the measuring instrument
- Item 2: Recording simple information by presenting the information in various forms
- Item 3: Compiling the information in table complete with its title
- Item 4: Completing a procedure based on the use of guideline card with information in the form of writing
- Item 5: Doing measurements by using measuring devices
- Item 6: Choosing the appropriate lab equipment based on the task given

Based on the observation, data recording and information on basic skills are in very good criteria, skill of organizing information into tables, skill of implementing procedure, techniques, and technique of using the equipment are in good criteria. Beside good and very good category, three other items on basic skills indicators are in enough category. Figure 1 describes basic skills indicator scores.
b. Skills Indicator Processing/Processing

<table>
<thead>
<tr>
<th>No.</th>
<th>Sub Indicator Processing Skills / Processing</th>
<th>Score</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Item 1</td>
<td>75</td>
<td>Less</td>
</tr>
<tr>
<td>2</td>
<td>Item 2</td>
<td>122</td>
<td>Enough</td>
</tr>
</tbody>
</table>

Information:
Item 1: Writing hypothesis
Item 2: Collect relevant data, and select an appropriate form of result presenting correspond to the investigation procedure which had been chosen

Indicators of process/process information is divided into two items. The first item on the ability to write hypothesis is in less category. The second item is collecting relevant data, and selecting a form of present results corresponding to an investigative procedure that has been selected in enough category. Figure 2 shows the indicator score processing skills/process information.

c. Indicator of Investigating Skills

The third Science Process Skills Indicators is investigating. In this study, investigation skills are measured by two sub-indicators, namely: designing skills of investigation/research and reporting the result of investigation. Two sub-indicators divided into four items. Sub indicators of designing the results of investigation/research divided into item of identifying the relation between independent and dependent variable in an investigation/research. Mean while the sub-indicators of skill in reporting results of investigations item divided into presenting the result of investigation/research that has been done with in the form of charts, tables or graphs, provides a summary of data results of the investigation/research that had been done, and present discussion results of the investigations/research. Table 7 describes data science skill of third indicator that is investigating skills.
TABLE 7. DESCRIPTION OF SCIENCE PROCESS SKILLS INDICATORS IN INVESTIGATING

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicator</th>
<th>Score</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Item 1</td>
<td>137</td>
<td>Good</td>
</tr>
<tr>
<td>2</td>
<td>Item 2</td>
<td>133</td>
<td>Good</td>
</tr>
<tr>
<td>3</td>
<td>Item 3</td>
<td>112</td>
<td>Enough</td>
</tr>
<tr>
<td>4</td>
<td>Item 4</td>
<td>84</td>
<td>Less</td>
</tr>
</tbody>
</table>

Information:
Item 1: Identifying the relationship between independent variables and dependent variable in an investigation research
Item 2: Presenting the results of the investigation research that has been done in the form of charts, tables or graphs
Item 3: Provides a summary of data results of the investigation research that has been done
Item 4: Presenting discussion result of the investigation research

2. Analysis of Science Process Skills Student Category for All Indicators

In addition to describe the achievement of each item, it also described the achievement of each student. It means that all indicators score of science process skills from students summed, then it compared with the raw criteria. After that, calculated the percentage of students who are in very good, good, enough, and less category. Table 8 provides an overview percentage category of students for all indicators of science process skills.

TABLE 8. PERCENTAGE STUDENT CATEGORY FOR ALL INDICATORS SCIENCE PROCESS SKILLS

<table>
<thead>
<tr>
<th>No.</th>
<th>Criteria</th>
<th>Total of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total</td>
</tr>
<tr>
<td>1</td>
<td>Very Good</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Good</td>
<td>27</td>
</tr>
<tr>
<td>3</td>
<td>Enough</td>
<td>22</td>
</tr>
<tr>
<td>4</td>
<td>Less</td>
<td>2</td>
</tr>
</tbody>
</table>

B. Discussion

This study was conducted to determine the level of science process skills possessed by students of Physic education at STKIP Taman Siswa Bima. The subjects were all students who programmed Physics education courses with practicum course. During the practicum, students were observed by using observation sheet instrument with check list and the scale of assessment (ratting scale) to determine the science process skills that appear based on the activities performed during lab activities. Besides the observation during lab, the researcher also performed an assessment of the practical reports to complete some of indicators in the assessment of science process skills. At practicum activity, the students were formed into groups consisting 3 people in one group.

Science process skills were assessed in this study includes three indicators namely basic skills, the skill to process/processing and investigating skill. Three of these indicators are divided into ten sub indicators. Basic skills are divided into six sub indicators observing skill, charting skill/recording of data and information, skill to follow directions/instructions, measurement skill, skill to manipulate the movement, skill to implement the procedure, techniques or use of equipment.

Indicators of cultivate/processing skill is divided into two sub namely the skill to make prediction and the skill of selecting the procedure. The last indicator is investigating skill, it divided into two sub- namely designing skill of investigation/research skills and report the results of the investigation.
Based on the observation score of science process skills, it showed that the science process skills possessed by students of each item varies. On the indicator of basic skills, in item of recording simple information and present it in various forms, are in very good category. Good category is occupied by item of organizing information in table complete with table titles, as well as select lab equipment corresponding to the task. Item of identifying type of data that can be collected in conducting observations with gauges, completing a procedure based on manual lab or card that contains information in the form of writing and making measurements using measuring tools are in enough category.

Result of the observation shows that during the practicum, students are able to record data information during practicum very well. Students’ ability to record information in form of table and choose the lab equipment to suit the task during practicum also fall into good category. It is because these basic skills are commonly did by the students. In addition, the students also assisted by practicum guide therefore it makes easier for the students.

Three items that need to be noticed are the students' ability in identifying the type of data to make observations with gauges, completing lab procedure using work instructions, and perform measurements using measuring devices. These three categories are in enough category. This is due to the treatment of researchers asked the students to understand the instructions before students doing practical work. However, in several steps, the students are doubt about the steps that they will do. Besides, in the use of measurement tools, there are several ways that students are less precise in reading the measuring tools, so it makes the result of parallax is error. Interestingly, in the research found that in reading the results of measuring with a ruler, the way students read a ruler is not in the position of the eye straight to the scale. Or the use of thermometers, for example, students are not noticing which areas are sensitive category that should not be hold.

Item of identifying the type of data that can be collected in observations, the students are still need guidance from the lecturers eventhough in fact they are guided by practical instructions. It means that, even if the student are guided by a manual lab work, the students still confused with the data that should be collected in the lab. It also appears in item of completing a procedure based on the use of cue cards work. The students still do not understand the sequence of the activities eventhough in general the students already read steps in lab activities. While in item of making measurements by using measuring tools, the student still do not fully understand about how to read a measurement tool. Most students are still perform parallax error in using a measurement tools.

In indicator of processing skill, it measured by item of writing hypothesis and collecting relevant data and to train an appropriate form of presenting the results for a given procedure. The Ability to write hypothesis of physics education program is in less category. The number of errors occurred because students are not accustomed to write hypothesis in interim report of practicum. Students only describe the purpose of research to fulfill the required research hypothesis. In addition, the students are not accustomed yet to write hypothesis in practicum. This condition is thought to be the cause of low score in writing skills hypothesis.

The second item of this indicator is the skill of collecting relevant data and chose the appropriate result presenting correspond to an investigation procedure in enough category. This item describes the students' skills in selecting the procedure. Result of the observations indicates that there is an error in identifying requested data. For example, practical mathematic pendulum, the requested data is the period of pendulum but the students write down the time taken during the swing progress. Although the time period and has a second unit, but the definition of this term in two different waves.

The last indicator is reporting the results of investigations by the sub-indicators, skill of designing investigation/ research and the skill of reporting the results of investigation. The first item, identify the relation between independent variable and dependent variable in an investigation/ research, both are in good category. This mean that students are able to distinguish which one is the independent and dependent variable in research report. The next item is presenting the results of research in the form of charts, tables, or graphs. This item is including in good category. In writing the reports, students are not only process the data with the usual calculation but also they are able to process the graphics as well as complete it with the writing of data tabulation in table.
Item of providing the conclusion of data investigation from the research that has been conducted, it includes in enough category. It can be concluded that this item is in enough category because the students are not able to conclude the data in accordance with the purpose of the experiment. Besides, result of the observation shows that the student’s way of submitting the reports are still partial. The students are still at the stage of doing a partial procedure. The last item is presenting the discussion results of investigation. This item is in less category. The ability of the students in discussion in less category because the students are not able to link between the experimental results with the theory. In the discussion, the students are only able to describe the way of practicum or the students rewrite the theory without linking it with the result of the experiment. Where as the students should be able to write the discussion linking to the theory and data experiment.

After categorizing the ability of science process skills of students, it also described the overall percentage of science process skill toward students of physics education. Physics education students who have science process skills are categorized very good is 1,92% or one person. Good category are 27 students or 51,92%. Enough category is 22 students or 42,31%, and less category is 2 students, or 3,85%. It describes that in general the science process skills of students are in good category. Although in general the science process skills of students are in good category, it is also needed to notice few indicators which include in enough and low.

V. CONCLUSION

Based on data from the research and discussion, it can be conclude that:
1. Science process skill which in goog category is the skill of recording simple information by presenting in various forms, meanwhile science process skill which in low category are the skill of writing hypotesis and the skill of presenting result investigation of the research.
2. Number of student who fulfit all science process skills which in very good category is 1,92%, good 51,92%, enough 42,31%, and less 3,85%

REFERENCES
THE ANALYSIS OF SCIENCE LITERACY TOWARD CHEMISTRY TEXTBOOKS AT THE ELEVENTH GRADE

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Abstract—This experiment was aimed in order to know the balance of 4 indicators used toward chemistry's textbook. Those 4 indicators were (1) The knowledge of science (2) Natural of science investigation (3) Science as a way of thinking (4) Interaction of science, technology, and society. Descriptive method was used in this experiment. Technique of investigating called triangulation was applied to utilize the other researchers. The other researchers need to recheck the degree certainly of data. Agreement of coefficient that was gotten by the Researcher could be categorized as very good with ranging 86-97%. From those four books that had been analyzed, the researcher conclude that the result of A’s textbook has a sequence in term of indicator percentage of the knowledge of science, natural of science investigation, science as a way of thinking, and interaction science, technology, and society with percentage 56,66%, 35,00%, 4,17%, and 4,17%. B’s book with percentage 62,40%, 17,46%, 8,73%, and 11,41%. C’s book with percentage 55,67%, 35,85%, 2,82%, and 5,66%. D’s book with percentage 56,81%, 34,09%, 4,55%, and 4,55%. The conclusion that we can got stated B’s book has more balance proportion among those four books which had been analyzed.

Keywords: Science Literacy, Textbook

I. INTRODUCTION

Science education is a discipline that teaches students to the discovery process. Essential aspect in science education is that students can realize the limitations of their knowledge, have the curiosity to explore various new knowledges, and finally apply it in their lives [1]. In science, students are expected to learn how to think like scientists, are doing discovery independently and research in the laboratory, forming self-reliant attitude in students that will protect them from the arbitrariness of the experts and give them the opportunity to participate actively and effectively in society [2]. This expectation is in line with some of the competencies that must be achieved by students by Education Minister Regulation No. 23 of 2006, namely: (a) Students can develop themselves optimally by using the advantages of self as well as improve its shortcomings, (b) establish and apply the information and knowledge as logical, critical, creative, and innovative, (c) demonstrate the ability to think logically, critical, creative, and innovative decision-making, (d) demonstrate the ability to analyze and solve complex problems, and (e) demonstrated ability to analyze natural and social phenomena [3]. This ability is known as scientific literacy.

Science literacy according to the OECD is a student's ability to use scientific knowledge to identify questions, acquire new understanding, to explain the phenomenon of science, provide conclusions based on the issues related, the ability of scientific investigation, awareness of how science and technology related to society, and a desire to engage with scientific issues [4]. Briefly, Toharudin, Hendrawati and Rustaman according to scientific literacy is a person's ability to understand, communicate and apply scientific knowledge in order to solve existing problems in daily life based on considerations of science [5]. Thus, scientific literacy is an ability that is needed in life to be formed in learning activities.

There is a sad fact that Indonesian students have low ability of science literacy. Based on an assessment of PISA, Indonesia always get an average score below the international average, which reached 500. Scores obtained in 2000 was 371, in 2003 was 382, and in 2006 was 393 [5]. In the year of 2009 was 383 and in 2012 was 382 [6][7]. Based on the level of proficiency on PISA assessment criteria, 31.1% of Indonesian students
were below their levels of literacy-1, 37.6% are at a level of literacy-1, 24.8% are at a level of literacy-2, 6.1% at a level literacy-3, and only 0.4% of students were able to achieve levels of literacy-4, and no one with the most points at the level of literacy-5 let alone the level of literacy-6 [8].

Some factors that may affect the achievement of students' science literacy Indonesia is education policy on a national scale, competency standards, teaching and learning in the classroom, the quality of teachers, teaching materials, and educational evaluation system [8]. One factor that directly intersects with learning activities that affect the low scientific literacy is the ability of teaching materials [9]. Teaching materials is a learning material that contains knowledge (such as facts, concepts, principles, and procedures), skills, and attitudes or values that must be studied to achieve the standards of competence which have been determined [10].

Teaching materials are materials (information, tools, and text) that systematically arranged and contain the necessary competence achieved by students and used in the process of learning. It that can be textbooks, modules, handouts, worksheets, models or mockups, teaching materials audio and interactive teaching materials [11]. As one part of the teaching materials, textbooks have a role as an intermediary in a process of teaching and regarded as a source of information for students [12]. Textbooks can be said to be the same as the textbook definition as a book that is used for a particular subject that has standards, prepared by experts with the aim of instructional, and is equipped with a means of teaching that is easily understood by the user to support the learning process in schools and university [13]. Textbooks have several characteristics, which provide benefits in the learning process, showing the form of different activities, and provide assistance in the learning process [12].

Textbooks should come from sources that support life-skills, authentic materials, and have a cultural value that are tailored to students' learning experience [8]. Textbooks should help to build a society which has literacy ability in science and technology, and in order to achieve these objectives, the learning process needs to prepare lessons to draw and emphasis on knowledge, inquiry, thought, history of science, and concern for the technological and social [14]. Yager stated that most textbooks are too stressed on the terminology and vocabulary, so students only remember all the information and use the information to answer the test, then assume that it is a science [15], Science text books for secondary education in Indonesia is still not able to meet the expectations resulting in a lower quality of student learning [8]. Textbooks that emphasize only the terms and vocabulary are not able to build scientific literacy of students. Based on interviews found that aspects of scientific literacy are contained in the book are of little use. Thus, it is a necessary to analyse the chemistry textbook to know the appearance of scientific literacy in the book.

Research conducted by Chiappetta et al., in Texas provide results that chemistry textbooks analyzed emphasize the science as a body of knowledge, a bit emphasize the science as a way to investigate, much less science as a way of thinking, as well as the interaction of science, technology, and society [15]. Another study conducted by Yuliyanti in analyzing the Physics textbook which contain scientific literacy found that the category of scientific knowledge is dominant compared to other categories [16]. Meanwhile, the category of scientific literacy approaching proportions were 42% for the category of scientific knowledge, 19% to the nature of scientific inquiry, 19% to the category of science as a way of thinking, and 20% for the interaction of science, technology, and society. Annur has been doing research on analytical chemistry textbook for SMA class X with the findings of the four books that analyzed describe categories science literacy as a whole, with the category of the emergence of indicators of science as a body of knowledge, science as a way to investigate, science as a way of thinking, and the interaction between science, technology, society respectively 75%, 5%, 12%, and 3% [17].
Based on the data above, researchers interested in conducting research on the analysis of chemistry textbooks based on the category of scientific literacy, because chemistry is a branch of science which contains materials and the concept of the principle of PISA, namely: First, the concept being tested must be relevant to the situation of daily life are real. Second, the concept of it will still be relevant at least for the next decade. Third, it must be related to the concept of competency process – i.e. knowledge that not only rely on the memory of students and pertains only to a certain set of information [8].

II. RESEARCH METHOD

The method used in this research is descriptive. Descriptive research does not intend to test a hypothesis, but only describe what the events, variables, or circumstances [18]. The research was conducted in June 2015 until February 2016 in West Jakarta.

The population in this study is the high school chemistry textbooks used in class XI Madrasah Aliyah Negeri (MAN) in West Jakarta. Samples were taken by using purposive sampling, is sampling technique through specific considerations [19]. The basic competence in the analysis are: (1) Competence 3.5 Explain the application of the principle of balance in everyday life and industry. (2) Competence 4.4 Describe the nature of the role of buffer solution and the buffer solution in the living body. (3) Competence 5.1 Make a variety of colloidal systems with materials in the vicinity.

The steps in conducting research analysis of textbooks by Nawawi and Martin, as follows; selecting textbooks to be analyzed, namely by making use of observation to determine the breadth of the book, compiling the indicators that will be used as a research instrument, which will be decisive chapter in the analysis, comparing it based on indicators that have been established and draw conclusions [20].

The research instrument used was pieces of identification that contains indicators of scientific literacy that was built by Chiappetta, Filman&Sethna to analyze the book based on scientific literacy charge [15]. The research instruments used in analyzing the book is as follows: code indicator table listing information science literacy and science literacy indicators pieces of identification.

Data analysis techniques used in this research is descriptive and to measure the reliability of the data obtained by researchers, the technique of triangulation is used. The technique used is triangulation with the investigator, the investigator or other observers utilize for the purpose of checking back in the degree of confidence of the data [21]. Checking data performed by experts, namely two chemistry lecturer (observer I and II) and practitioners are two chemistry teacher (Observer I and II). Data from checking, and then calculated the level of reliability to get the coefficients of agreement between the two observers. In calculating the reliability of the observation, the steps that need be done is to make contingency table agreement between the two observers. Categories span of the agreement the two observers are: very good (> 75), good (40-75), and very poor (<40) [18].

III. RESULTS AND DISCUSSION

This study aims to determine the appearance of scientific literacy in chemistry textbooks. Those 4 indicators were (1) The knowledge of science, (2) Natural of science investigation (3) Science as a way of thinking (4) Interaction of science, technology, and society. The discussion of each indicator presented scientific literacy in the explanation below.

1. The Knowledge of Science (KoS)

Indicators of scientific knowledge present text intends to show, discuss, or demand the return of students to recall information, facts, concepts, principles, laws, theories, and so forth. This reflects the transfer of scientific knowledge from books to students when students receive information. This category is the type most numerous in textbooks and involves information that needs to be learned by the students [15]. Science knowledge to dominate the four books were analyzed. Here is a Figure. 1 results analysis indicator in the fourth book of knowledge of science.
Knowledge of science is an indicator that has three sub-. The first sub- presenting facts, concepts, principles, and laws. Second, presenting hypotheses, theories, and models. The third sub- is asked students to call back the knowledge or information. These four books that have analyzed the percentage of great scientific knowledge, ie 56.66% in book 1, book 2 62.40%, 55.67% in 3 books, and 56.81% on book knowledge 4. The results of the analysis indicators science obtained are supported by previous studies in other countries show that the emergence of scientific knowledge indicators dominate, both in chemistry textbooks or in addition to the chemical. The interesting thing is that the results of the analysis of the results of the analysis of Indonesia, Nigeria, and Australia have the same pattern. Pattern in question is, the range of differences in the percentage of the book with other books is not very significant. In contrast to the results of the analysis in Texas, the percentage difference of the book with other books look much. This means that the author of chemistry textbooks in Texas have different content delivery in chemistry textbooks.

Indicators of scientific knowledge is an indicator that either the products of science, such as facts, principles, theories and laws. But other than products of science, nature science has other elements such as processes, applications, and attitude. The process is a procedure of solving problems through scientific methods of observation, hypothesis formulation, experimental design, experiment or research, testing hypotheses through experimentation, evaluation, measurement, and drawing conclusions. The application form of the application method or scientific work and concept of science in everyday life. Then the attitude is curiosity about objects, natural phenomena, living beings, and the causal relationship that raises a new problem that can be solved through correct procedures [22]. Based on the results of the analysis can be seen that the indicators of scientific knowledge is an aspect that is emphasized by the author because of the importance of these aspects that are traditionally used by testers to create and teachers about itself [23].

Related learning about science products is necessary for the students as a basis for the understanding of the science itself. However, the book is dominated by products of science can lead to other impacts, that the students' knowledge of science or chemical limited to rote or theory. The contents of the books used by teachers and students need to bring the activities to provide opportunities for students to investigate themselves, understand the important role of chemistry in everyday life, and describes the way scientists do in performing the invention.

2. Natural of Science Investigation (NoS)

Many chemistry textbooks that involve the reader in an activity that causes students to think, reason, and find. This is defined as the natural science investigations. These four books analyzed present the questions to be answered by the students. Some questions can be answered by studying the tables in the text or to find it in practice in the laboratory. Some other questions can be answered from material that has been written in the chapter. Some questions and problems ask students to explain the reason for the answer [15]. Here are the results of analysis of textbooks based on indicators of natural science investigations.
Investigation of natural science is a great indicator of dominance after the indicator of scientific knowledge. The part that greatly contributed to this indicator is sub-ask students to make calculations. The third book is a book which is the highest result of the percentage of indicators of natural science investigations. The third book which is C’s book, is a book containing predominantly about the matter, so that the contribution of sub-asking the students give an account large enough that 26.42% of the percentage of existing indicators. The second book is a book that gives the smallest percentage in indicator investigations of natural science. The second book is a book published by B’s book dominated by sub-ask students to make calculations, but do not like the book C’s book that the amount reached 26.42%, B’s of the book, which C’s book dominance count is big, but the B’s book less pointed out.

The emergence of the sub-indicator asks students to make the calculation is greater than the four other sub-. The fourth sub-other indicators only give a percentage with an average of less than 7%. Sub-indicator asks students to answer using charts, tables, and others bring up the smallest percentage when viewed from the average, which is only 0.17%. This is because due to the book 1, book 3, and 4 books emergence of sub-indicator is 0.00% and only appears in the second book with a percentage of 0.67%.

The percentage of indicators of natural science investigations in book 1, book 2, book 3, and 4 books consecutively is 35.00%, 17.46%, 35.85% and 34.09%. The results obtained in this study are relevant to the research conducted previously. The results shown in every country provide different ranges of every book in the analysis. However, natural science investigations indicators still give dominance arising after the indicator of knowledge of science.

Indicators of natural science investigation intends to stimulate students to think and do. In relation to the investigation, students were asked to investigate. Investigations conducted by the student intended to engage students in the methods and processes in a science, such as observing, classifying, making inferences, calculate, experiment, and so forth.

3. Science as Way of Thinking (WoT)

The analysis showed that, compared with the three other indicators of scientific literacy, science indicators as a way of thinking gives the least part. Meanwhile, lately, it is important to give emphasis to build students' thinking process so that there is an increase and it should be underlined that in order to achieve this, the science as a way of thinking should be emphasized in textbooks. Here are the results of the analysis of indicators of science as a way of thinking.
Analysis results showed that, four chemistry textbooks do not emphasize science as a way of thinking. The author of the text does not emphasize the importance of how scientists discover new ideas and experiments, the formation of the history of chemistry concepts, causality, evidence and proof, and testing myself from thinking that the ideal of knowledge. This is an important aspect of the efforts of scientists and science literacy development of science [15].

Research results obtained, are relevant to the research results from other countries. Occurrences indicator of science as a way of thinking in this study provide results that are relevant to research in the state of Texas as well as Nigeria. The percentage difference between the three countries is not too significant, but different results shown by the state of Australia are on a higher percentage.

The analysis showed that the second book provides the highest percentage of indicators of science as a way of thinking. Presentation of the contents of the second book is to show how a scientist experimenting, shows the historical development of an idea, emphasizing the empirical nature and objectivity of science, illustrates the use of assumptions, show how science goes inductive-deductive, provides a causal relationship, discussing the facts and evidence and serves the scientific method and problem solving. Although not all of these sub- appear but the percentage contribution of science as a way of thinking in the second book of 8.73% lead approaching the second book balance the proportion of scientific literacy. Unlike the third book that does not emphasize indicators of science as a way of thinking, this is because the author of three books with more emphasis on the contents of the products of science that goes into the indicators of knowledge of science and natural science investigations were dominated by questions that ask students to make calculations.

Science as a way of thinking has an important role for the development of scientific literacy, because basically the science has a causal relationship between the phenomena of nature. Therefore, textbooks need to develop the ability to think of the students in order to see the relationship between science and associate them with his knowledge. The material presented in chemistry textbooks need to be focused on aspects of science as a way of thinking to stimulate students' thinking as scientists expected. While in fact the material displayed predominantly on science products such as facts, concepts, and principles.

4. Interaction of Science, Technology, and Society (STS)

Science is one of the supporting part of the development of a technology. Development of a technology can enhance previous findings. Technological developments are also of course be able to create a new tools. Improvement or invention of a device of this technology will impact the development of science. So create a reciprocal relationship between the two [24]. Additionally, the technology and science also has a close relationship with the life of the community to support the ease in their lives.

The interaction among science, technology and society are part of the indicators analyzed textbooks based on science literacy category. Because, in essence science learning is not only the necessary knowledge of the students, but more broadly the knowledge can be applied to the life of society and of course for the advancement of technology. Here are the results of the analysis of indicators of the interaction between science, technology, and society.

![Figure 4: Proportion Indicators Emerging Interaction Among Science, Technology, and Society](image)

Author for four books analyzed, pursue science, technology, and society to appear in the book section. Although, part of which was obtained indicator sanis interaction, technology, and society is not as much as other indicators. The second book, a book that most give presentations third appearance of this indicator
compared to other books, amounting to 11.41%. This is because, the author of the book involves a passage in a book called Chemistry Info which contains information relating to the material studied, technology, and society. However, Chemistry info in the book is presented in English, not Indonesian. This will give two contradictory effects for students. first, that the students who are not familiar with the English language would be difficult to absorb the information presented. Meanwhile, the impact of the latter, ie information in English will give habit for students to use English that is useful in the era of globalization. In previous studies, Chiappetta et al. find textbooks Merrill insert pictures and descriptions below the picture called "Careers in Chemistry" at the book. Likewise, Allyn and Bacon emphasize science, technology, and society use the pictures and descriptions below and enter the colored part of the renamed "Chemistry in Action" [15].

The data showed that the first book is a book that at least provides the proportion of this indicator, namely 4.17%. Author of book emphasizes the description of the material and then proceed with the sample questions. No special column on the book that illustrates the interaction between science, technology, and society. The results obtained are relevant to the results of previous research conducted, namely that, indicators of the interaction of science, technology, and society had a small part in a chemistry textbook. Indicators of interactions between science, technology, and society is not a dominant part in the research results. This is because an indicator that dominates the scientific knowledge of the textbook.

Emerging scientific literacy indicators when viewed from the basic competencies give different results. This is because the material presented each basic competency is different and presented materials also have different sections. The first basic competencies analyzed are basic competencies 3.5 Explain the application of the principle of balance in everyday life and industry. At KD 3.5, indicators of scientific knowledge is an indicator that dominates. The fourth book that analyzed have different results. The first book, second, and fourth did not provide a significant percentage difference is the range of 6-8%. Meanwhile, the third book gives a different percentage of the third book, which is 19%. This is because in the discussion of KD 3.5 in the third book, the existence of a discourse Chemistry Around Us discussing the process of the stalactites and Stalagmites in Cave Limestone that applies the principles of natural science investigations kesetimbangan.Indikator give the appearance that is much less than the indicator knowledge of science. Likewise the emergence of indicators of science as a way of thinking that gave rise slightly. This is because the material presented on the basis of competence 3.5 less provide parts for students to conduct an investigation in the category of natural scientific investigation. The same thing happened on indicators of science as a way of thinking, whose occurrence is below 2% in the textbook. Occurrences indicator of science as a way of thinking on textbooks contributed by sub- shows the history of the formation of ideas, which is the history of the manufacture of ammonia which was originally coined by the scientist named Fritz Haber who later developed by Carl Bosh and evolves with technology until now. The fourth indicator is the interaction between science, technology and society emerged with a range of 0-6%. The fourth book does not provide an indicator part of interaction between science, technology, and society. Meanwhile, the second book is a book that has the largest percentage of the achievement of 6%.

The second basic competence analyzed are basic competencies 4.4 describes the properties of the buffer solution and the role of the buffer solution in the living body. 4.4 Basic competence take a larger share than the previous basic competence. Indicators of scientific knowledge has a percentage range of 17% -40%. The highest percentage, namely 40% is the percentage owned by the second book. Presentation material on the second book different from the three other books. The second book presents the material with tables displaying pH and changes in pH when acids, bases, and buffers are added slightly acidic, basic or diluted. Then after it was shown that the buffer solution is a solution which when added slightly acidic, alkaline, or diluted pH practically unchanged. Unlike the third book that gives the percentage of knowledge that is at least 18%; the presentation given on the third book given the data on the pure water solution is added acids or bases will change the pH. Meanwhile, when the buffer solution is added slightly acidic or alkaline pH will not change drastically. Then, the third book provides direct exposure to the material to be studied. Indicators of natural science investigations provides that the fallout from the indicators scientific knowledge. This indicator is an indicator with the largest percentage in the third, and the second book with the smallest percentage. This is because the number of exercises on the third book more than the second book. A large
The number of questions because the effect on the percentage of matter is an element that contributed significantly to the natural science investigations indicators. The largest percentage of indicators of science as a way of thinking and interaction between science, technology and society obtained by a second book. The second presentation of the material in the book, not only dominated by science products such as facts, concepts, principles, laws, hypotheses, theories, and models. However, the second book gives room for indicators of science as a way of thinking and interaction between science, technology, and society in the presentation materials at KD 4.4.

The third basic competence analyzed are basic competencies 5.1 Make a variety of colloidal systems with materials that are nearby. 5.1 Basic competence is a basic competence that includes indicators of scientific knowledge dominance is quite big in the basic competencies 5.1. The percentage of indicators of scientific knowledge on the books of the first, second, third, and fourth respectively 24.17%, 13.42%, 18.87% and 23.86%. Unlike the indicators of knowledge of science, natural science investigations indicator only gives the percentage of 6.67%, 3.36%, 3.77%, and 13.64% in the fourth book that analyzed. The largest percentage, i.e. 13.64% was obtained by the fourth book. This is because the fourth book, there are some activities or experiments involving students to make colloids. The experiment is a sulfur sol preparation, manufacture sol / gel gelatin, emulsion oil in water, the manufacture of sol Fe(OH)₃, As₂S₃ sol preparation and manufacture of calcium acetate-alcohol gel. Experiment is one sub-part of natural science investigations. Indicators of science as a way of thinking in the basic competencies 5.1 provides the results of 0% in the first book, second, and third. However, in the fourth book, these indicators appear, although only by 1.14%. Indicators of interactions between science, technology, and society gives the percentage of 2.50% in the first book, and 0% in the second and third books, and 3.40% in the fourth book. This is because in the fourth book, there are some parts which exposes the negative impact of science and technology in society, namely the negative impact such as detergents and foam colloid produced by the industry for the community.

Based on the analysis, it can be seen that the indicators of knowledge of science and natural science investigations took a big part. This is because teachers often teach and I often write a covering material appearing in the exam. If the test material is more emphasis on natural science investigations indicator of the interaction between science and technology and society in the test, it will show an increase in proportionate given on both of these indicators by teacher and author [23]. The results obtained showed that of the four books that analyzed the second book is a book published by the author B’s book is a book close to balance the scope of scientific literacy with the percentage of 62.40%, 17.46%, 8.73%, and 11.41%. In his journal, Chiappetta et al. does not mention the exact figure the percentage of the balanced literacy category. However, the research results stated that the book Addison-Wesley close to balance by the percentage of indicators of scientific knowledge, investigative science natural science as a way of thinking, and the interaction between science, technology, and society respectively 69%, 14%, 5% and 12% [15].

IV. CONCLUSION AND RECOMMENDATION

The result of A’s textbook has a sequence in term of indicator percentage of the knowledge of science, natural of science investigation, science as a way of thinking, and interaction science, technology, and society with percentage 55,66%, 35,00%, 4,17%, and 4,17%. B’s book with percentage 62,40%, 17,46%, 8,73%, and 11,41%. C’s book with percentage 55,67%, 35,85%, 2,82%, and 5,66%. D’s book with percentage 56,81%, 34,09%, 4,55%, and 4,55%. The conclusion that we can got stated B’s book has more balance proportion among those four books which had been analyzed.

However, the proportion should be expected emergence of scientific literacy in the other book is more balanced. Textbooks often contain indicators of knowledge of science and natural science investigations. Therefore, it is better to improve the indicators of science as a way of thinking and investigation among science, technology, and society in textbooks used. This study also analyzes only four textbooks, it should be more textbooks analyzed, to determine the balance of indicators of scientific literacy. Thus, the analysis results can be used as a consideration in choosing textbooks used in the learning process.

REFERENCES


IMPROVING SCIENCE HIGH LITERACY THROUGH LIFELONG LEARNING SETS BASED BY BLENDED LEARNING USING LMS

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Abstract—Literacy culture is an important thing in the process of lifelong learning because it makes the culture of a nation can achieve various field of science so the learner is more creative, innovative and always prepare to advanced in competition at world economy principled knowledge. Efforts to improve high science literacy is not only required from formal institutions, but important for the learner in non-formal institutions also. This requires need support all of the aspects, from education personnel until the facilities and infrastructure. Science high literacy can be initiated from things as simple as reading the environment and learned by using science, supported by technology to add information or as object of solving problem that can be useful to themselves and the community. Widespread development of science and technology in the globalization era can also be used as media in an effort to improve high science literacy. It is certainly can be implemented and utilized by the limited such as formal institutions only, but can be accessed for non-formal institutions or public. One of the applications can be developed and used as the media is LMS. LMS is a learning management system not only can be used for management of the formal learning system but can be developed and applied in the learning system as well as implementing a conventional learning system in the form of virtual world learning. Development of the LMS can be implemented for a variety of application forms as needed. The purpose of this paper is to providing insight and learning innovations that take advantage of the environment by using Science, Environment, Technology, and Society (SETS) based and blended learning (combining conventional way by implementing LMS), can improve high science literacy. In this idea, SETS-based learning combined with LMS in order to optimize the development of science and technology in education to enhance the high science literacy.

Keywords: Science High Literacy, Life Long Learning, SETS, Blended Learning, LMS

I. INTRODUCTION

Nowadays many countries both developed and developing countries are trying to improve the scientific literacy of students. Increased scientific literacy required by a country in order to create the next generation that is able to read scientific information and scientific thinking to make decisions the utilization of environment that benefits many people. Therefore, the country can advance through next generation who have high scientific literacy because it is able to adjust to the changing times that happened.

Indonesia is a country has scientific literacy which is still less compared to other countries. This is consistent with the results of the evaluation of Indonesia student's science literacy on PISA tests from 2003 to 2012. Indonesia always ranked at the bottom compared to other countries, such as in 2003, Indonesia ranked 38th out of 40 participating countries, in 2006 ranked 50th out of 56 countries, in 2009 ranked 61 out of 65 countries, and in 2012 ranked 64th out of 65 countries.

Scientific literacy is ability to acquire new knowledge through identification of science issues, explaining phenomena scientifically, and using scientific evidence to make decisions that benefit people [1]. Students' science literacy skills measured by PISA consist of three competency that is identifying scientific issues, explaining phenomena scientifically, and using scientific evidence. Therefore, test science literacy by PISA
focusing on knowledge of science and about science (knowledge about the real world and the science itself) [1].

The framework developed by Bybee on the determination of the level of scientific literacy there are five levels, that is nominal (write a term without understanding), functional (capable of defining the term), conceptual and procedural (know the principles and theories of science), and multidimensional (understand the concepts and is able to relate one each other) [2]. The existence of these levels indicates that everyone will gradually acquire literacy skills in science from the simple to the complex. It is generally aligned with the person's age and mental development.

The scientific literacy generally will be enhanced through a learning process of life that occurs lifelong learning. Lifelong learning is a learning process to form new knowledge through knowledge and skills possessed to solve the problems of everyday life both personal and community problems [3]. Lifelong learning is learning directly to the real world while enhancing science literacy indirectly. This is accordance with the opinion of Dam and Volman that scientific literacy learning can be enhanced through the use of a real situation [4].

One of learning approach that uses real situations is SETS approach. SETS approach is a learning approach that provides learning experiences directly with the linking of science, environment, technology, and society [5]. Learning based SETS able to improve scientific literacy of students through learning by seeing the situation (environment) to find solutions of the society problems based on science and technology.

SETS learning not only be done in conventional way, but it can be done electronically that is use of technology. The majority of which are often found in the field, SETS learning is still done conventionally and yet optimize the use of technology as well. One way to optimize the use of technology is using an electronic-based learning, for example with e-learning or blended learning. Reference [6] blended learning is a learning approach that combines process-face and online learning so that the learning can be controlled anytime and anywhere quickly [7]. One effort that can be done in blended learning is harnessing the LMS application. LMS is an application that can be used to assist the directly or indirectly learning either. Through the use of LMS applications, blended learning can be organized properly. In addition, LMS not only helps blended learning in formal education but also can be used by non-formal educational institutions to optimize student’s science literacy skills. So that students can improve their science literacy skills through lifelong learning based SETS with blended using LMS applications anywhere, anytime and by anyone.

II. DISCUSSION

A. Correlation between Science High Literacy and Lifelong Learning

Reading activities is one of the way to get knowledge, insight and experience to learn independently, so the reading would be better if made a habit, especially for students to improve and developing their knowledge or their insight. Reading culture is essential thing in the lifelong learning process because through that way, a nation get achieve some of various sciences field that makes the learner more creative, innovative, and always to prepare for advance in competition era especially in economy world. They will be able to compete in globalization era on the basis of knowledge and experiences. Lilianasari (2011) revealed science is a branch of science field and has an important role in all aspects of life to establish a science-literate society [8]. Learning science is responsible for the student scientific literacy, because quality of science learning science learning needs to be improved in order to achieve sustainable development.

Program for International Student Assessment (PISA) (2012) revealed science literacy as “the capacity to use scientific knowledge to identify questions acquire new knowledge, explain scientific phenomena and draw evidence-based conclusions about science-related issues; their - understanding of the characteristic features of science as a form of human knowledge and enquiry; their awareness of how science and technology shape our material, intellectual and cultural environments; and their willingness to engage in science-related issues, and with the ideas of science, as a reflective citizen” [21]. Elsy Zuriyani revealed important of science literacy is caused by an IPA understanding to personal helped and give a benefits for any one [9]. Furthermore, the countries faced some of the questions in life that need scientific information and scientific thinking for making decisions and interests of many people who need to be informed as air, water,
and forests. Based on the result of Indonesia students science literacy evaluation from 2003-2012, Indonesia is almost always under from the other countries. The evaluation result are shown in Table 1:

<table>
<thead>
<tr>
<th>Year</th>
<th>Field</th>
<th>Indonesia Average Score</th>
<th>Indonesia Ranked</th>
<th>The number of States Parties to the PISA</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>Reading</td>
<td>382</td>
<td>39</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Mathematics</td>
<td>360</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Science</td>
<td>395</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>Reading</td>
<td>393</td>
<td>48</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>Mathematics</td>
<td>391</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Science</td>
<td>395</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>Reading</td>
<td>402</td>
<td>57</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Mathematics</td>
<td>371</td>
<td>61</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Science</td>
<td>383</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>Reading</td>
<td>396</td>
<td>62</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Mathematics</td>
<td>375</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Science</td>
<td>382</td>
<td>64</td>
<td></td>
</tr>
</tbody>
</table>

Resources : [10]

Based on review of the evaluation results showed Indonesia is students science literacy is decreasing. These results show science high literacy in Indonesia is low, this can occur because of external and internal factors. The influence of external factors including a lack of awareness conducting high literacy and have not been able to utilize the facilities and infrastructure that are already available. Meanwhile, internal factors are influenced by the students’ attitudes towards science will give greater influence to the high science literacy. Based on data, it’s known that in the year 2006-2009 students’ attitudes towards science better when compared to other years. The scientific attitude includes the student’s interest, confidence, and responsibility of students towards science.

Another issue found in the field is a mistake or miss concept about the meaning of lifelong learning. Majority of older people or have been worked will be stop learning process because they have been considered sufficient to have a lot of experience and knowledge. Furthermore, another reason that is often used for routine work is less allowed to continue the learning process. That mindset like this can make their mindset that turns off the power of creativity and the potential exists in them self. So, lifelong learning can be one effort to improve science literacy but not easy for implementation as requires awareness of each individual.

Science high literacy and lifelong learning have a closed correlation because in improve high literacy requires effort not only per period, but must be done on an ongoing basis until the end of life. The concept of lifelong learning is fundamental learning concept by utilizing and based on events that occur in daily life or experience you have had. The concept of lifelong education knows no boundaries of age, all of human are both young and elderly can still be learners, because way of lifelong learning can be done anywhere, anytime, and anyone. This correlation including mutual correlation to support between two variables because this way will begins from the real thing or problems in our daily lives.

This statement supported by Sudjana revealed the lifelong education should be based on principles such as: 1) education will only end when the man had died; 2) lifelong education is a powerful motivation for learners to plan and carry out activities in an organized and systematic learning; 3) the purpose of learning activities are to obtain, renew, and improve the knowledge, attitudes and skills that have been held; 4) education has sequential purposes in fulfilling the learning needs and develop self-satisfaction every human learning activities; and 5) the acquisition of education is a prerequisite for human life development, both to improve its capabilities, so that people are always learning activities to meet their needs [11].
Scientific literacy is nurtured by quality science education [12]. The effort to improve of science high literacy not only in formal education but informal and non formal also need to improve because science high literacy is essential component of lifelong learning. This statement get supported from Report on Science Education about essential of science high literacy are widespread scientific literacy is a vital element in gaining public support for continuing advances in scientific discipline [12]. Furthermore, through this way all members of the public have opportunity to learn about science and know until understand new discoveries in an informal and engaging setting. The other side through science high literacy is vital component for supporting a science high literate populace and lifelong learning.

B. **Blended Learning using LMS to Improve Science High Literacy through SETS**

Blended learning is one alternative that can be implemented in formal and non-formal institutions that can be made the combine between the conventional and online method. Blended learning is not new [13] in education field. Blended learning is about effectively integrating ICTs into course design to enhance the teaching and learning experiences for students and teachers [13] and combines the best elements of online and face to face learning [14].

Through blended learning students will be easier to get learning experiences, not just get contextual information with the environment, but they can get information outside of their environment is like in the other place, situation, and condition. Furthermore, through this blended learning, the students are guided and encouraged to use technology wisely, both of the directly and indirectly. Bybee (1997) framework developed of scientific literacy there are five levels, i.e. nominal (write a term without understanding), functional (able to defining the term), conceptual and procedural (know the principles and theories of science), and multidimensional (understand the concepts and able to related with one each other) [2]. The existence of levels are indicates that everyone will gradually acquire literacy skills in science from the simple step to the complex step. It is generally that line with the person’s age and mental development. Based on these known that in the high science literacy development process requires the support of various aspects, one is the aspect is infrastructure used. Facilities and infrastructure are not only available, or can be used and accessed in formal institutions, but also can be used and accessed for non-formal institutions until the public.

Based on the Bybee framework, it is known in acquiring and developing science literacy begins from simple step and can be obtained from what students know and what students see in the field or in other words by reading natural (environment) and then try to figure out the meaning and the intent of what is known or seen [15]. After that, the students try to understand that problem until they can understand the concept and linking relations with one each other. Such of the processes require precise knowledge and methods, especially in the field of biology that have specificity in problem object, the method until get and able to make problem solving. The process to get the information, understand that information to solve these problems would require the support of another aspects, one of the aspect is utilizing technology in the right way. Through technology students can play an active and independent, not only get information passively but also actively.

One of the ways can be implemented through the technology use that is used in the LMS is an alternative that allows for increased high science literacy. This is because the utilization of LMS is not only in the formal form but also can be set in the non-formal form but did not reduce benefits and increase efforts in high science literacy. The use of technology in obtaining information literacy requires the media appropriate. This statement supported by Christine Susan Bruce information literacy is conceivably the foundation for learning in our contemporary environment of continuous technological change [16] and Edwards said undergraduate students in Australia keep diaries to reflect on their experience of learning to search the internet [17]. They create web sites that organize information resources of use to a business of their choice; requiring access, evaluation and synthesis.

Based on Alajab and Ameera Musa Ali Hussain research about the impact of a blended learning course on Khartoum University students achievement and motivation to learn scientific english [18]. The result and conclusion from this study are Khartoum University should encourage English for science instructors to adopt blended learning and make use of the Moodle learning environment along with the traditional method of
teaching to facilitate the learning process, scientific english instructor should motivate their learner to use internet technology in general and multimedia format in particular that help them to interact with outside learning material and communication with their colleagues and teachers as well as be independent learners. Another research to support effectively of LMS to help learning process is Eden Dahlstrom, et al based on their research to known 74% faculty said the LMS is a very useful tool for enhancing teaching [19].

Based on some of information, the efforts to improve science high literacy is not only done conventionally but can be done online as well and combine both ways or in other words by making blended who use LMS applications. The research before just has been done only tried one of the way in effort to improve science high literacy not yet to try to combine both of the method. Furthermore, high science literacy has a close correlation with SETS and lifelong learning concept, because basically science high literacy concept begin from the real problems that occur in the environment and this way in line with SETS concept directly or indirectly. What will be developed or improved in according with the student’s mental readiness need the right media in the process of development until the end of the process may be disseminated or distributed to the public and can be useful to themselves and society.

The purpose of this paper is to provide insight and learning innovations take advantage of the environment by using SETS base and blended learning (conventional by implementing LMS), can improve science high literacy through learning-based with SETS combined with LMS as well as to optimize the utilization of the development of science and technology in education to improve high science literacy. Furthermore, through this paper is also expected to not only improve the high science literacy for certain periods or limited by time, but will be sustainable in according with the lifelong learning concept.

III. CONCLUSION AND RECOMMENDATION

CONCLUSION

Science literacy must have and developed by each person in a country so that it can create qualified resources capable of promoting the country. Scientific literacy can be improved by any person gradually during life through a continuous learning (lifelong learning) anytime, anywhere, and by anyone. In addition, scientific literacy can also be enhanced through learning that associates with real problems or situations. Therefore, the integration process of lifelong learning based SETS with blended using LMS applications is expected to increase science literacy of students.

RECOMMENDATION

The suggestion of this idea is need to followed up with implemented on learner/students to form qualified human resources by having high science literacy so that created the next generation capable of promoting the country.

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INTEGRATED MODULE EKOGEOTHERITAGE GUNUNG API PURBA NGLANGGERAN BASED ON SCIENCE LITERACY AND CARE ATTITUDE OF THE ENVIRONMENT

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Abstract—Ecology is generally centered on urban issues, they are like industry, urban location system, reclamation, and waste pollution. While the problems take the inspection of authentic area, especially local wisdom is still rarely. If any like that, it is just limited to the observation, and it has not taken resources as the learning material. The area of Nglanggeran Ancient Volcano is Geoheritage area which has local potential with the ecosystem component of the varieties vegetation. If it is used correctly, it will bring the big benefit. It can be formed when all of sides pay attention to the sustainable living principle. The important thing of this ecology phenomenon observation needs to be done, because we remember that it is interesting, of the geology history side and to know the condition of nature wealth after it is impacted of the tourism ecology. If this issue is impacted as the study resources of the module for High School, it can dig the ability of the science literacy. Because it is used to solve the problem of ecology phenomenon and it is needed the ability of the society who has science literacy. The module which is improved as the printed subject learning facilitates the collaboration knowledge inter the student and the society. Besides taking Geoheritage area of Nglanggeran Ancient Volcano as the study resources, it is also able to increase the awareness of the students toward homeostatis nature and respect to the relationship on both sides inter the human being. As an explicit manner, every school has to give support to the human resources who has attitude. While the plantation of the environment care as a part of the noble ethics must be applied in the school.

Keywords : Integrated Module, Geoheritage, Science Literacy, GAP Nglanggeran

I. INTRODUCTION

In this 21st century, Biology is not just for the sake of science which learn about life, all sort of research has been done, and various inventions which have been developed are able to improve quality of human life. Various problems of food insecurity, the providing houses, energy needs, health and the environment depend on the biological sciences. Biology has developed in every realm of knowledge, one of which is biology in relation to ecology. Ecology learning the intricacies of interaction between biotic and abiotic components. In the world of education, ecological subjects are presented to the students in 10th grade in second semester. The purpose of this chapter is to make students comprehend to the reality of the world in an effort to understand their identity and their environment, and raise awareness for the love of nature with all its contents.

As for the standard of competency based syllabus is that students are able to analyze the relationship between the components of ecosystems, changes of matter and energy, and the role of humans in the balance of the ecosystem.

A phenomenon that was named to be material of ecological studies generally centered on urban issues, such as the existence of the industry, the layout of the city, reclamation, and pollution. Whereas the problems that raise the authentic studies of area mainly local wisdom are rarely, if any, are limited to the observation of vegetation, not yet lifting the existing resources as teaching materials. Materials of authentic studies are related to the social life, contextual and involve different disciplines in studying, for example, the environment, ecology, and biotechnology.
Ecological phenomenon, both in relationships between components of ecosystems and vegetation in the area of Gunung Api Purba Nglanggeran can be used as an authentic assessment for student. Besides having an interesting geology and geomorphology, since 2009 this region also has been set into ecotourism sites geoheritage. The importance of ecological phenomena research needs to be done because of all the interesting geologic history and determining the condition of vegetation due to the impact of ecotourism. If the issue is studied as a learning resource, for sure it will explore the potential of scientific literacy of students, because to solve various problems of ecological phenomenon it is needed the community who has the literacy skill. Community who has literacy skill has the ability to use scientific knowledge, to identify questions and draw conclusions based on the evidences, in order to understand and make decisions regarding the nature and changes made to nature through human activity.

Raising the ecology issue of regional Gunung Api Purba, is expected in addition to improve the ability of literacy also able to increase students’ awareness to environmental concerns. Students are responsive and sensitive to the problems that exist around them would have a value of usefulness to the environment. Explicitly every school should support the creation of human resources who stance the noble ethical so that instilling caring attitude to the environment as a part of the noble ethics should be implemented in schools. This is in line with the purpose of learning science namely participate in preserving, maintaining and preserving nature. Human behavior can be shaped or educated through education so that the positive character in the form of consciousness, sensitivity will appear on students.

The international literature shows that geoheritage, focused on geology and geomorphology, globally, is now important for local culture reason, natural resource management, land management, research, education, and tourism [1]. Given the needs analysis taking into account the resources of learners by considering students’ learning sources therefore the preparation of instructional media by lifting geoheritage management in Gunung Api Purba Nglanggeran regarded as an appropriate solution. Media Learning developed a module, the selection of this module will provide ease and great opportunities for learners to access globally.

II. METHODS

The development model used in the present study was adapted from the model of the development of the results of the adaption of both model produce measures to: (a) identify learning needs, (b) identify the characteristic of students, (c) identify the general purpose if learning, (d) conduct an analysis of learning, (e) formulate specific goals, (f) develop tests, (g) develop learning strategies, (h) develop and select instructional materials in the form modules, (i) develop and implement evaluation, and (j) to revisie the module [2].

The implementation procedures of the Research Methodology module were done through the following steps: (a) identifying learning needs as an attempt to locate and describing needs for a module on Research Methodology with science, environment, technology, and society (SETS) approach. To collect data, a questionnaire was used to identify the needs adn there were two kinds, namely a questionnaire for student and a questionnaire for teacher; (b) identifying the characteristics of student, the knowledge and skills of the students will be assessed before participating in learning activities with module that will be developed; (c) identifying the general objectives derived from the list of objective in the curriculum, the results of a literature review; (d) analyzing general formulation of learning objective and a review of the literature; (e) formulating specific goals in a form of special or specific statements of what students will be able to do when completing the specific learning; (f) developing the design and planning of learning strategies including measures of learning strategies; (g) developing a research methodology module prototype with constructive learning strategies. Development is done on the basic of the previous steps, namely the identification of needs, identification of student characteristics, formulation of common goals, learning analysis, the formulation of specific objectives, results and current development plan developed learning strategies, and a review of the literature. This development result in the form of an outline of the content of the module that will be developed.
III. DISCUSSIONS

1. Region Gunung Api Purba Nglanggeran Geoheritage

Geoheritage include landscaping and other geomorphological features that describe the effects of this time, the effects of the past and the formation of the Earth [1]. GAP Nglanggeran Geoheritage region is one area that has geological features and landscaping or landscape that is formed naturally. Management of this area is focused on ecotourism.

Ecotourism is a tourism concept that collaborate recreation, education, nature conservation and socio-cultural integration. Management is not only exploring the natural beauty, but also encouraging the preservation of cultural (local wisdom). Ecotourism concept also emphasizes community participation as one of the important part that the tourism activities can bring economic benefits for the local population. This is also done in GAP Nglanggeran, management involving local residents as responsible. Pemuda Karang Taruna Bukit Mandiri is the pioneer of tourism activities based environment then this time it is called Tourism Awareness Group (Kelompok Sadar Wisata/Pokdarwis) Nglanggeran. The concept of ecotourism in Nglanggeran supports the principles of sustainable tourism, or tourism that supports a sustainable nature conservation efforts, the social culture by utilizing local potential.

Gunung Api Purba Nglanggeran has a height of 200-700 meters above sea level. The appearance of hills Nglanggeran is a result of the process of an Gunung Api Purba Oligocene age (more than 42 million years ago) in the form volcanic neck and dike shaped boulders of old andesite breccia. In geomorphological, the top of the Gunung Api Purba Nglanggeran has five peaks, namely Gunung Kelir, Gedhe, Bongos, Blencong, and Buchu; four springs, they are Sumber Comberan, Telaga Wungu, Mardhidho, and Talang Kencono. Natural phenomenon with a variety of biological and ecological potential which is large enough, is the reason for a variety of habitats able to survive in this place.

Various types of habitat encountered are probable that the development of the vegetation and fauna are identical. Region Peman Gadhung is a dwelling ape habitat, snakes and bats. Some species of orchids in Nglanggeran is a terrestrial orchid, among others species Calanthesp, Spathoglottisplicata, Pecteilissussanane this orchid is obscured by the presence of plants around, even few visitors or the manager can recognize them. Some types of epiphytic orchids and litofit also found in this area, with many and scattered in several locations. Epiphytic orchids and litofit more easily observed because the existence stuck on rocks and tree trunks. Epiphytic orchids found in Nglanggeran ranging from cosmopolitan species that Crumenatum Dendrobium (Anggrek merpatti), Coeloeugyne, Pholidota etc.

Gunung Api Purba landscape that is unique with different types of vegetation and fauna in is the reason it is named by UNESCO to be one of the Geopark. However, this ecotourism is also facing a big challenge in terms of environmental management. It is not impossible if insufficient environmental management and exploration panorama excessive, will cause hue ecotourism end up the same as the sights elsewhere.

Indications ecotourism GunungApiPurbaNglanggeran potentially threatening the survival seen from a number of support facilities along the hiking trail. Development of postal services as well as some stairs resting climbers have eliminated a number of biodiversity habitats. One is spesies orchid lost its host trees and orchids living along the hiking trail. Without knowing the biodiversity potential, the principle of conservation-based tourism development is also threatened neglected. This is unfortunate because besides a beautiful panorama, this region is a natural laboratory with high diversity.

Environmental management efforts in the area of Gunung Api Purba Nglanggeran can be done with various instruments, including through social culture while maintaining local wisdom (local wisdom). Other effort that can be done is through education, research to explore the biological diversity needs to be improved. Inventory and identification of biodiversity are needed to guide the development of ecotourism in order not to cause environmental damage. Information about the habitat is also useful for managing ecotourism to determine the ideal location of the opening of the hiking trail and determine which areas to visit and should not be visited. Without decreasing the functions of the available facilities, management potential ecotourism also requires an awareness of the environmental carrying capacity. Orientation to bring tourists and generate
The maximum retribution must be accompanied by attention to aspects of environmental management in order to ensure the sustainability of the available resources.

Lack of knowledge managers and the public on biodiversity and its value may make the species vegetation and fauna more threatened because their habitat is damaged by tourism development. Ensuring the preservation of biodiversity and habitat becomes special attention to the conservation-based ecotourism. Some of the steps that have been carried out by operators of ecotourism GAP Nglanggeran in order to remain sustainable is cooperating Islamic State University Sunan Kalijaga (UIN Sunan Kalijago). The existence of educational institutions play an active role in assisting and supervising the management of ecotourism in order to keep attention to the aspects of the natural balance, so that the principle of sustainable living still ensure sustainability in the future.

2. Integrated Module
Science and technology development is directly proportional to the rapid advancement of science education into formal knowledge pioneer in the school environment. While in the traditional society, knowledge is preserved in the original form of local customs and delivered from generation to generation about the wise attitude to treat nature. These forms of knowledge are not facilitated in the formal curriculum. For example, the public has a strategy to preserve the springs with making some sacred places.

Environment, both physical and socio-cultural contribute to the children's learning experience [3]. The learning experience includes three domains, among others, the cognitive, affective and psychomotor. Furthermore, Baker et al., (1995) students have an understanding of science concepts as diverse as a result of social factors, particularly students' initial conceptions (preconception) and preferences (predestination). Generally science is introduced in schools do not pay attention to the culture of children, the consequences students will have difficulty in understanding some of the concepts. If the development of science in schools is harmony with the everyday culture of students, the teaching of science will contribute significantly to the students' scientific thinking in understanding the phenomena of the universe [4]. But if science which is taught is different from the everyday culture of the students, the teaching of science will have a tendency to separate the students' from native cultures. The result is the assimilation which has a negative connotation, students tend to reject key aspects of his own culture and separation of students of traditional culture. For cases in Indonesia, especially in Yogyakarta, it can be seen from the increasing number of damaged natural environments such as mining quarrying C, destruction of ecosystems Goa Pindul, the least of forests due to excessive exploration as induced the people themselves.

Before children learn science at school, the child has his own idea about natural phenomena, which are formed through informal learning from everyday experience (preconceptions). Conception of science students is different from the science to the scientists, who tend to be complex, while the student's preconceptions is simple, appears based mindset common sense in dealing with problems that are often encountered. Based on the chart in picture 1 shows that the science exists in a variety of life such as ecology, botany, obtained through observation, questioning, classification, inferring, predicting, problem solving, and so forth. This knowledge hand in hand with local knowledge (traditional wisdom) that contains the values of caring, ethics, and spirituality.

Once students become acquainted with the school environment, gradually will know the original science (socio-cultural science). Science is the study of indigenous knowledge systems developed from the perspective of the local culture with respect to the objects and activities associated with natural phenomena. The original science also has processes such as observation, classification, inferring, predicting, problem solving, and so forth. This knowledge hand in hand with local knowledge (traditional wisdom) that contains the values of caring, ethics, and spirituality.

Therefore, in the learning of science, especially biology in schools, it is needed for bridging the gap so that occurs harmony between the cultural heritage with cultural values of science in schools. Thus, the local knowledge of the students in traditional societies do not simply disappear with the arrival of the growing...
influence of science and technology, but can be run in parallel and potentially even strengthen a culture that has been embedded.

Based on these descriptions, integrated module becomes one solution to bridge the knowledge students gained in school with the knowledge that already exists in the local society. Integrated module is a module that is packed with all the attention to diversity as well as local wisdom. The module is designed systematically and facilitate students to be independent and achieve learning objectives. Integrated module is expected to enhance students' understanding of the topic in depth contextual.

3. Science Literacy and Caring Attitude to the Environment

Diversity in the types of vegetation and fauna in GAP Nglanggeran is a natural laboratory that is a source of contextual learning, but its utility as a source of learning is not maximize. If this potential is assessed, the course will explore the potential of scientific literacy of students, because to solve various problems of ecological phenomenon it is needed the community who has the literacy skill.

As students who live at the level of global society, students are expected to be able to answer the problems that become an issue of environmental problems such as: whether the potential impacts of ecotourism management Gunung Api Purba Nglanggeran, whether ecotourism management contributed to the destruction of the diversity of natural resources? how to deal with conservation-based ecotourism management? how to contribute to the ongoing environmental balance in ecotourism Gunung Api Purba Nglanggeran, In order to answer such questions, it is necessary that students have an understanding of scientific ideas, intellectual ability, creativity, reasoning and also have concern for issues and problems that occur in nature so that they can preserve the environment, health, and can make decisions about social policy for yourself and the global community. Hope this will be achieved if students are trained to have scientific literacy. Therefore, scientific literacy more necessary today so that we can live in the midst of modern society. Raising the issue of local as well as wisdom, is expected in addition to improve the ability of science literacy also able to increase students' awareness towards environmental care attitude. Students are responsive and sensitive to the problems that exist around them would have a value of usefulness to the environment. Explicitly every school should support the creation of human resources so that the noble ethical stance instilling caring attitude to environment as a part of the noble ethics should be implemented in schools. The attitude of care for the environment can be interpreted as efforts to preserve, prevent and improve the natural environment. This is in line with the purpose of learning science, namely, participate in preserving, maintaining and preserving nature. Human behavior can be shaped or educated through education so that the positive character in the form of consciousness, sensitivity will appear on students.

IV. CONCLUSIONS

Based on the description above, we can conclude several things: (a) potential diversity of natural resources in the area ecotourism Gunung Api Purba Nglanggeran still require special attention in the inventory diversity. The diversity of this potential can be lifted into a contextual learning resources, (b) the science introduced to students should be bridging their knowledge at school and knowledge they obtained in the community, it is necessary in order to be bridging gap effort and make a harmony between cultural heritage with cultural science at school, (c) this integrated module into one of the alternatives to bridge the knowledge students gained in school with the knowledge that already exists in the local society, (d) the ability of science literacy and environmental awareness attitude needs to be invested as a first step to prepare students in the development of the global order.

REFERENCES


CREATIVE THINKING PROCESS CAPABILITY STUDENT IN PHYSICS PROBLEM SOLVING

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Abstract-- The ability to think creatively is a very important part of success in solving the problem. In realizing the ability to think creatively to solve problems must be supported by the stage of the creative thinking process. This study aims to obtain a description of the process of creative thinking of students in solving physics problems. This research is descriptive qualitative and in-depth interviews to determine the ability of students in creative thinking process. The subjects are the physics students and public in the Universities of Surabaya. The results showed that the creative thinking processes of students at the stage of preparation, incubation and illumination is good.

Keywords: Problem Solving, Preparation, Incubation, Illumination

I. INTRODUCTION

The ability of creative thinking and problem solving skills are very important to him field activities that the government always gives considerable attention in the field of education. It can be seen in the efforts of policy-making in the field of education to include both of these components either loaded in the curriculum, instructional strategies and other learning tools. The effort is meant in order that any educational activity or learning, the students can be trained for skills to develop creative and problem-solving abilities. Thus the world of education will make a major contribution in developing human resources creative and have the ability to solve problems of daily life is full of challenges.

But in reality the creative thinking ability of students in solving physics problems are lacking. This happens because the students have not been able to understand the steps creative thinking process. One means to develop creative thinking skills and problem solving for students in education is through learning physics in mechanics courses. In this case it can be argued that the process of learning physics, students obtain explicit exercise creative thinking in solving physics problems.

II. THEORETICAL BASIC

Thinking is a mental activity that involves the brain. Brain function and the condition of the human brain has a chance which also adds to one's way of thinking. Thinking also means toil mentally to understand something experienced or looking for a way out of the problems being faced. In a simple thinking is a mental process information or cognitively. Here are some expert opinions about thinking:

1. Ref. [1] thought is high level mental ability that can only be achieved and is owned by the individual human being.
2. Ref. [2] that thinking is an activity manipulate and transform information in memory to form concepts, reasoning, critical thinking make decisions, think creatively and solve problems.

The process of creative thinking is a process that combines the logical thinking and divergent thinking. Divergent thinking is used for ideas to solve the problem whereas logical thinking is used to verify those ideas into a creative solution. To know the process of creative thinking of students, the guidelines used were creative thought processes developed by [4][5][6]. the creative thinking process includes the preparation, incubation, illumination, and verification. Creative thought processes based on these stages when associated with troubleshooting is as follows:
In the first stage students prepare themselves as the problem, understand the problem, synthesize ideas and build ideas to solve the problem by collecting relevant data, and find the solution approach.

In the second stage, the students seemed to break away temporarily from the problem. This stage is important as the early onset of inspiration process which is starting point of an invention or new creations from local pre-conscious. In the third stage, one obtains a problem solving followed by the emergence of inspiration and ideas that initiate and follow the emergence of inspiration and new ideas. In the last stage is the stage of a person's test and check the troubleshooting of reality. Here the necessary critical thinking and convergent. In the verification stage of this person after doing creative thinking it must be followed by critical thinking. In this study, researchers wanted to see how the pace of preparation of students in solving physics problems, see how the measures taken by the students at the incubation stage, and stage illumination.

III. SOLUTION TO PROBLEM

In real life many problems that require physics to solve. Recognizing the important role of physics in solving everyday problems, students need to be taught problem solving. Ref. [7] defines the problem solving is a way that a person using the knowledge, skills and understanding to meet the demands of the situation are not routine.

Ref. [8] explains that solving the problem is an attempt to find a way out of a difficulty to achieve a goal that is not immediately achievable. Solve the problem can be seen as a process that asks students to find a combination of rules that have been learned in advance is used to solve the new problem.

Based on the above it can be concluded that solving the problem is a person's efforts to resolve the problem by using the knowledge, skills and understanding he had.

IV. RESEARCH METHODS

Based on the purpose of the study is to determine the ability of students creative thinking process in solving physics problems, then this type of research is qualitative research. Qualitative research is research that research procedures produce descriptive data in the form of words written or spoken can be observed. This research was conducted at the Faculty of Science, Department of Physics at the State University of Surabaya. The subjects chosen are students of physics first semester of the school year 2014/2015.

The study design is a description of the implementation of the research consists of the research steps that consists of three main stages, namely pre-court stage, the stage of field work and analysis phase. Source of data obtained from the results of observation, testing, and interviews. In this study, the researchers conducted an analysis of data during activities field in data analysis, namely:

1. Data Reduction. Data reduction means summarizing, choose things that are fundamental, focusing on things that are important. Thus the reduced data will provide a clearer picture and facilitate researchers to conduct further data collection, and look for it when necessary.

2. Presentation of data. Once the data is reduced, then the next step is to present the data. Presentation of data is done in the form of brief descriptions, charts, connections between categories.

3. Verification or Conclusion. Preliminary conclusion expressed still provisional and will change when supported by evidence that is valid and consistent when researchers returned the spaciousness of the collected data, the conclusions are credible conclusion.

V. RESULTS AND DISCUSSION

Analysis of process capability of creative thinking of students at the stage of preparation is very good because to solve physics problems, students prepare themselves by reading, understanding and learn the secrets of matter and thought what strategies will be used in solving the problem. For example, when given a problem of mechanics through example problems, the student is able to understand the content of the material first before going on stage to do it.

The process of creative thinking of students at the incubation stage analysis result is good because in solving the problems of physics students unhurried doing physics problems, but still trying to find a solution in solving physics problems by linking the material that had met with the material now facing either never
learned or are based on the experiences of everyday life. In this incubation period when they encounter difficulties in solving the problem, the students stop thinking activities and distracts khal others. In this incubation period when they encounter difficulties in solving the problem, the students stop thinking activities and distracts khal others. Eg play pen, scribbling on paper, Out of the classroom, till they found the idea pa to be used in solving the problem. Based on interviews with students, all done it unconsciously and just happens.

The thought process at the stage of illumination based on the results of the analysis is good because after going through the incubation stage or stages khal distract the others, suddenly came the idea to solve the problem or what strategies will be used to solve a problem. For example in a matter of mechanics.

Students asked about the progress in solving some equations using the equations of Newton's laws, Lagrange and Hamiltonian. So the first thing to do is to determine the equation of Newton's laws, Lagrange and Hamiltonian. Through research on the thought process stage illumination, the students were able to write 3 equations. Thus at this stage of illumination is good because students are able to find ideas in solving problems.

VI. CONCLUSION AND RECOMMENDATIONS

Based on the results of research and discussion can be concluded as follows:

1. The ability of creative thinking processes of students at the preparatory stage in solving physics problems is very good. Because it is able to understand the given problem and is able to associate the material ever studied. At this stage of the process of creative thinking for the incubation period results have been good because at this stage the student is not in a hurry to do the problems but distract khal others. Until it finds a way to solve physics problems.

2. The ability of creative thought processes in the illumination stage the result is good because it has been able to find a solution or how to solve a problem or have found the idea of solving the problem.

VII. SUGGESTION

The ability of students creative thinking process has been good for preparation, incubation and illumination, but to the verification stage has not been implemented. For that we need further research to the next stage in the class with mathematics physics, materials, and thermodynamics. So that in the future we better understand how the process of creative thinking of students to make it easier for us to carry out the task of teaching the class.

REFERENCES

VALIDITY LEARNING TOOL THAT USING LEARNING MODEL PRIMA TO TRAIN HIGHER-ORDER THINKING SKILLS AND OPTIMIZING CONTROL CONCEPTS BIOLOGY STUDENT

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Abstract—Research aims to train thinking skills and to optimize mastery of concepts students are, is a Developmental Research that are widely used to solve practical problems in education which includes three stages: a preliminary study, the development and validation of learning tools, as well as the testing and implementation learning tool. In this section are reported the results of validation of learning tools are developed, the learning device that uses a project-oriented learning model based on research and problem solving. Validator provides an assessment of the learning device that was developed using the assessment form by giving a score and comment/suggestions/corrective. Based on the average ratings validator produces a mean score of 82.5 or 93.7% (very valid) from the ideal score (ideal score = 88) for SAP, 39.2 or 98% (very valid) from the ideal score (ideal score = 40) for the work paper, as well as the decision of "Decent used" in learning to assessment activity observation sheet, thinking skills, and mastery of concepts students test questions, the lecture using model PRIMA.

Keywords: PRIMA Learning Model, Learning Tool, Higher-Order Thinking Skills, Mastery of Concepts

I. INTRODUCTION

Facing the trend of change in the 21st century, we are required to afford higher-level thinking. Relation to the matters, in learning, learners should be taught to think critically, getting used to reconstruct knowledge and the skills they have with the various tendencies in the society. Thinking skills is not automatic skills possessed by humans but rather a skill that must be built, developed and trained to be while in school. That is why any attempt at innovation in learning should be directed to the establishment, development and training of thinking skills, besides aimed at achievement of learning objectives according to the demands of the school curriculum. Reference [1] suggests "Creative and critical thinking skills are Considered essential for students". All this has many kinds of learning innovations that have been implemented and developed.

Based on preliminary studies conducted in subjects genetics 1, student results are still limited understanding of the concept, and the acquisition of student learning outcomes in 2011, 2012 and 2013, which are divided into three classes, with the number of students for each class as much as 35-40 people, showed 25% received grades A and B, 60% obtained a grade of C, and 15% received grades D and E. Furthermore, the need assessment on 30 votes biology student in Gorontalo State University who has not been genetically programmed course, but already graduated in general biology courses, and 20 students of biology who has programmed the course of genetics, sampled, to determine the high-level thinking skills, showed that 80% of students have not been able to think critically and creatively.

Low acquisition of learning outcomes are limited to the understanding of concepts, critical thinking skills and creative, an indication the low performance of student learning. Those problems are expected with regard
to the strategy of lectures conducted by lecturers. [2] suggests that the strategy of the course is very influential on interest, and motivation of students to the subject.

Based on the above it is developing an instructional model that is oriented toward project-based learning, who use the issue as a first step in integrating new knowledge, and conduct scientific performance in the form of collaborative research, making students able to cope with the demands of 21st century life that requires human resources that have the expertise, capable of critical thinking, creative and productive, able to solve the problem, can take the initiative, have the ability to communicate with others, and be able to apply the concepts they have learned on the situation/new knowledge, and in everyday life.

Several studies have been conducted to report that the implementation of project-based learning can improve the quality of learners, enhance learning motivation and confidence, as well as the creativity of learners, improve the ability to develop ideas, skills, and work in groups [3], [4], [5], [6], [7], [8], [9].

Development of learning tools that use the model PRIMA, is intended to make students able to understand the concepts are abstract; Mastering the concepts learned; Applying the concepts learned in the situation and new knowledge as well as in everyday life; To train high-level thinking skills (critical and creative); Conduct scientific performance in the form of research; Improve communication skills; Improve the ability to solve problems. Before it is implemented, these learning tools are developed, first in value by experts in their field. [10] suggests that a learning device that is developed, it should be valid criteria, based on expert judgment.

II. RESEARCH METHODS

This study is a developmental research, which is a type of research that is widely used to solve practical problems in education, which refers to the development of the proposed research model [11], and has been modified by [12], which includes three stages: preliminary studies, model development and validation of models, as well as the testing and implementation models.

Learning model developed using four traits learning model as proposed by [2] consisting of: 1) The theoretical foundation prepared by the developer, 2) learning objectives to be achieved, 3) behavior teach that the model can be implemented, 4) learning environment necessary for learning objectives can be achieved.

Data were collected using a sheet of validity of the learning model developed, analyzed using the criteria set forth Lawshe as quoted [13], where 4 out of 5 people expert, has given a final conclusion with the statement fit for use (DU), a decent used to repair (DLP), or with a minimum eligibility of 0.60 using the formula content validity ratio (CVR).

\[
CVR = \frac{N_e - (N/2)}{N/2}
\]

Information:
CVR = Ratio feasibility of contents
Ne = The number of experts who demonstrate the feasibility of the model
N = Total number of panelists

The assessment by the validator done through meetings and discussions on the draft model of learning developed. It aims to obtain feedback and confirmation of suggestions/improvements of the validator, for the improvement of the draft model of learning. The results of these improvements further consulted back for approval. The criteria to declare that the learning model used is valid (fit for use) shown in Table 1.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.00% - 36.00%</td>
<td>Invalid (TV)</td>
</tr>
</tbody>
</table>
III. RESULTS AND DISCUSSION

To determine the feasibility of a learning model developed, done by counting the number of the scores given by the five validator for every aspect assessed, calculate the percentage of achievement score of the ideal score (maximum score) for each aspect assessed, calculate the average percentage of achievement score of five people validator, then interprets the data using the percentage based on the interpretation of achievement eligibility criteria.

The assessment by the validator done through meetings and discussions about learning model draft developed. It aims to obtain feedback and confirmation of suggestions/improvements of the validator, for the improvement of the draft model of learning. The results of these improvements further consulted back for approval. The results of the expert assessment of the learning tools developed are listed in Table 2, Table 3, Table 4, Table 5 and Table 6.

<table>
<thead>
<tr>
<th>Number</th>
<th>LKM Rated</th>
<th>Rate of Validator</th>
<th>Average</th>
<th>Percentage of Achievement</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I  II III IV V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>I</td>
<td>84 83 80 84 78</td>
<td>81.8</td>
<td>93%</td>
<td>SV</td>
</tr>
<tr>
<td>2</td>
<td>II</td>
<td>84 87 80 84 78</td>
<td>82.6</td>
<td>93.9%</td>
<td>SV</td>
</tr>
<tr>
<td>3</td>
<td>III</td>
<td>84 87 80 84 80</td>
<td>83.5</td>
<td>94.3%</td>
<td>SV</td>
</tr>
<tr>
<td>Amount</td>
<td></td>
<td>84 86 80 84 79</td>
<td>82.5</td>
<td>93.7%</td>
<td></td>
</tr>
</tbody>
</table>

The results of the expert assessment of the Events Unit Class (SAP) which uses a learning model PRIMA on Mendelisme material, Multiple alleles in the Blood, and Gender Links, as listed in Table 2, showed that the design of learning described in SAP in accordance with the PRIMA study model developed, so “Decent Used” in learning, by taking into account the advice and has been fixed for improvement. Comments and suggestions for improvement given by the validator does not change the substance of SAP that uses PRIMA learning model.

<table>
<thead>
<tr>
<th>Number</th>
<th>LKM Rated</th>
<th>Rate of Validator</th>
<th>Average</th>
<th>Percentage of Achievement</th>
<th>Information</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I  II III IV V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>I</td>
<td>37 40 40 40 40</td>
<td>40.6</td>
<td>98%</td>
<td>SV</td>
</tr>
<tr>
<td>2</td>
<td>II</td>
<td>37 40 40 40 40</td>
<td>40.6</td>
<td>98%</td>
<td>SV</td>
</tr>
<tr>
<td>3</td>
<td>III</td>
<td>37 40 40 40 40</td>
<td>40.6</td>
<td>98%</td>
<td>SV</td>
</tr>
<tr>
<td>Amount</td>
<td></td>
<td>37 40 40 40 40</td>
<td>40.6</td>
<td>98%</td>
<td></td>
</tr>
</tbody>
</table>

The results of the expert assessment of the Activity Sheet Students (LKM) which uses a learning model PRIMA on Mendelisme material, Multiple alleles in the Blood, and Gender Links, as listed in Table 2, showed that the design of learning described in LKM in accordance with the PRIMA study model developed, so “Decent Used” in learning, by taking into account the advice and has been fixed for improvement. Comments and suggestions for improvement given by the validator does not change the substance of LKM that uses PRIMA learning model.

<table>
<thead>
<tr>
<th>Validator</th>
<th>Grating Tests</th>
<th>Decision</th>
<th>Comment/Suggestion/Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1</td>
<td>DU</td>
<td>1. Perform a review of the key answers incomplete.</td>
</tr>
</tbody>
</table>

The following table summarizes the results of the expert assessment of the Mastery Test Problem Concepts in Learning Using Learning Model PRIMA.

The results of the expert assessment of the concept mastery test questions are listed on the grille tests, as listed in Table 4. This assessment is done by selecting the alternative answer is not good, not good, good, and excellent, visible validator fifth gave the verdict “Decent Used” in learning. Some comments and suggestions about the tests and their associated answer keys has been fixed for improvement. Comments and suggestions for improvement given by the validator does not change the substance of the matter mastery of concepts students after learning using learning model PRIMA.

TABLE 5. EXPERT ASSESSMENT AGAINST OBSERVATION SHEET STUDENTS ON THE CRITICAL THINKING SKILLS LEARNING USING LEARNING MODEL PRIMA

<table>
<thead>
<tr>
<th>VALIDATOR</th>
<th>DECISION</th>
<th>COMMENTAR/SUGGESTION/IMPROVEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>DU</td>
<td>Use during the learning process.</td>
</tr>
<tr>
<td>II</td>
<td>DU</td>
<td>1. Fix the instructions for use.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Should be used during the learning process</td>
</tr>
<tr>
<td>III</td>
<td>DU</td>
<td>Fix a few sentences on responses to questions / problems</td>
</tr>
<tr>
<td>IV</td>
<td>DU</td>
<td>There was a meeting with analysts.</td>
</tr>
<tr>
<td>V</td>
<td>DU</td>
<td>There was a meeting with analysts.</td>
</tr>
</tbody>
</table>

The results of expert assessment of the observation sheet creative thinking skills of students in Table 5. Rate overall validity by the fifth validate the observation sheet of students' critical thinking skills in learning by using model PRIMA is "Decent Used", taking into account the advice and has been fixed for improvement.

TABLE 6. EXPERT ASSESSMENT AGAINST OBSERVATION SHEET STUDENTS ON THE CRITICAL THINKING SKILLS LEARNING USING LEARNING MODEL PRIMA

<table>
<thead>
<tr>
<th>VALIDATOR</th>
<th>DECISION</th>
<th>COMMENTAR/SUGGESTION/IMPROVEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>DU</td>
<td>Use during the learning process.</td>
</tr>
<tr>
<td>II</td>
<td>DU</td>
<td>1. Fix the instructions for use.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Should be used during the learning process</td>
</tr>
<tr>
<td>III</td>
<td>DU</td>
<td>Fix a few sentences on responses to questions / problems</td>
</tr>
<tr>
<td>IV</td>
<td>DU</td>
<td>There was a meeting with analysts.</td>
</tr>
<tr>
<td>V</td>
<td>DU</td>
<td>There was a meeting with analysts.</td>
</tr>
</tbody>
</table>

The results of the expert assessment of the observation sheet creative thinking skills of students in Table 6. Rate overall validity by the fifth validate the observation sheet of students' critical thinking skills in learning by using model PRIMA is "Decent Used", taking into account the advice and has been fixed for improvement.

IV. CONCLUSION AND SUGGESTIONS

Based on the assessment conducted by five (5) people validator, it has been decided that the learning device that uses a learning model PRIMA "Decent Used" in learning, and can provide opportunities for educators to be able to apply them in learning.

A good learning devices should meet the eligibility requirements, practicality, and effectiveness. It required further research to be able to see the practicality and effectiveness of the learning model PRIMA.

REFERENCES


MONITORING CARD TO EXERCISE SELF ASSESSMENT SKILL FOR STUDENTS

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Abstract—The aims of this research were producing a valid monitoring card and applying monitoring card to exercise self assessment skill for students. The subjects were student of Mathematics Education Department on STKIP Bina Insan Mandiri selected by random sampling. This research was developing used 4D model with data collecting technique used tests and observation. Data was analyzed by descriptive qualitative. The result of this research: 1) the validation scores were in the range 71.00 - 85.00 with a valid category, 2) the score of the students on cognitive, affective, and psychomotor has been increased. Based on those findings, it could be concluded that the monitoring card can be used to exercise self assessment skill for students.

Keywords: Monitoring Card, Self Assessment

I. INTRODUCTION

Assessment is one of the important things in learning process. Bransford, Brown, and Cocking stated that assessment is one of the effective learning component because it can monitor the process, progress, and improve of students learning [1]. Continuous assessment can help teachers determine the level of students abilities so that they can design a learning model that suitable with their characters. But as a paradigm changing in education, which emphasizes student centered learning, assessment process still use teacher center learning. Students have not been trusted to do an assessment for their performance. From the observation from five PTS in Surabaya, only 1 PTS ever apply self assessment to their students. It caused several things such as the ability of the students who has considered less in assessment. Besides that, unavailable of assessment rubric that used as a guide for students in assessing their performance as a cause. Even though self assessment based on the research by Farisi concluded that Self Assessment Students (ADS) has generally shown effective results to develop of character in a variety of contexts, fields of study, institutions, countries, and levels of education [2]. Moreover, it supported by intensive practical exercises, an adequate understanding of the criteria, internalization purpose, clarity of criteria, and the seriousness of students. In addition, research by Syahrul concluded that self assessment is a valid, effective, and practical assessment models, to assess the competence of vocational students in the learning process [3]. From those results it can be seen that self assessment skills need to be exercise to the student. With these skills can exercise students to be honest in assessing so can develop their high thinking skills. Besides that, this models make them more responsible for their learning progress and develop reflective thinking skills that are needed in the concept of longlife learning. Based on the above, we make a research to exercise self assessment skills for students using monitoring card. Monitoring card contains of many aspects that must be assessed by students about their performance. In each of that aspects are given an assessment rubric that clearly and measurable. It was expected that the result of self assessment from students suitable with their performance. The problems were taken in this research include: 1) How did the validation results of monitoring card to exercise self assessment skills for students?; 2) How did the application of monitoring card to exercise self assessment skills for students?
II. RESEARCH METHOD

This research is developing research to develop a monitoring card to exercise self assessment skills for students. The subjects were students of Mathematics Education Department on STKIP Bina Insan Mandiri. Research was conducted in the odd semester of 2015/2016 on the Basic Physics course with subject selected by random sampling. Development models used 4D model, which was developed by Thiagarajan, which includes define, design, develop, and disseminate [4]. Research design used One Shot Case Study Design with one class without comparison and without any preliminary tests. This research design is described as follows:

\[ X \rightarrow O_1 \]  

Information:
\( X = \) Learning activities by lecturers to students on the Physics matter  
\( O_1 = \) Tests given to students to obtain scores then the students assess themselves using monitoring card that developed by researchers

Data collecting technique by observation and tests. The results were analyzed descriptively qualitative.

III. RESULT AND DISCUSSION

1. Validation

Monitoring card validation performed by 3 experts on assessment used validation instrument that developed by researcher. The experts assess draft of monitoring card and its rubric. They also assess suitability between draft with learning steps and development theory of instrument. Then the scores converted using a Likert scale [6] and get the results as follows:

<table>
<thead>
<tr>
<th>Validators</th>
<th>Scores</th>
<th>Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expert 1</td>
<td>82</td>
<td>Valid</td>
</tr>
<tr>
<td>Expert 2</td>
<td>84</td>
<td>Valid</td>
</tr>
<tr>
<td>Expert 3</td>
<td>85</td>
<td>Valid</td>
</tr>
</tbody>
</table>

Based on the table were obtained score in the range of 71.00 - 85.00 with a valid category. This shows that three experts agree that monitoring card can be used to exercise self assessment skill for students. Matondang said that a valid measuring instrument indicates that tools can measure what is to be measured accurately [7]. It means, monitoring cards that have been declared valid to used by the experts can be used to exercise students self assessment skill. However, the scores given by expert on that scale means that monitoring card may be used with some revisions. Therefore, there are several components in rubrics that given feedback by experts to be repaired before being used in the classroom.

2. Implementation of Monitoring Card on Learning

After the subject matter was delivered to students and they were given a task to do, they assess their performance using monitoring card that developed by researchers. The results as follows:

Subjects I

![FIGURE 1. MONITORING CARD OF SUBJECT II](image-url)
Based on the results of card monitoring used at the first meeting, the cognitive domain on the subject I given score 67.5, in the second meeting scored 73, and the third meeting scored 87.5. This case shows that student self-assessment skills increase in the cognitive domain by 3.9% - 9%. While in the affective domain, we focus on the honesty and cooperative characters, at the first meeting to the third meeting there was an increase by 7% - 10%. This indicates that students have been able to assess themselves in the affective domain. As well as in the psychomotor domain. From three categories that observed such as the skill to use a spring balance, the skill to measure the length of the spring, and the skill to string of spring balance, subject I have an increase by 14% - 43% from the first meeting, second, and third. It is also an indication that the student has been able to assess themselves on psychomotor domain.

Subject II

Based on the results of card monitoring use on the subject II, the cognitive domain in the first, second, and third meeting gets scores of 68.5, 78.5, and 84. This indicates that students self-assessment skills increase on the cognitive domain by 6.8% - 3.4%. While in the affective domain to the character of honesty and cooperation, at the first until third meeting there was an increase by 14% - 16%. This indicates that the students have been able assess themselves in the affective domain. As well as in the psychomotor domain. From three categories that observed such as the skill to use a spring balance, the skill to measure the length of the spring, and the skill to string of spring balance, subject II have an increase by 14% - 50% from the first meeting, second, and third. It is also an indication that the student has been able to assess themselves on psychomotor.

Based on two examples above can be concluded that the students are able to assess their own performance using a monitoring card that developed by researchers. This is according with research of Kartono which concluded that the results of self assessment is very profitable for student, because it can be used to improve their learning process so that their learning outcomes can be optimized [8]. Students that assess their own performance can know their deficiencies in the learning process. Moreover, with skill of assess their performance, they can know the raw assessment standards. Therefore they can apply the strategies that need to do to repair it. Otaya mentions in his research that to improve the characters of honest in assessing of strengths and weaknesses learning is through self assessment [9]. So with other words that student self assessment skills can also exercise the characters of honesty. Honesty is one of the positive attitude that should be owned by the students. Honest to recognize the weaknesses in learning will increase student motivation to repair it. When motivation appear on students so the learning interest will grow and develop so that they will absorb the subject matter easily.
IV. CONCLUSION

From the research can obtain some conclusions as follows:
1. The results of validation monitoring card get scores in the range of 71.00 - 85.00 with valid category
2. The implementation of monitoring cards can be used to exercise self assessment skills for students in cognitive, affective, and psychomotor.

REFERENCES

STRENGTHENING THE VALUE OF CHARACTER THROUGH DISCIPLINE SCIENCE EDUCATION IN SMP NEGERI 1 BOYOLALI

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Abstract - This study aimed to describe the appreciation of the character through science education for students in SMP Negeri 1 Boyolali. This study is a qualitative research. Subject of research is the students of Class VII SMP N 1 Boyolali and the object of research is the character values of discipline. The data collection method that interview, observation and documentation. Data analysis techniques used interactive analysis technique consists of three steps: data reduction, data display, and conclusion. The results showed that the strengthening of the character discipline through education of science for students of SMP Negeri 1 Boyolali do science teachers during the learning process in class by way of the start and end of learning to pray, sing national songs before the learning begins, salute and shake hands with the teacher, collect homework given to students, warning students who violate school rules, warns students who do not bring textbooks IPA, reward and punishment to students, provide exemplary discipline, as well as being objective submarines a process ongoing learning. The conclusion that the strengthening of the code of discipline of students through science education can be planned carefully through learning activities to promote science subjects consistent with the various regulations in effect at the school. Besides strengthening can also be done with the exemplary attitude of the teacher during the learning process.

Keywords: Value Discipline Characters, Science Education

I. INTRODUCTION

Being a man of character is the target of the curriculum in 2013. Human characterized by Mursitho [1]: “explain a man who in daily life always showed attitudes, behaviors and actions are in accordance with the principles of values and norms of religion, morality, decency and the law.” Meanwhile, according to Afif [2] human character is that every human attitudes, behaviors and actions provide positive benefits both for himself and for others. Meanwhile Lena [3] asserts that human character is that every human attitudes, behaviors and actions always be an example to other humans. From some views, we can conclude that human's character targeted curriculum in 2013 is human attitudes, behaviors and actions are always beneficial for themselves and become role models for others because it is in line with religious norms, decency, morality and legal norms.

In education the character values according to Ministry of National Education includes a 18-character value, namely: 1) religious, 2) honest, 3) tolerance, 4) discipline, 5) work hard, 6) creative, 7) independent, 8) democratic, 9) curiosity know, 10) the spirit of nationalism, 11) love homeland, 12) appreciating achievements, 13) communicative, happy friends or proactive, 14) love peace, 15) likes to read, 16) care for the environment, 17) concerned social, and 18) responsibility. Achievements of each value is not only charged on one of the subjects but is charged on all subjects in an integrated manner. Therefore in every lesson every teacher should target the value of what will be achieved during the process and the end of the lesson.

The value of discipline that is part of the 18 values have an important role in the achievement of learning. As the research results Suyatno which concluded there was a positive relationship between discipline and academic achievement in these subjects at junior PPKN characterized by discipline children who tend to have good learning performance compare with children who lack discipline [4]. According to research from
Widodo which concluded that students who are disciplined in terms of learning achievement science everything turns out better than the students who lack discipline [5]. Based on these results, it can be concluded that the value of discipline character support achievement of learning outcomes.

The problem is the development of science and technology and art has shifted essence and existence value discipline character students. As the result of research Susi that the development of technology, especially information and communication technologies have a positive influence on the occurrence of a lack of student discipline in performing all activities including learning activities [6]. Likewise, the results of research Rubai which concluded that global developments had changed the pattern of student discipline that is internal discipline that discipline arising from within itself and discipline student [7].

namely external discipline should be imposed. Further Wasito concludes the internal disciplinary research however, should continue to be built and strengthened because it is through this discipline the students to do something in the thrust of the activities so as to provide a positive influence on what he does can be maximized [8].

Seeing that the urgency of the value of discipline, the problems in this study was formulated: how do the strengthening of science education discipline through junior high school students 1 Boyolali? In line with these formulations, the purpose of this study was to describe the appreciation of the discipline through education junior high school science students 1 Boyolali.

II. METHOD

This research is a qualitative study using a case study approach. Bogdan and Taylor explains that qualitative research is a research procedure that produces descriptive data in the form of speech or writing and behavior of the people being observed. A qualitative approach is expected to produce in-depth description of the speech, writing, or observable behavior of an individual, group, community, or certain organizations in a particular context setting that were examined from the standpoint of complete, comprehensive, and holistic. There are several characteristics of qualitative research, namely: 1) Using the natural environment as a source of data; 2) Have a descriptive and analytical nature; 3) Pressure on the process not the outcome; 4) Characteristically inductive; 5) Prioritize meaning.

There are several types of qualitative research; 1) Method of Ethnography; 2) Method of Phenomenology; 3 Case Study Methods; 4) Method of Basic Theory; 5) Methods of Critical Studies; 6) Method of Analysis Concepts and 7) Historical Analysis Method. Subjects in this study were teachers Sain and Seventh Grade Students of SMP Negeri 1 boyolali, while the research object is the character values discipline and science education. Data collection methods used were interviews, observation and documentation, while data analysis technique used is the technique of interactive analysis flow consists of three steps: data reduction, data display and data verification.

III. RESULTS AND DISCUSSION

Based on the findings of the field carried by the observation method can be described as follows: a lot of seventh grade students who lack discipline in life at school, this indicator is shown by: the delay students in follow learning, not completing the assignment of teachers, often students forget to bring a book lesson, the student does not return equipment to normal laboratory practice, students do not wear practice for various reasons, students are not appropriate in practice in the laboratory. Basing these results further research observations of teachers with a view to cross-check the causes of indiscipline students. The results of observations of teachers of science education can be described as follows: there is a teacher who does not timely in doing the learning, some teachers when laboratory practice not wear practice, the teacher did not do the billing to the task given by the students. Basing on the results of these observations there is a relationship between lack sambilan students with sambilan lack of teachers, which means that teachers become role models for their students or mirror, so when the teacher was not disciplined then the student will be affected. Results of research conducted by Suprapti Hariyani concluded that teachers who discipline in the learning process of committing a positive impact on the creation of discipline students anyway [9]. Also performed by Endang
which concluded that there is a positive relationship between the discipline of teachers to discipline students who support the achievement of learning outcomes are maximized [10].

The research focus is how to provide discipline through the strengthening of science education. The character value of this research, focused on discipline. Discipline is basically self-control in either comply with the rules made by themselves and outside themselves both families, educational institutions, community, nation or religion. Discipline also refers to the freedom of the individual not to rely on others to choose, make decisions, goals, change behavior, thoughts and emotions in accordance with certain principles of moral rules are adopted.

The term discipline has diverse meanings of which are self-regulating and monitoring, adjustment to the rules, obedience to command leadership, adjustment to the societal norms and others.

Discipline is a person compliance in following the rules or discipline driven by the awareness that there is in his heart. Discipline can be interpreted as an encouraging thing to have to do according to the rules that already exist. Discipline is an activity that is carried out in order to avoid a breach of any applicable regulations for the creation of a purpose. Discipline is the process or result of directives to achieve more effective actions. According Oteng Sutisna in creating effective discipline required activities such as the following: 1) Teachers and students should have the character traits the school community such good manners, language is good and right; 2) Students should be able to receive a reprimand or penalties fair; 3) Teachers and students should work together to build, maintain and improve the rules and norms.

A person with a healthy discipline characteristic is the person who can do psychosocial functioning in a variety of settings including: 1) Competence in academic, work and social relations; 2) The management of emotions and controlling impulsive behaviors; 3) Leadership; and 4) a positive self-esteem and self-identity.

Evolving discipline on individual behavior, the implications can be done so that intervention facilitated disciplined development process and can be reached maturity. The development of the discipline is influenced by the following points. 1) Parenting and control exercised by parents (adults) on behavior. Parenting parents influence how a child thinking, feeling and acting. Parents who from the beginning to teach and educate children to understand and comply with the rules will encourage children to obey the rules. On the other hand the child who never introduced to the rules would behave: 2) An understanding of self and motivation understanding of who, what they want themselves and what they can do by themselves so that life becomes more comfortable, enjoyable, healthy and successful make individual life planning and adhere to plans made; 3) social relationships and their effects on individual social relations with individuals and social institutions force individuals to understand social rules and make adjustments in order to be socially acceptable. If in a society growing net culture would be very uncomfortable when we make trash any and all people see us expresses some surprise and shows that the current behavior is wrong.

School is an institute which has the authority to make students learn to develop healthy behaviors, one of which is discipline. The process of education and learning that can be done in schools to develop the discipline of learners as follows. 1) Develop the mind and understanding and positive feelings about the students about the benefits of self-discipline for the development of self-developing skills (life skills) students to have discipline; 2) Develop students’ understanding and positive feelings about the rules and benefits comply with the rules in life; 3) Develop the student's ability to adjust themselves health; 4) Develop the student's ability to develop internal controls on behavior as the basis for disciplined behavior. 5) Being modeling and developing exemplary; And 6) Develop systems and mechanisms strengthening of positive and negative for the enforcement of discipline in schools.

The attitude of discipline is not the attitude that presented itself, so that a child can be disciplined hence the need for direction and guidance. In terms of instilling discipline in these children have objectives that are practical short-term goals and long term goals. The definition of short-term goal of discipline is to make children trained and controlled, by teaching them to other forms of appropriate behavior and inappropriate, or that is familiar to them.
While the long-term to the development of the discipline is self-control and self-direction (self-control and self-direction), namely: in the case where children can orient themselves without influence from external control. Self-control means mastering behavior yourself by referring to the clear norms, standards and rules that have become their own. Therefore, parents must be effectively and continuously strive to played a smaller role than the disciplinary work, with gradually to develop self-control and advise to their children.

Discipline will grow well if volition yourself, but if discipline is based not on their self-discipline then there will not grow inside the child. With the embedded discipline of the students will make them more active and creative in learning. With the discipline of learning for students will improve and increase the likelihood of students to be creative and excel. Therefore, when students have discipline in study time, then these students will be encouraged and motivated them to always learn and learn. With the discipline that have been applied and implanted will encourage success and success for the students themselves. Discipline is an orderly situation in which those who belong to a system subject to the existing rules. Self-discipline is obedience someone to a task or regulations that confronted him. Although sometimes people always feel a fundamental desires on him like laziness, sick and tired. So that self-discipline is usually referred to as “self-control (self-control).

**Table 1. Results Interview With 4 Science Teacher Education Associated With Perception Conception, And Applications Strengthening the Value Discipline Students Education Through Science**

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Do you understand the concept of science education?</td>
<td>4 Teachers answered yes we understand</td>
</tr>
<tr>
<td>2</td>
<td>If you understand whether the learning of science education can be integrated with character education</td>
<td>Of the four teachers, three teachers can answer while one teacher answered less know</td>
</tr>
<tr>
<td>3</td>
<td>If you can answer the values of any character that can be integrated in the learning of science education, while one teacher answered just a lot of character values</td>
<td>Of 3 teachers, 2 teachers answered no 18 character value that can be integrated in the learning of science education, while one teacher answered just a lot of character values</td>
</tr>
<tr>
<td>4</td>
<td>According to the value you get the discipline code is integrated into the teaching of science education</td>
<td>3 teachers from all answered can</td>
</tr>
<tr>
<td>5</td>
<td>How do I integrate learning the character values of discipline in science education</td>
<td>Of 3 teachers, 2 teachers answered the way done by giving examples of attitudes, behaviors and actions that reflect the values of discipline for example, come to teach on time, checking student, admonishing students who are undisciplined, charging a given job, taught according to the RPP made, set ordinance asks, ending lessons on time, when the practice in the laboratory practitioner must wear uniforms, lab obedient discipline, reward and punishment on students, while one teacher responded with examples of exemplary discipline teachers</td>
</tr>
<tr>
<td>6</td>
<td>Do you think it true that today there has been a decline in student discipline?</td>
<td>4 teachers all answered yes true</td>
</tr>
<tr>
<td>7</td>
<td>What factors do you think is the cause</td>
<td>Of the four teachers answered many factors, environmental factors that affect the family, school and community environment</td>
</tr>
<tr>
<td>8</td>
<td>According to your kin character values given discipline through strengthening science education</td>
<td>4 teachers answered strongly agree at all</td>
</tr>
<tr>
<td>9</td>
<td>How to strengthen the character values of discipline through science education</td>
<td>4 teachers answer can be given in two ways: through the study of science education in the classroom and through the practice of science education in the laboratory</td>
</tr>
<tr>
<td>10</td>
<td>Try to specify the elements anything that can be used to strengthen the character values through learning discipline of science education in the classroom as well as the practice of science education in the laboratory</td>
<td>3 teachers answered elements her in the implementation of education learning science in the classroom, among others: teachers come on time, teachers explain accordance with plan that has been made, teachers collect tasks that have been given the student, the teacher reprimanded the students who did not do the task, the teacher reprimanded the students who do not pay attention to the lesson, the teacher reprimanded the students who do not bring textbooks, teacher admonishing students not using uniform, whereas elements in the practice of the laboratory include: teacher reprimanded coming belated, the teacher reprimanded the students who do not wear a uniform practice, the teacher advised that obey order orderly lab, the teacher explains the steps practice, teachers begin and end the practice of precise time. While one teacher answered just a lot elements.</td>
</tr>
</tbody>
</table>
There are some tips that can help us in order to familiarize themselves into a disciplined person. For example: 1) Looking at every new opportunity as a new-life experience enjoyable. 2) Working on the task, the sooner the better, so it does not disturb the mind continuously. 3) Getting used to clean up what has been start. 4) Avoid stalling. Busy ourselves at work. 5) Trying to become professional foster self-confidence and confidence in our potential to enhance the task. 6) Avoid anxiety. 7) To prepare themselves for upcoming assignments. 8) Ask for help or ask the experts, if we can not strive after. 9) Take measured risks in order to progress. 10) Frequently asked. And 11) Planning for the future, while still facing today.

Habituation character at school can also be done by all teachers in all subject areas including science education. Through science education can to strengthen the value of the character. So how to strengthen discipline value characters performed by Teachers of science education in SMP Negeri 1 Boyolali.

The results of the interview the researchers did in July 2016 against four teachers of science education in SMP Negeri 1 Boyolali description in Table 1.

Based on the results of these interviews, the description are:
- In terms of the perception of the concept of science education as a means of strengthening the character values of discipline, general education teachers have understood but not maximized. The heterogeneity of the answers given assumes that each teacher has a different conception perception about the conception of science education as a means of strengthening the student discipline code.
- Likewise in the case of application of science education as a means of strengthening the character discipline obtained answers variations. It can interpreted to mean that all teachers have a different perception in applying education science as a means of strengthening the student's character.

On the basis of these explanations, it can be affirmed that science education teacher at SMP Negeri 1 Boyolali have a different perception in terms of understanding the conception and application of science education learning implementation as a means of strengthening the discipline code students VII in junior high school class 1 Boyolali. Therefore in order to strengthen the character of the student discipline, the science education teachers need to do a joint discussion to identify perceptions conception of science education.

IV. CONCLUSION

Based on the discussion on the above results, the study concludes that: strengthening the character of discipline made through science education can be done in two ways: teaching in class and when the laboratory practice, to be punctual when starting and ending their science lessons, explaining teaching materials according to the design that has been made, the roll student, asking students who do not enter, collect student work that has been commissioned, admonishing students do not pay attention, admonishing students who are not in uniform and did not pay attention to the teacher. Treatment of teachers applies to all students without exception.

REFERENCES

RELATIONSHIP BETWEEN SOCIO-ECONOMIC STATUS AND MOTIVATION WITH STUDY ACHIEVEMENTS OF STUDENTS IN VOCATIONAL SCHOOL

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Abstract—The aim of this research is to know the relationship between socio-economic status and motivation with study achievements for Multimedia students in public vocational school 1 Tondano. There are 3 variables in this research which are Socio-economic Status (X1), Motivation (X2), and Study Achievement (Y). The research method that have been used was correlational where two multimedia classes (A = 30 students and B = 29 students) became the population. To determine the sample, probability sampling is a sampling technique used and ultimately resulted in 38 students as sample. Questionnaires used to collect the socio-economic status and motivation data while study achievements data was taken from the final result of Combining Texts into the Multimedia Presentation subject. The results of this study indicate that (a) there is a relationship between socio-economic status with the study achievement of students (0.613, partial correlation). (B) There is a relationship between motivation and study achievement of students (0.638, partial correlation). (C) There is a relationship between socio-economic status and motivation queried together with the study achievement of students (0.562, multiple correlations).

Keywords: Socio-Economic Status, Motivation, Study Achievements

I. INTRODUCTION

The progress of a nation is determined by the quality of human resources, while the quality of human resources depends on the quality of education. Changes in the education system should be done to improve the quality of education of a nation. With a range of government policies in improving the quality of education is expected to raise the dignity of Indonesia. Some efforts have been made to improve the quality of learning, among others: updates to the curriculum, learning model development, improving the quality of educators, changes in the assessment system and so forth. One element that is often studied in conjunction with the results of student learning is a learning model used by teachers in learning activities at school.

Vocational High School (SMK) is one the institutions that is devoted to preparing learners have the ability, skill and expertise, so that graduates can develop areas of expertise when entering the world of work. Vocational education itself aims to improve the ability of learners to be able to develop themselves in line with the development of science, technology and the arts, as well as to prepare students to enter the workforce and develop a professional attitude.

High learning achievement by students cannot be separated from the standard process to show the quality of learning services. For that student achievement cannot be avoided from having to analyze each component that can shape and influence the learning process. Socio-economic status and motivation are two very important factors for the success of students in order to obtain good study achievements.

The method used in this study was correlational. Retrieval of data is using questionnaires of socio-economic status and motivation while study achievement data are from the final result of Combining Text into Multimedia Presentation subject. The populations were all students in Multimedia study program in
Public SMK 1 Tondano and determination of sample using probability sampling in order to get a sample of 38 students.

II. METHOD

For the purposes of the study, the research method that used was correlational. Murdalis said that the purpose of this study is to find out a new relationship complex issues [1]. Questionnaires surveys were used to collect socio-economic status and motivation data, and the study population consisted of 59 Multimedia Students (A and B) who study Combining Texts into the Multimedia Presentation. The scales of the study were adapted primarily from various published sources. Each item of the scales was measured on a five-point ‘Likert’ scale (1=strongly disagree to 5=strongly agree). In this study, SPSS 19.0 was used as the statistic software. Descriptive statistics, one-sample t-test, dependent-sample one-way ANOVA, dependent-sample t-test, and path analysis of multiple regression analysis were employed to analyze the data.

III. DISCUSSION

1. A. Study Achievement

The result of learning is a process due to changes after participating in learning activities. The study achievements are the capabilities of the students after receiving a learning experience [2]. So therefore concluded that: The learning result is something that has been achieved after doing business study abroad, study achievements indicative of success or failure of students, study achievements is the ability possessed by the students after receiving the experience of learning, study achievements is a visible due to changes that after following learning activities. In fact, to get good results, it is not as easy as imagined, but a struggle with the various struggles that must be achieved. Omar Hamalik said that overall study achievements measurement activities, processing in order to achieve the learning objectives that have been set [3]. The results of study showed the process study abroad, while study achievements is an indicator of the degree of change in student behavior study achievements achieved by an individual is the integration of several factors both from outside and from within the individual. Conny Seniawan said that the study results should be meaningful to the students themselves in the foster initiative and creativity, that is limited to the acquisition value of a study, but were able to shape attitudes and necessary in processing ability obtained from study that followed [4]. From some study achievements proposed by the experts above, clearly visible on certain words for emphasis, but essentially the same results achieved on an activity that has been done. For it can be understood that the study achievements are the result of an activity that has been done is created reassuring, obtained with the tenacity of work.

B. Socio-economic Status

Socio-economic status is a category of people according to economic characteristics, education, and employment [5]. According to Soerjono Sukanto said that “a person's social status is generally in society in relation with others, in the sense of social environment, rights and obligations [6]. Sugihartono argues, socio-economic status of parents include parental education, parental occupation, income parents [7]. The things that affect the socio-economic status are [6]:
a) Measures of wealth, the wealthier a person, it will be a high level of a person's status in society.
b) Size of the power, the higher and more authority of an individual in society, the higher the level of the person's economic status.
c) Size of honor, respected person in the community would be placed higher than others in the community.
d) The size of science, science as a measure used by people who value science

C. Motivation

Motivation is the generation process, directing and stabilizing behavior toward a goal. Motivation is the background for an individual do to achieve certain goals. Motivation can be observed from the stress experienced by the individual, the greater the tension, the higher the level of effort shown individuals reaches their goals. Motivation comes from the Latin word “movere” which means a push or move. The word
motivation and motive are often used in turns in explaining the impetus that drives a person to behave [8]. Furthermore, according to Kambey, motivation is the process of promotion/enhancement motives in such a way that it is compelled to do something (to behave) with zeal to achieve the desired goals in an effort to satisfy their needs reference [8]. Motivation may be internal, meaning it comes from himself; can also be external, namely from teachers, parents, friends and so on. Therefore, to understand the motivations that exist in individual should also understand some theories put forward by the other.

D. Research Hypothesis
Based on the literature review, it can be formulated hypothesis of the study as follows:
1. There is a positive relationship between socio-economic status with study achievements of students in Public Vocational High School (SMK) 1 Tondano.
2. There is a positive relationship between students’ motivation with study achievements of students in Public Vocational High School (SMK) 1 Tondano.
3. There is a positive relationship between socioeconomic status and motivation with study achievements of students in Public Vocational High School (SMK) 1 Tondano.

IV. RESULT
Based on data and analysis of the research results as follows:
1. The results of study achievement of students in Public Vocational High School 1 Tondano likely to be influenced by Socio-economic Status. The link is partially 0.613 of correlation coefficient indicates that the Socio-economic Status positively related to study achievements. Thus it can be said that if the Socio-economic Status above, the results of student learning will be high. Vice versa, if low, the Socio-economic Status of student study achievements will be low.
2. The results of study achievement of students in Public Vocational High School 1 Tondano likely to be influenced by the motivation to learn. The relationship is strong enough for partial correlation coefficient of 0.638, indicating that the motivation positively related to study achievements. Thus it can be said that if a high motivation to learn the results of student learning will be high. Vice versa, if the low learning motivation, the study achievements of students will be low.
3. The results of study achievement of students in Public Vocational High School 1 Tondano likely to be influenced by Socio-economic Status and Motivation. The relationship indicating that the Socio-economic Status and Motivation has a strong relationship with study achievements. It was noticed the multiple correlation is 0.562. Thus it can be said that if the Socio-economic Status and high motivation, the results of study achievements will be high.

V. CONCLUSION AND SUGGESTION
Based on the results of the discussion of data analysis through the evidence against the hypothesis of the issues raised about the Influence of socio-economic status and motivation with study achievement of students in Public Vocational High School 1 Tondano described the results section.

Furthermore, schools as formal educational institutions should pay attention to the condition socio-economic status of students. If the condition of the socio-economic status is low, school should provide scholarships to support their study while in school. Then, teachers have to pay attention to the student’s motivation while in classroom. Teachers must have the capacity in order to improve students’ motivation. Use of existing learning media by using modern technologies should be used by teachers to improve students’ motivation. Thus the quality of education will increase.

ACKNOWLEDGMENT
Compliments of gratitude to Almighty God for all the blessings that allows writers to finish this paper. In making this paper, the writers have received many contributions, advice, and guidance from some outstanding persons. Firstly, the writers sincerely thank the parents who have supported to take part in this seminar. Secondly, writers would appreciate all to the Yogyakarta State University who has held this international
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THE EFFECT OF PBL ON CRITICAL THINKING
SKILL AND LEARNING ACHIEVEMENT ON
PHYSICS SUBJECT

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Abstract—The aims of this research are to investigate the effect implementation of Problem Based Learning (PBL) on: (1) critical thinking skill, (2) learning achievement, and (3) critical thinking and learning achievement on Physics subject of eleventh grade students majoring IPA at MAN Yogyakarta III. This research was a quasi experiment research. The population was all of eleventh grade students majoring IPA at MAN Yogyakarta III in second semester of academic year 2013/2014. The sampling technique used was purposive sampling until the two classes of research sample had been obtained. 29 students of class XI IPA 4 as the experimented-class were given the lesson by using PBL and 28 students of class XI IPA 3 as the controlled-class were given the lesson by using conventional learning oriented to cooperative learning. The learning achievement measured in this research was confined to cognitive aspect. The data were obtained by using test and observation techniques. The test technique was done by giving the pre-test to get the students’ initial learning achievement and critical thinking skill. Later, the students were given a post-test to measure final capability of the students. The observation technique was used to obtain the data of critical thinking skill observed during the learning process. The technique were analyzed by using multivariat anova test or MANOVA with significant equivalent 0.05. Based on the statistic test done, it can be concluded that the result of this research are: (1) there is no effect of implementation Problem Based Learning (PBL) on the critical thinking skill; (2) there is no effect of implementation Problem Based Learning (PBL) on the learning achievement; and (3) there is an effect of implementation Problem Based Learning (PBL) on the critical thinking and learning achievement on Physics at fluid static XI MAN Yogyakarta III.

Keywords: Problem Based Learning, Critical Thinking Skill, Learning Achievement

I. INTRODUCTION

The three main dimensions in the study of science are the product dimensions, processes, and scientific attitude [1]. It confirms that the purposes of learning are not only to develop aspects of knowledge (product) but also to develop and improve other skills.

Physics as a branch of science, is basically a set of knowledge, ways of thinking and inquiry. Learning physics in high school goal is to educate and train students to develop competence in terms of observation, experimentation, and scientific thinking and behaving [2]. Therefore, the process of physics learning is required to develop the capacity to process, to be scientific, and training to improve the ability to think.

It is related with the Regulation of the Minister of National Education 23 of 2006 on Graduates Competency Standards for Primary and Secondary Education Unit. Some competencies related non-thinking skills mastery, that graduates should be able to: demonstrate the ability to think critically, showing a high curiosity and realize their potential, as well as demonstrate the ability to learn independently according to their potential. On the other hand, critical thinking skills are skills that can not grow by itself in line with the physical development of man. So, it is necessary for learning to cultivate these skills. Therefore, it is important to develop critical thinking skills for learning in schools.
Cronbach say that learning is a change in behavior as a result of the experience and best learn is by experiencing something that uses the five senses [3]. Therefore, the study of real problems in life can make students develop critical thinking skills and can improve learning outcomes is by relating facts, concepts, theories and laws derived in physics learning. Students need to learn to overcome the problem that the output of learning does not just appear higher learning achievements but also critical thinking skills.

Critical thinking skills are needed so that the students get used to solve problems in their life. Critical thinking skills are developed in learning so that students understand the application of physics in their life. By developing critical thinking skills, students will be used to organize the mindset and skills to grow as students doing research process. Critical thinking skills are also taught students to think about ways in assessing the facts, consider the concept from different angles and can take decisions in solving the problem. By developing critical thinking skills during the learning process so that students can respond to overcome these problems.

Familiarize students learn from real-life problems and engage students in learning will encourage students to reconstruct his own knowledge. Problem solving is a tool that allows one to use previously acquired knowledge, skills, and solutions to meet the demands of unusual circumstances [4]. Students who learn from the real problem will be trying to understand the problem, planning a solution according to the level of thinking and learning experience before, then carry out the steps of completion and checking the results obtained. If students have a problem-based learning then students will construct their own knowledge and have an impact on the length of the knowledge stored in the memory of the child so that the impact on increasing learning achievement.

The results of preliminary observations in Yogyakarta MAN III, learning physics is still using conventional learning models. It is proved by the learning is centered on the teacher and the continued prevalence of learning by using the lecture method. Learning physics generally rarely raises problems in everyday life as a basis for studying the physics concept. Submission of materials physics rarely done in the laboratory or lab. Learning physics is done with this lab was still centered learning and the teacher did not come from a problem in everyday life. Teachers provide the material with a lecture and assisted with the power point and the material has not been associated with everyday life make students MAN Yogyakarta II tend to memorize the formulas that have been recorded teachers in the board. It makes students less steeped in application of the formulas they learn in everyday life. So that, the development of critical thinking skills aspects mainly through problems in everyday life is not maximized. Problems developed in measuring the ability of physics still revolves around the ability to memorize concepts and formulas.

Assessment product-focused (cognitive), lead to students ignoring the attitudes and scientific processes due to work on the problems of students simply memorize formulas taught by teacher only. Assessment instruments with formalin test, widely used during this time and quite effective on the assessment of cognitive aspects. However, the test is considered to have not been able to measure the actual capabilities as new aspects of the product alone does not include other aspects. This research has not supported the attitude of learners were told be to find out. This has an impact on not optimal development of critical thinking skills.

Furthermore, there needs to be a model of learning that explore the potential of critical thinking skills and improve learning achievement. Students need to be familiarized with the teaching that departs from the problem, is to appear with greater curiosity to students and in order to foster critical thinking skills during the learning process, and ultimately to improve learning achievement. One of model learning that can develop thinking skills is the model of Problem Based Learning (PBL) [5].

In model PBL, students are given the opportunity to construct their own knowledge. This makes the learning activities of students studying in accordance with the interests and concerns that resulted in students more motivated to learn. Based on the description above, the need for enterprises to develop critical thinking skills and student learning outcomes simultaneously in the learning process in the classroom, especially physics class XI in Yogyakarta MAN III.

Because of it has never been found the study about the influence of PBL implementation of the critical thinking skills and student learning achievement in Yogyakarta MAN III. This study aims to determine: firstly,
the influence of PBL implementation of the critical thinking skills; secondly, the learning achievement; and thirdly, the critical thinking skills and learning achievement of physics at XI IPA class of MAN Yogyakarta III.

II. RESEARCH METHOD

This study uses a quantitative approach. This type of research is a quasi-experimental research using design posttest only control group. The research conducted at MAN Yogyakarta III from February to April 2014.

The population of study was a class XI student of MAN Yogyakarta IPA III second semester of the school year 2013/2014. The sampling technique was by purposive sampling or determination. Class XI IPA3 as control class and class XI IPA4 as an experimental class with the assumption that the initial ability of students in the two classes are homogeneous. This is supported by the results of tests of homogeneity in the two classes. The average sample based on test results on the students' initial ability static fluid material (pretest) can be seen in Table 1.

<table>
<thead>
<tr>
<th>No</th>
<th>Class</th>
<th>Number of Students</th>
<th>The Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>XIIPA3</td>
<td>30</td>
<td>35.00</td>
</tr>
<tr>
<td>2</td>
<td>XIIPA4</td>
<td>31</td>
<td>34.45</td>
</tr>
</tbody>
</table>

It given treatment during five meetings. Conduct experimental class learning with PBL. PBL steps are as follows: (1) provide an authentic problem to students; (2) organize the students to examine; (3) conduct an investigation of the group; (4) presented the results of the discussion; and (5) evaluate the results of discussions and student presentations.

Control class is using conventional discussion teaching. The steps of conventional classroom learning are: (1) presenting material; (2) organize the students to discuss; (3) presented the results of the discussion; (4) evaluating the learning process.

After being given the treatment, the experimental class and the control class is given a posttest to encompass the ability of the student's final and critical thinking skill. To gather data critical thinking skills are also using observation sheet.

Data collection techniques in this research is to use tests and nontes. Technique of tests are used to measure critical thinking skills and student learning achievement. Test students' critical thinking skills and achievement test are arranged in the form of multiple choice questions. Non-test technique of are used to determine the results of observations of students' critical thinking skills during a physics lesson in three observations. To capture the critical thinking skills and student learning achievement after a given treatment, the experimental class and control class given posttest.

Instruments in this research is a matter of pretest-posttest in the form of students' critical thinking skills tests, tests of student learning outcomes, and critical thinking skills observation sheet. Therefore, data obtained in this study are the data interval and ordinal data. Interval data obtained through pretest and posttest matter of critical thinking skills and learning outcomes while ordinal data obtained through observation sheet of students' critical thinking skills.

Learning achievements measured in this study is limited to the cognitive aspect. The measurement of learning achievement is by using Bloom's taxonomy and limited only to the C1 through C5.

Instruments critical thinking skills are developed based on indicators of critical thinking skills by Ennis. There are five dimensions of critical thinking skills in Ennis which is then translated into twelve indicators [6]. In this research, critical thinking skills indicators that are used are indicators of critical thinking skills in accordance with PBL and fluid static. The following are indicators of critical thinking skills that are measured using the skills pretest and posttest.
TABLE 2. THE LATTICE PRETEST AND POSTTEST CRITICAL THINKING SKILLS

<table>
<thead>
<tr>
<th>Category of Critical Thinking Skills</th>
<th>Indicators of Critical Thinking Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarifying the basic</td>
<td>Analyzing arguments</td>
</tr>
<tr>
<td>Assessing basic support information</td>
<td>Assessing the credibility of sources of information</td>
</tr>
<tr>
<td>Draw a conclusion</td>
<td>Creating and assess observations</td>
</tr>
<tr>
<td>Clarifying the advanced</td>
<td>Interesting conclusions deductively</td>
</tr>
<tr>
<td>Applying the strategy or tactics in solving problems</td>
<td>Interacting with others</td>
</tr>
</tbody>
</table>

The indicators pretest and posttest were used to examine students’ critical thinking skills are the seven indicators. This is the result of empirical validation. Questions escaped from the empirical validation contains seven indicators. Additionally, this indicator is also adapted to the characteristics of PBL is a problem-based learning. Besides customized with PBL, critical thinking skills indicators also adjusting to the physical materials used in this research that the fluid static. The indicators that measure critical thinking skills using observation sheet illustrated in Table 3.

TABLE 3. THE LATTICE OBSERVATION SHEET CRITICAL THINKING SKILLS

<table>
<thead>
<tr>
<th>Category of Critical Thinking Skills</th>
<th>Indicators of Critical Thinking Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarifying the basic</td>
<td>Focus on questions</td>
</tr>
<tr>
<td></td>
<td>Analyzing argument</td>
</tr>
<tr>
<td></td>
<td>Asking and answer questions of clarification challenge</td>
</tr>
<tr>
<td>Assessing basic support information</td>
<td>Assessing the credibility of sources of information</td>
</tr>
<tr>
<td>Clarifying the advanced</td>
<td>Identify the terms and appraise term</td>
</tr>
<tr>
<td>Applying the strategy or tactics in solving problems</td>
<td>Decide on an action</td>
</tr>
<tr>
<td></td>
<td>Interacting with others</td>
</tr>
</tbody>
</table>

It is different with the indicator on the test of critical thinking skills, indicators of critical thinking skills on the observation sheet adapted to that seen in the classes. So that, that is used on this study only four dimensions and seven indicators of critical thinking skills.

III. TECHNIQUE OF ANALYSIS DATA

The analysis of data using two methods: inferential statistics and descriptive statistics. Inferential statistical analysis performed to analyze the data pretest and posttest while descriptive analysis performed to analyze data on the observation of critical thinking skills.

The aims of this study was to determine the effect of implementation of Problem Based Learning toward: (1) critical thinking skills; (2) learning achievement; (3) critical thinking skills and learning achievement physics at class XI IPA MAN Yogyakarta III.

Hypothesis testing is done on the data inferential using parametric statistical tests. Parametric statistical requirement is fulfilled normality test and homogeneity test. Normality test is done to determine the normally distributed data. Test for normality is using the Kolmogorov-Smirnov test performed with SPSS 16.0. Data is normal if the probability of the Kolmogorov-Smirnov test has probabilities \( p > 0.05 \) [7].

Homogeneity test aims to determine whether or not a homogeneous population sampled. This means homogeneity test to test whether the data experimental class and control class has the same variant or not. Homogeneity test is conducted at pretest and posttest critical thinking skills and student learning achievement. In this study, homogeneity test does is the \( F \) test using SPSS 16.0. Samples were said to have the same population variance if the price calculation of probability greater than 0.05 or \( p > 0.05 \) at the 5% significance level.

Homogeneity and normality test was also performed on the data posttest. This is to determine the statistical test to be used. Different test parametric statistics have provided the data must be normal and homogeneous, if one is not met, then different test should use non-parametric statistical tests.
Descriptive statistics were used to describe or give a picture of the object studied. Analysis and conclusions made are not generally applicable [8]. This analysis was conducted to obtain a score of observation of critical thinking skills are further classified based on the criteria of the raw score.

To determine the percentage of observation of students' critical thinking skills in learning physics using PBL models, data from the observation sheet described critical thinking skills and decision taken prescribed criteria, both in the experimental class and control. The following are criteria krits students' thinking skills.

**TABLE 4. CRITERIA OF CRITICAL THINKING SKILLS STUDENTS**

<table>
<thead>
<tr>
<th>Range of Score</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>X &gt; M + 1.50s</td>
<td>Very High</td>
</tr>
<tr>
<td>M + 0.50s &lt; X ≤ M + 1.50s</td>
<td>High</td>
</tr>
<tr>
<td>M - 0.50s &lt; X ≤ M + 0.50s</td>
<td>Medium</td>
</tr>
<tr>
<td>M – 1.50s &lt; X ≤ M – 0.50s</td>
<td>Low</td>
</tr>
<tr>
<td>X ≤ M - 1.50s</td>
<td>Very Low</td>
</tr>
</tbody>
</table>

Where:

M = The average of score ideal

s = Standard deviation

X = The number of scores obtained by students

**TABLE 5. CONVERSION OF SCALE CRITICAL THINKING SKILLS**

<table>
<thead>
<tr>
<th>Range of Score</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>X &gt; 28,005</td>
<td>Very High</td>
</tr>
<tr>
<td>23,335 &lt; X ≤ 28,005</td>
<td>High</td>
</tr>
<tr>
<td>18,665 &lt; X ≤ 23,335</td>
<td>Medium</td>
</tr>
<tr>
<td>13,995 &lt; X ≤ 18,665</td>
<td>Low</td>
</tr>
<tr>
<td>X ≤13,995</td>
<td>Very Low</td>
</tr>
</tbody>
</table>

**IV. RESULTS AND DISCUSSION**

After the test prerequisites, test of normality and homogeneity of the pretest and posttest data is more than 0.05, then the data is said to be normal and homogeneous. Figures significance been 0.05 for the significance level in this study was 5%.

**TABLE 6. RESULTS OF NORMALITY**

<table>
<thead>
<tr>
<th>Class</th>
<th>Data</th>
<th>p</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>Pretest of learning achievements</td>
<td>0.726</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Posttest of learning achievements</td>
<td>0.625</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Pretest of critical thinking skill</td>
<td>0.563</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Posttest of critical thinking skill</td>
<td>0.227</td>
<td>Normal</td>
</tr>
<tr>
<td>Control</td>
<td>Pretest of learning achievements</td>
<td>0.374</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Posttest of learning achievements</td>
<td>0.334</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Pretest of critical thinking skill</td>
<td>0.060</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Posttest of critical thinking skill</td>
<td>0.477</td>
<td>Normal</td>
</tr>
</tbody>
</table>

Table 6 illustrates the value of probability (p) normality test results of all the data obtained in the experimental class and control class. From Table 6 all the data has a probability of more than a significance level of 0.05. So that, it can be concluded that the experimental class and control class are normal. In addition to the normality test, homogeneity test data is also performed to determine the variance data.

**TABLE 7. THE RESULTS OF HOMOGENEITY DATA**

<table>
<thead>
<tr>
<th>Data</th>
<th>p</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest Critical Thinking Skills</td>
<td>0.467</td>
<td>Homogen</td>
</tr>
<tr>
<td>Posttest Critical Thinking Skills</td>
<td>0.388</td>
<td>Homogen</td>
</tr>
<tr>
<td>Pretest learning Achievement</td>
<td>0.184</td>
<td>Homogen</td>
</tr>
<tr>
<td>Posttest learning Achievement</td>
<td>0.366</td>
<td>Homogen</td>
</tr>
</tbody>
</table>

The research sample is said to be derived from a homogeneous population if the price of the probability is greater than 0.05 (p > 0.05) [7]. According to Table 7, pretest and posttest probability of critical thinking skills and learning achievement are more than 0.05, it means that the data have variances were homogeneous.

The prerequisite test results indicate that the data is normal and homogeneous. Therefore, the data is analyzed by statistical parametric MANOVA. The first hypothesis in this study is whether there is any the
influence of PBL implementation towards the physics critical thinking skills of XI IPA MAN class Yogyakarta III on static fluid material. Statistical analysis showed that $p = 0.254$ or $p > 0.05$. It means there is no influence of PBL implementation towards students’ critical thinking skills of physics of XI IPA class MAN Yogyakarta III.

The second hypothesis in this study is whether there is any influence of PBL implementation towards students’ learning achievement of physics of XI IPA MAN class Yogyakarta III. Statistical test results mentakan that $p = 0.003$. This means $p < 0.05$ or there is the influence of PBL implementation towards students’ learning achievement of physics of XI IPA class MAN Yogyakarta III.

The third hypothesis is whether there is any influence of PBL implementation towards students’ critical thinking skills and learning achievement of physics of XI IPA MAN class Yogyakarta III. MANOVA test results shows that $p = 0.01$. This means $p < 0.05$ or there is influence of PBL implementation towards students’ critical thinking skills and learning achievement of physics of XI IPA MAN class Yogyakarta III.

In simple terms, PBL learning steps are: (1) small group division. Students are divided into small groups consisting of 5 to 6 people. The members of each group come from high category, medium category, and low category. (2) Problems Orientation. Teacher reveals the problems that will be delivered in learning. These problems become the basis for developing the material presented at the meeting. In this phase, students are asked to write their problem formulation which will be investigated.

(3) Group investigation. The group then planned problems solving that have been presented. Searching of the data is done by experimenting with students’ worksheet (LKS) guidance that has been prepared by the teacher. To develop material derived from the results of the investigation, the students look for other references such as books. (4) Discussion in the group. Students held discussions with members of the group to complete the worksheets that have been distributed by the teacher. Students also write the results of the investigation as the answer to formulation of the problem they have created.

(5) Presentation of findings. The group appointed by the teacher presents the findings of the group investigation. While, another group that is not presenting listen, respond and criticize the findings of the presenting group. (6) Evaluation. Teacher provides feedback and assessment of the process and the results of investigations conducted by the students.

Control class uses conventional discussions learning that lead to cooperative learning. After the students receive material, students learn in a group that have been distributed by the teacher. Then the students are given time to discuss the discussion sheets distributed by the teacher with group members. After the discussion, students present the results of discussions in front of class. The groups that have not had a turn for presenting have to listen, respond and criticize the presentation of presenting group. After students doing the presentation, teachers provides feedback, input and strengthening of the findings presentations and group discussion.

Based on the results of hypothesis testing on three formulation of the problem, it is concluded that there is no effect of PBL towards critical thinking skills, there is the influence of PBL towards learning achievement, and there is the influence of PBL towards students’ critical thinking skills and learning achievement on physics of MAN Yogyakarta III.

The following will be discussed separately the influence of PBL towards critical thinking skills as well as the influence of PBL towards the students’ learning achievement in physics at XI IPA class MAN Yogyakarta III by linking theory and reality on the ground. The influence of PBL towards Students’ critical thinking skills of Physics of XI IPA class MAN Yogyakarta III.

After testing the hypothesis based on critical thinking skills tests, it was concluded that there is no significant influence of PBL towards students’ critical thinking skills in static fluid material on physics at XI
IPA MAN class Yogyakarta III. This could be due to learning of the experimental class and control class is group discussion.

Basically PBL has several characteristics, including the discussion group. To solve the problems described at the beginning of the meeting, students conduct a research and problem-solving with the group. Students, by their own, find concepts of physics from the problem that is revealed.

Control class learning is in the form of delivering the materials and then group discussion to complete discussion sheet distributed by teacher. The discussion sheet consists of physics question, either in the form of formula application in the normal calculation or the application of physics concepts in daily life. Although the control group got treatment and were trained to apply the concepts of physics in daily life, but the control class learning is not trained to find themselves the physics concept. The existence of group discussion to apply the formula in everyday life application in control class is suspected to cause critical thinking skill at the control class and the experimental class is equal.

This is supported by Duron et al [9], who argued that one of the measures to develop critical thinking skills is teacher should exploit the curiosity during the learning. This is illustrated by the learning of the experimental class as well as the control class to find out the application of physics concepts in everyday life. The difference in these two classes is class PBL did investigation with simple experiments without a concept that is given by teachers first, while the control class associate the concepts of physics to everyday life after getting the concept. The habituation of students to exploit the curiosity make students trained in applying concepts of physics in everyday life so the critical thinking skills in both classes are alike.

In addition, on the background of the problem it has been discussed that students of MAN Yogyakarta III are familiar with teacher centered learning and are not familiar with the learning from the real problems. It makes some of the initial meeting during conducting research, students need direction to associate the problem with the study procedures. The students can not associate the problem presented with the next step they would do to solve the problem.

A high level thinking involves of self regulation thinking processes [5]. We can not suggest a high order thinking in an individual when somebody else determines his behavior. This happened during the research conducted. Students are not familiar with the PBL process so it is required an adaptation by the special direction from teacher. This means that students can not study independently. Moreover, the LKS used in this study is an open worksheets.

On opened LKS, there is no lessons steps written. It makes the students really are forced to associate the problem with the learning objectives at the meeting. The students who are not familiar with the student centered learning confused so it takes time at the early meeting of the study for students to adapt. That is why in several beginning meetings students can not be released to learn independently. Therefore, students should be guided by the teacher.

In addition, critical thinking skills are not inborn skills, but skills that are developing because of practice and it is also learned. As it has been explained at the beginning of the discussion, based on the observation of pre-study, students had been used to get teacher centered learning. It is thought to cause students are not ready yet to follow a problem-based learning, or student centered learning.

According to Taraban et al. [10], in the paradigm of teacher centered, the learning focuses on the development of content, so it is only a few in developing the skills that students needed in scientific method based learning. The situation that occurs in conventional learning is the teacher gives the information to the students, then the students receive and remember it. In this way, it is clear that the ability of students to learn how to investigate itself can not develop properly.

This is supported by Tittle [11] which says that in fact people tend to think uncritically, so to develop critical thinking, humans should strive for critical thinking skills is not something inborn. Apparently, teacher
centered learning experienced by students in school caused the critical thinking skills of learners have not been trained to the maximum.

In addition, the other possible reasons is the lack of operational of arranged instruments. It is very possible that observation sheet prepared is undefined optimally, causing a double interpretation over the observer. Although the observers have been briefed about of each indicator, it is possible when learning takes place, observers forgot some points.

Critical thinking skills is a process, therefore, it needs to assess students' thinking process is not only with the observation sheet but also interviews. The interview will provide a space for researchers to the better understanding about the critical thinking skills of students directly. Using observation sheet to assess the process, it is possible there are indicators that have not been described as a whole during the observation. Although in this study the students' critical thinking skills are not significantly different, but this study illustrates that there are qualitative advantages of the PBL model towards critical thinking skills of students.

Apparently, the activities of students who were studying with PBL models are different from students who were studying with conventional models. Students who perform learning by using PBL models show more activity that lead to critical thinking skills than students who were studying with conventional learning. This is evidenced from the descriptive analysis.

Descriptively, the observation data of critical thinking skills none of students in the experimental class goes to the very low category and there are only two students in the low category (7%). In the control class, there is only one student in very low category (4%) and there are 3 students in low category (11%). It might not look that these two classes differ significantly. However, the indicators of identify and assess the terms and determine the action, the value of experiment class observation is much higher than the control class. On the other indicators, the value of experiment class observation was higher than the control class, but it is not too far.

In addition, it is needed to know that the indicators making and assessing observations, creating and deduction assessing, and creating and induction assessing do not appear in the control class. All three indicators of critical thinking skills only appear in the experimental class. This means that the chances of the experimental class students trained on those three indicators was bigger than the control class that has not led to the three indicators in their learning.

The findings obtained from this hypothesis is there is significant influence on the PBL model towards students' learning achievement in static fluid material of class XI MAN Yogyakarta III. It can be shown from the analysis of MANOVA test with a probability value. The probability value obtained from MANOVA test was 0.003, in other words the probability value less than 0.05. This means that $H_0$ is refused or $H_a$ is accepted.

Based on the research results, with the PBL model investigation activities to real problems can train students to find their own concepts studied. The problems studied help students to associate the problem with physics concepts they will learn. According to Ausubel a person learns to associate a new phenomenon into the scheme which he had during the learning students can develop a scheme or change it by constructing what they learned themselves [12].

Learning according to Ausubel occurs in PBL learning. PBL strongly emphasizes the importance of new experiences and direct experiences into the concept or understanding of the students. This is illustrated by the problems that will make the students learn to associate experiences, phenomena, and new facts into the understanding system that they already have.

Ausubel statement is also supported by the Bettencourt who says that the learning achievement is influenced by the students experience with the physical world and its environment [12]. PBL provides opportunity for students to contact with the surrounding environment. Problems that are designed from real life then continued with the completion of research problems by using the experiments equipments will
stimulate student on disequilibrium situation (imbalance). According to Suparno learning process actually happens when a person’s scheme is in doubt which stimulate further thought [12]. This imbalance situation is a good situation to stimulate students in learning.

Likewise, grouping in learning can facilitate students to collaborate, exchange of opinions, as well as learning about each other concepts that they find difficult. At the time of class discussions, students are motivated to express ideas fluently, broad-minded and able to look into the problem from different angles.

Learning with PBL makes the students more active in learning. The students perform formulation of the problem to be studied, determined a hypothesis, conduct an investigation, discussed the data that has been collected, made a presentation. The students do their own investigation and are directly involved in the discovery of theory process. It makes students easier to understand the intent of physics concepts learned.

This is in line with the constructivist theory that became the basis of the development of PBL model. The constructivist theory emphasizes that learning is more determined because of their individual activities. According to Budiningsih [13] students activeness become a very important element in determining the success of learning. PBL familiarize students to be actively involved in the process of investigating the problem and then associate it with a physics concept. Although the problems described are problems that are not too complicated, but the discovery by students themselves the basic concepts of the subjects being taught to make students more easily in remembering the material presented. This is a model of excellence PBL compared to conventional models. Model PBL emphasizes construction of knowledge the students themselves actively.

Teachers using PBL models in the learning process encouraging students to construct and process knowledge with students’ own language. Students will construct knowledge of the real problems is disclosed actively.

Based on data analysis and discussion that has been done, it can be drawn the following conclusions: (1) there is no impact on the implementation of Problem Based Learning towards students’ critical thinking skills of physics of XI IPA class MAN Yogyakarta III; (2) There is an effect of implementation of Problem Based Learning towards students’ physics learning achievement of XI IPA class MAN Yogyakarta III; (3) There is an effect of the implementation of Problem Based Learning towards students’ critical thinking skills and learning achievement of physics of XI IPA class MAN Yogyakarta III.

V. CONCLUSIONS

Based on data analysis and discussion that has been done, it can be drawn the following conclusions: (1) there is no impact on the implementation of Problem Based Learning towards students’ critical thinking skills of physics of XI IPA class MAN Yogyakarta III; (2) There is an effect of implementation of Problem Based Learning towards students’ physics learning achievement of XI IPA class MAN Yogyakarta III; (3) There is an effect of the implementation of Problem Based Learning towards students’ critical thinking skills and learning achievement of physics of XI IPA class MAN Yogyakarta III.

REFERENCES


SURVEY ON METACOGNITION OF KNOWLEDGE IN BIOLOGY OF LEARNING SMAN IN MADIUN CITY

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Abstract—Today the required knowledge in the cognitive abilities of students in the learning dimension, particularly in the aspect of thinking learners. One aspect of cognitive knowledge of learners in the realm of thinking is the mastery of metacognitive knowledge. This study aims to determine the percentage of students in the metacognitive level of mastery of the material ecosystem biology grade X SMAN in the City of Madiun. Metacognitive knowledge in learning covers several aspects including metacognitive skills include two aspects of metacognitive knowledge (metacognitive knowledge) and the regulation of metacognition (metacognitive regulation). Aspects of metacognitive divided into sub aspects have knowledge (metacognitive knowledge) consists of declarative knowledge (DK), procedural knowledge (PK), conditional knowledge (CK) whereas the regulation metacognition (metacognitive regulation) consists of planning (P), information management strategies (IM), comprehension monitoring (CM), debugging strategies (DS) and evaluation (E). This research is a descriptive survey. The study population was all students in the class X-IPA SMAN in the City of Madison in the academic year 2015/2016. The sampling technique used purposive sampling technique. Data collection technique used metacognitive students' mastery of the instrument. Analysis of the data in this study using SPSS version 16. Based on the survey results of students' mastery of metacognitive obtained a different percentage for each aspect of mastery metacognitive students in every school in SMAN Madiun.

Keywords: Metacognition Knowledge, Learning Biology

I. INTRODUCTION

Biology is the science that underlies the development of modern technology and science, which was instrumental in playing a role in the development of science. The development of science requires the development of thinking skills in every human being. So it requires the availability of human resources who have some proficiency particularly in the realm of thinking. Skills think someone can be known through learning in school, so that learning in school can be used to hone the students' ability to think. One of them can be seen through the aspects of cognitive thinking. Aspects of this thinking can be done by evaluating student learning outcomes in the main cognitive domain students.

Realm of thinking in the knowledge dimension into the cognitive aspects that require few skills and abilities related to high-level thinking skills. The ability of high-level thinking is closely related to the ability to solve problems, critical thinking, and critical thinking. Aspects contained in some of the capabilities of a person in a high-level thinking requires awareness of the thought of what has been thought or learned.

Context awareness aspect of thinking in the knowledge dimension into the metacognitive awareness. According to Widodo explains that knowledge of metacognitive someone will continue to increase with the development of learners, so bring learners to know the will of consciousness itself to better learning [1]. Anderson and Krathwohl states that metacognitive knowledge is the knowledge of a person's cognitive in realizing what is known and what is unknown to anyone [2]. So it can be described that metacognitive awareness is knowledge related to the ability that one has to think so as to reflect on what has been done. Here is presented related aspects of the scope of the division of metacognitive Schraw & Dennison and Panaoura & Philippou in Paidi [3].
Schraw & Dennison and Panaoura & Philippou in Paidi describes the metacognitive ability to cover two aspects of metacognitive knowledge (metacognitive knowledge) and the regulation of metacognition (metacognitive regulation). Aspects of metacognitive the selanjtnya divided into sub aspects have knowledge (metacognitive knowledge) consists of declarative knowledge (DK), procedural knowledge (PK), conditional knowledge (CK) whereas the regulation metacognition (metacognitive regulation) consists of planning (P), information management strategies (IM), comprehension monitoring (CM), debugging strategies (DS) and evaluation (E). The division is done as a sub aspect of self awareness of the activities performed [7].

Metacognitive awareness realized survey should be conducted to determine the extent of learning that has been done to help regulate and control the cognitive processes of a student in learning and thinking. This is done so it can be used for the evaluation of learning that has been done, so that hope can be used to develop the students’ ability to think. Metacognitive knowledge is very useful in overcoming the difficulties of student learning, this can be done in organizing student learning conditions of students, through metacognitive knowledge more students learn how to identify strengths and weaknesses in the process of learning undertaken to improve cognitive abilities [4].

II. RESEARCH METHODS

Research conducted using this type of descriptive survey. Research conducted at the National High School (SMAN) in Madiun. The population in the study using the learners Senior High School (SMAN) in Madiun. The sampling technique school conducted using purposive sampling technique. The total number of samples used as many as 561 students. This research was conducted in six schools in Madiun in class X on the ecosystem material. Phase 3 trials conducted in schools, while three schools used as study sites. Schools were used as test sites and criterion research are high, medium, and low.

Data collection techniques in this study using quantitative data collection techniques to determine the percentage of achievement of knowledge metacognitive learners. The instrument is composed of 29 items, divided into 8 sub aspects of metacognitive knowledge. Instruments of control metacognitive students have been validated to one expert measurement and 1 subject matter experts before trials conducted empirical. Reliability of each item questionnaires execution of cognitive dimensions and control of metacognitive skills of learners can be determined by using the analysis software program SPSS version 16. The validity of the questionnaire was conducted by empirical test to 273 students. The results of trials empirical analysis is then performed using SPSS version 16.

Data analysis techniques in this study conducted quantitatively. Data analysis technique is done by looking at the achievement of mastery questionnaire metacognitive abilities of students. The results of the analysis presented in the graph the percentage of metacognitive knowledge level of students.

III. RESULTS AND DISCUSSION

Respondents or learners used in the questionnaire in this study was conducted in two parts, namely in the pilot phase sampling is 273. The number of pilot deployment phase sheet metacognitive performed to test the reliability and validity of the instrument metacognitive before being applied to the study. While at the implementation stage of sampling is some 288 learners.

Items located in the sheet questionnaire distributed to 273 students sample with the item number as many as 29 items showed Cronbach alpha reliability coefficient value of 0.729 is based on the analysis SPSS version 16. Then, based on the data after analysis concludes that grain sheet instruments the metacognitive reflection reliable. While based on the empirical validation test on 273 students declared invalid instrument, so it deserves to be tested at the research stage. The study of metacognitive student mastery survey conducted after the learning process is complete ecosystem material, following the results of the percentage of learners' metacognitive skills associated with the material in schools ecosystem category of high, medium, and low.
Based on the results the percentage of metacognitive skills learners showed that the percentage of the ability of learners to each school did not show a significant difference. Mastery metacognitive for each school showed the highest aspect of the school SA1 on declaratif aspects of knowledge by 32%, while at school SA2 on aspects debugging strategies by 30%, then in school declaratif SA3 on aspects of knowledge by 30%. As for the control room for the school metacognitive SA1 on aspects of monitoring comprehension by 28%, on a school SA2 monitoring and evaluation aspects of comprehension by 24%, while in school SA3 on planning aspects by 29%. Here’s the translation using Figure 1.

Based on the graph shows the differences in the percentage amount for each aspect of the metacognitive skills of students for each school based on the percentage did not show a significant figure, but shows the different aspects of the ruled. it is influenced by several factors related to materials submitted ecosystem. Overall, many of the students at the high school have difficulty on category aspect of comprehension monitoring. While at school that category is showing that students have difficulty in comprehension monitoring and evaluation. While in high school category shows the difficulty in planning the material to be studied, suggesting that the high school aspect of planning is at a low percentage. Also according to Chandra, the effect of metacognitive mastery can be used to demonstrate student learning outcomes, due to the high level of mastery metacognitive students can find out the advantages and disadvantages in the process of learning to do [4], it certainly can be used to develop the students' level of cognition.

Differences in metacognitive student mastery of the material of this ecosystem is influenced by the demands of the materials developed so that would allow the different aspects of the master learners. Meanwhile, according to Yanti explains that the difference mastery influenced by metacognitive activities which did not facilitate their learning skills in honing students' metacognitive skills [5]. Meanwhile, according to Akabogu & Ajiwoju is influenced by several factors, including the absorption of knowledge based on the information obtained, sociability and ability to find solutions to the lack of knowledge through a variety of learning resources [6].
IV. CONCLUSION

Based on this research can be concluded that there are differences in mastery of metacognitive students in each school is influenced by the demands of the material that was developed to allow for the different aspects of the master learners and yet their activities are facilitating their learning skills in honing students’ metacognitive skills.

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REFERENCES


INTEGRATED SCIENCE IMPLEMENTATION
CHALLENGES IN DIFFERENT COUNTRIES AND
VARIOUS EFFORT TO SOLVE CHALLENGES

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Abstract— Integrated science has been a Unesco program and has been implemented in various countries who take shelter in the organization. Since been planned in 1969, up to 3 decades later, many countries facing of the challenges in implementing the policy. This article will be describe the challenges of learning science in various countries and attempt to address these challenges. This paper collects research reports from the United States, Barbados, Ghana, Indonesia, Nigeria and Turkey. Problems experienced by many countries, identified through this paper is; teachers must acquire adequate preparation and education in order to teach according to the demands of integrated science curriculum, integrated science curriculum is too dense, the arrangement of the material is less good. Another challenge is the lack of adequate laboratory facilities and the ability of teachers to teach the scientific method both in the laboratory and in the space environment, should be improved.

Keywords: Integrated Science, Implementing Challenges, Various Country

I. INTRODUCTION

The first international conference on integrated science education, sponsored - one of which by Unesco, were held in 1968 at Droujba Bulgaria, in cooperation with the International Council of Scientific Unions (ICSU) and the Committee on Teaching of Science (CTS). A year after the conference, Unesco follow up with meetings or gatherings that is Unesco’s Planning Meeting for Integrated Science Teaching. The meeting was held at the headquarters of Unesco from 17 to 19 March 1969 [1].

Since the beginning - when conducting meetings for the planning of integrated science teaching, Unesco realized that the implementation of the integrated science can not automatically be implemented smoothly. Therefore, the Final Report:Summary Planning Meeting For Unesco’s Integrated Science Teaching Programme In Unesco, Paris, 17-19 March 1969 stated that the Unesco Science Integration Program encourages the development of appropriate teaching materials and better equipment for schools, universities and teacher training. Encouraging experimentation and testing it on the scale of pilot projects, and support appropriate mechanisms for ongoing curriculum development. The experiment is based on international cooperation could enable comparative data that can be used on a different approach.

Through Unesco recommendations, many experiments to help elementary school and secondary school children to study science is already done in many countries. Based on the experiments several conditions universally accepted to teach good science, ie: stimulating and developing natural curiosity of children, fostering attitudes ask about nature, developing attitudes and scientific skills.

Demand for integrated education culminated in 1970 when the US Advisory Committee for the National Science Foundation recommending curriculum where science and technology should have relevance to human and social community. In the same period, two international organizations Unesco and ICASE begin continuous mapping and development of integrated science education in various country. ICASE (The International Council of Associations for Science Education), is an international association of teachers' organization that has the purpose to integrate science education. Unesco carry out 6 times science integrated international conferences and publishing the series reports “New Trends in Integrated Science Teaching”
II. DISCUSSION

Unesco has carried out 6 meetings and conferences to discuss science and science integration. Volume VI report is based on the consultation process Unesco, which was held in the framework of the World Wide Conference in Canberra in 1988 about the science education and quality of life, hosted by ICASE and Science Teachers Association (ASTA) Australia. Consultations were carried out 10 years after the conference held at the Univ of Nijmegen Holland and designed to look at developments in integrated science teaching during the period between an inventory trends in integrated science teaching, to discuss important issues and problems arising in connection with integrated science teaching. Proceedings of the consultation, produced for Unesco by ICASE, including reports from the region and the country to indicate how far the integrated science teaching has spread around the world [2].

Generally acquired outlook that there are many challenges faced in teaching integrated science. Here is described integrated science implementation challenges experienced by many countries. The countries in this study are sorted alphabetically.

A. Challenges of Implementation Integrated Sciences in Various Countries

America-USA. Reference [3] investigate the obstacles encountered on implementation of integrated science curriculum and the factors related to the quality of teacher input: Background study, GPA, and exam scores of teachers. Participants were 93 teachers, selected from applicants Teacher Quality Grant Project for 8th grade science teacher during 2 years (2005-2006 and 2006-2007 academic period). The focus was on the teacher’s knowledge related to science class 8 in Texas, which uses an interdisciplinary science curriculum. Interdisciplinary science comprised of biology, chemistry, physics, and earth sciences [3].

Incompatibility background of teachers with teaching job. Reference [3] findings indicates a discrepancy sufficient knowledge of teachers with integrated science curriculum grade 8, particularly in the state of Texas. Ever more (from 1987 to 2004), the background knowledge of science teachers at secondary school in Texas are increasingly irrelevant to the task of teaching.

Based on the results of this study, 26% of teachers never taking chemistry course, and 45.7% of teachers do not take physics course. Teachers who are not taking classes of earth sciences as much as 48.9%. Furthermore, reference [3] tell that according to Monk findings; student achievement will be better when their teacher finished college equivalent with the major. Ingersoll [3] reported that 20% of all science teachers are recruited neither major nor minor related to their teaching duties. Ingersoll findings are consistent with Wirt [3] reports, which found that 20% of junior high school science teachers do not hold a major, minor or certification in accordance to their teaching duties.

To support her findings, Reference [3] said that Palmer claim that the integrated science requires 1) highly skilled teachers, 2) the subject matter is broad and rich but selective and 3) administrative support innovation and experimentation. However, when the teacher does not have the background needed to implement the curriculum, a big problem in connection with the development of students' knowledge, raised quite.

The test results TexEs (Teacher Competency Test in Texas). Another concern related to the implementation of the integrated curriculum is the practice of policy makers who organize assignments of teachers. Texas teachers in the task structure allows an individual who holds a certificate of secondary science to teach science classes 8. It is not surprising if tested, score teacher competence in the fields they teach is poor. Tests for teachers is not a new phenomenon in Texas. Teacher competency tests started in March 1986 [3]. The results of diagnostic tests (degree TexES 8-12) values obtained with the range of 13-84, where 100 is the maximum score. A passing score is ≥ 70. In this study, only 5 from the 93 participants passed the diagnostic test. The findings are troubling, especially in the state of Texas [3].

Academic preparation. The task to teach an integrated curriculum may be conflicting with the expertise of teachers [3]. Teachers graduated from colleges and universities which use a single field. Several the year candidates a single field of degree holders are increase. This is an indicator of poor alignment between teaching assignments and the successful implementation of an integrated science curriculum. The teacher job to provide content outside their area of expertise, will not promoting student achievement. Training for teachers required
to implement an integrated science curriculum. Training should facilitate the ability of teachers as experts in a particular field also [3].

Barbados. Reference [4] reports the results of research on the implementation of integrated science in his country. In elementary and secondary, the new curriculum has been developed to: 1) Integrating scientific concepts with technological and social themes. 2) An emphasis on inquiry-based approach to learning. At the high school, Caribbean Examinations Council (CXC) and the Caribbean Secondary Education Certificate (CSEC) continually revising the science curriculum to better reflect changes in the social environment, economic and technological areas. Although efforts have been made, the performance and interest in and the number of students who enroll in the Department of Science is not encouraged.

Many investigations carried out, various proposals, approaches, recommendations, and strategies presented by leading researchers and organizations, but this issue not been resolved. Students still complain integrated science is too difficult, or for various reasons, learning science does not correspond to the needs of students.

Research conducting survey and interview methods, using samples of 200 students and 30 teachers were taken from 8 secondary school. School chosen by purposive selectively by 4 criteria. Difficulty index 6.6 - 38.7%. The survey shows most difficult level (38.7%) is a matter of physics and chemistry. Level medium (6.67 - 12.5%) is a matter of biology and environmental science. Johnston [4] comment on the difficulty topic of integrated science. That difficulty may be due to the complexity of ideas and concepts.

Subject science be presented on three different levels: 1) Macro and concrete, 2) micro, and 3) representational or symbolic. For example the concept of 'water'; This concept can be taught at the macro level where students can observe the properties of water. It can also be taught at the micro level where, for example, students are taught that water comprised from hydrogen and oxygen molecules. At the level of representation, these molecules can be represented as a symbol of H₂O. Although the spiral nature of the curriculum allows the concept was gradually from concrete (macro level) to the abstract (micro and representational), excessively the science teacher had to use all levels in one lesson. Johnston stated the three levels of interaction cause excessive activity of working memory, its causing difficulty in conceptualizing various materials in science.

Behar and Polat [4] stated that too many terms and symbols used in science content. Students are not able to connect the new terms with their cognitive structures. It can also lead to information overload in working memory. This error causes difficulty in some science topics. Especially if the teaching strategies used by teachers are not adequate to facilitate conceptual change. However, many teachers use excuse integrated science curriculum overloaded to explain their dependency on less varied teaching methods.

Ghana. Reference [5] conduct research from April to May, 2012, in St. Louis College of Education, Kumasi - Ghana. The population was 250 teacher trainees science diploma level. 100 teachers were chosen by purposively selective sample. Research findings; educational background in the field of integrated science teaching affecting practices teachers. If the background of integrated science a little bit, therefore observation skills, problem solving skills and the ability to attract the attention students for integrated science lessons are also low. This influence is also shown by the unfavorable their performance on exam integrated science education. It was diploma level exam.

Teachers who have a good background in integrated science is able to show performance in terms of problem solving skills. Interest in integrated science subjects increased and the quality observation skills also fine. Teachers who have a good background in integrated science get a excellent status for diploma course.

Indonesia. Our country has been following the 6th Unesco conference in 1988, the world wide conference in Canberra was about science education and quality of life, organized by ICASE and Science Teachers Association (ASTA) Australia. Implementation problems of integrated science in Indonesia based Canberra conference, including: 1) an integrated science teacher, still few in number. Teachers who are currently teaching, has a different background from their teaching duties; 2) some services teacher training are not effective; 3) some teachers are not familiar with laboratory equipment; 4) supporting facilities are inadequate learning; 5) the official policy (on primary and secondary education) have not been affiliated to Unesco recommendation.
Results of research linked to the 46 secondary school science teacher in Pekan Baru Riau. The research [6] showed that 37% of science teachers graduated from Physical Education and 48% comes from Biology Education. Science subjects (either physics or biology) at the majority of schools taught by the same teacher. Qualification science teacher at Pekan Baru less in accordance with their teaching duties. Sufficient knowledge teachers to teach science is still inadequate. It was felt mainly by teachers of Biology Education background but must teach physics.

Furthermore, according to reference [6] 39% of respondents said that practical knowledge is still lacking. Science teacher physics skills using a variety of laboratory equipment is still low because teachers were never trained laboratory in last 5 years. Reference [6] cite research Jeperis (2009) and Sumintono (2010), as follows: science teacher, secondary school did not have a background in science education, allocation of time for physics is less than the amount of material and practicum required by the curriculum, limited space, not available science laboratories and equipment in the school lab, laboratory skills teachers are low and the school did not provide laboratory staff.

The next research report came from Banda Aceh. This research [7] was conducted a descriptive study through questionnaires, interviews and observations of the secondary school science teachers throughout the city of Banda Aceh. Science teacher junior high school in Banda Aceh have yet to implement an integrated science teaching. Based on the results of data processing found a number of constraints: 1) Means of learning such as laboratories not complete 2) students' motivation is low, 3) textbooks that support the PBM less available, 4) competence of teachers is inadequate, as a result of teachers had difficulty in linking the concept of inter subdisiplin in science, 5) the ratio between teachers and students is low, the number of students beyond the classroom capacity, 7) allocation of time is not effective. Hours of lesson are covered into science reduced, whereas science curriculum content quite a lot.

Nigeria. Reference [8] tried to explore the problems in the implementation of integrated science facing Nigeria. This study is based on evaluation results of science teaching in secondary school Nigeria, which getting poor predicate. The study was conducted by descriptive method survey of 10 schools and analyzed 300 questionnaires were successfully filled respondents.

Identification of pre-research [8] found that most teachers did not know about "integrated science". Teachers are the determining factor in the successful of curriculum innovation. Inproperity background of teachers in science, knowledge and skills of teachers is inadequate to teach integrated science is the main cause of poor integrated science teaching in Nigeria. Stake et al [8] said that the success of integrated science teaching and learning process is highly dependent on what teachers believe, know and do.

An important finding in this study are: 93% of respondents commented that the integrated science teachers do not have adequate teaching methods. Teaching science / science integrated in Nigeria entrusted to the majority of teachers who are not qualified to teach the lesson. 81% of respondents wanted the teachers improve teaching methods in science. In addition to the teachers, 95% of respondents suggest the subject matter should be reviewed because too many things go into the content. 91% of respondents suggest the breadth of the syllabus needs to be reduced, in order to the material became suitable for students.

Methods in integrated science should strive to infuse practical benefits and application of knowledge in everyday life in the students themselves. If the teacher is not able to apply the methods required to teach these subjects, the malpractice about to occur. The learning objectives such as social skills, open-ended inquiry and experimentation to exercise innovation and solve the problems of life, will not be achieved.

Recommendation: 1) The government should encourage the interest of young scientist through scholarship, symposiums and competitions science. 2) Integrated science should emphasize the importance of observation, examination and experimentation as the process of science to improve understanding of the environment, should also be introduced to thinking logically and encourage scientific talent students. 3) It is important in integrated science curriculum, subject content must be wisely selected. Materials are created collaboratively among different teachers and other specialists carefully. 4) The next experiment is to develop a new integrated curriculum and the production of teaching materials required [8]
Nigeria. The next research report from the same country. Reference [9] describes various problems in the implementation integrated science at secondary school Nigeria.

The complexity of the implementation of integrated science. Fewer qualified teachers, less equipment and facilities to teach, less work practical, the time allocated for integrated science disproportionate and poor teaching methods are the main rejection factors implementation of integrated science curriculum at various levels of the education unit. Science integrated junior level provides a strong base for science education at the next level, if the foundation integrated science knowledge not well, students in high school will not show interest in core science subjects (biology, chemistry and physics). Whereas Nigeria was working to increase the number of students to science [9].

Arrangement of materials unfavorable. Another problem that is quite crucial is organize the concept of integrated science in the curriculum that are not sequential. The concept of science should be taught from the start of the material known to the unknown and from the simple to the complex. If this is ignored students will find it hard to understand the concepts being taught. This was proven in the test integrated science - JSSCE (Junior Secondary School Certificate Examinations). Poor exam results led to the development of negative attitudes toward science among students. They do not show interest in biology, physics and chemistry in high school and science study programs at public universities.

Integrated science curriculum planning uses a spiral (or concentric) approach. The concepts will be taught by this approach, so that arranged the whole matter finished in three years. This sequence is progression in terms of depth, the lessons continue to deepen for many years of the next class or next level. The question is, whether the sequence of curriculum content really spiral? Investigations showed many of the topics have to be presented in stages, given directly only in grade 1, grade 2 or grade 3 only just. For example the nervous system and the reproductive system, it is not introduced in the year to 2, and suddenly presented in year 3. Planner curriculum should introduce the material was in the year to 2, with sequenced approach students will be helped to explore the topic again present in year 3.

Unpleasant arrangement of lesson. Students must acquire laboratory skills and field experience are adequate in the integrated science. The objective is facilitate understanding of the material, and clearly stated in the syllabus. Furthermore curriculum developers should also provide topics that have direct relevance to the society. In the curriculum there is no arrangement for it and time allocation table crowded with too many subjects. Learning does not meet the standards science. The purpose of integrated science thus never reached [9].

Teaching strategies have to meet the standards science. The new curriculum planners, should determine teaching methods to be adopted to manage the material. The recommended method is: 1. Guided discovery; 2. Use laboratory exercises in accordance with STAN for 1970; and 3. Field trip.

Teachers should use another teaching strategies, not just a talk and allowed to use appropriate strategies. Laboratory activities is important to improving understanding certain nature of science. This activity encourages intellectual and conceptual development in science. Laboratory activities in particular, develop a positive attitude toward science. Laboratory activities becomes an important element in the development of the ability to solve certain problems. Learning through laboratory strategy useful to expand and strengthen the theoretical learning. Nature is a great teacher science; invites students to the field will provide contextual experience of the organisms in their environment. The field experience is highly recommended, if the scientific work is not possible within the confines of the laboratory [9].

Integrated science teacher problems. Teachers remain the only hope to improve the quality of learning. But in fact, Nigeria is in of shortage teachers condition. Integrated science teacher there mostly inexperienced, untrained and, in some cases, are not qualified for the job they do [9]. Steps should be taken to improve the quality of teachers: 1) Better selection and recruitment. 2) Continuing education of teachers through the program as inservice (training). 3) Better education in teacher training institutions. 4) Apprenticeship young teachers with more experienced teachers during the training.
Recommendation. 1) Allocation of time for integrated science have to improved so that students could develop the ability to observe, experiment, discussion, hypothesize, and draw conclusions. 2) Teachers should follow the provisions of the curriculum, invite students to conduct field visits and tours. 3) The federal government and the ministry of education have to ensure that any integrated science teachers to attend at least one workshop or seminar every year. Furthermore, inservice training for integrated science teachers unqualified to be approved. 4) Experiment and investigation serves as the support of modern science education. This cannot be achieved without effective laboratory activities. Therefore, having a functional laboratories and other infrastructure facilities important for all schools. 5) Finally federal and state governments have to improve the prosperity of teachers, improve the status of the teaching profession and provide appropriate incentives. This will encourage young people become experienced and dedicated integrated science teachers.

**Turkey.** Reference [10] showed that Evagorou, EM (Univ of Nicosia Turkey), Guven, D & Mugalolu, E (Bogacizi Univ Istanbul Turkey) participated in a project funded by the European Community and the Life Long Learning Programme. The project was followed by seven European countries to develop programs preservice curriculum for elementary and secondary school. The program is Everyday Science to educate preservice elementary and secondary teachers in order to teach SSI - socio-scientific issues.

Preliminary analysis the curriculum of Cyprus, Spain, Turkey, UK, Denmark, Romania, and France revealed that seven countries emphasized the scientific literacy in their policies, and consider the importance of SSI in their curriculum reform document. Britain and Denmark explicitly approach the problem of science through a controversial topic. Countries left its emphasis on issues of everyday use to teach science, which is not necessarily a controversial issue [10].

Furthermore reference [10] quotes the opinion of many researchers about SSI: Science causing political dilemma and the moral and engage with issues of social-scientific, allows students to understand the relevance of science to everyday life, gain insight into how people using science and develop their capacity to become critical consumers (Kolsto, 2001). The study of SSI and science everyday so far focused on the decision-making student (Ratcliffe, 1996), a conceptual understanding (Zohar & Nemet, 2002), and engagement with science to everyday life (Albe, 2008a; Venville & Dawson, 2010 ).

Based on the identification of research publications, teachers are not able to make the relationship between science and everyday life. They are difficult to coordinate among the scientific data and the social aspects of the problem, bringing uncertainty in the discussion (Zeidler, Sadler, Simmons, & Howes 2005 in reference [10]) SSI is not explicitly taught in teachers’ professional training system in all participating countries. Based on these findings and the findings of a study that explains the importance of teacher training (Abd-El-Khalick, 2003; Kilinc et al., 2013; Sadler, 2009b; Zeidler, 1997), designed the framework to be used as guidance in the development of modules SSI for student teachers [10].

**B. Efforts to Solve Implementation of Integrated Sciences Challenges in Various Countries**

**America-USA.** Reference [11] conducted a longitudinal study over four semesters to track the ability of 41 preservice elementary science teachers when they take courses science methods, until practice in the classroom. Science lecture method focuses on the use of inquiry on teaching practice in schools. Preservice teachers should be immersed in scientific inquiry skills during a lecture to understand the process. This research is motivated by a number of findings. One of these teachers lack confidence in teaching science (Frey, 2004). According Luehman (2007) if the training focused only on knowledge of science content and pedagogy, without attention to increase confidence prospective teachers, it is impossible to change teaching of science in the manner expected.

The effectiveness teaching of science is determined by comparing the pre and posttest students who are taught by preservice teachers. The confidence level when they teach science measured quantitatively using Efficacy Belief Instrument (STEBI - B), by comparing the scores before and after practice teaching science. The qualitative data obtained by classroom observation, lesson plans, questionnaire surveys and interviews, open-ended structure for their teaching. Triangulation method performed on quantitative and qualitative data, then analyzed by analytical induction and constant comparative method. Results showed confidence preservice
teachers rising in applying the method of inquiry as well as traditional methods in their classrooms. Gain score increased significantly, especially for traditional classes [11].

Returned from America – USA. Refernce [12] used the model problem base learning, to train students doing interdisciplinry research with experts from various fields helping. They use research projects ongoing as the basis for the lesson content. The learning experience is manifested form of subjects interdisciplinry research (Leonard, 1991; Stukus 1995; Lawson 1999; Tolman 1999; Dimaculangan 2000; in [12]).

Support from instructors are given by manner modeling, training, assignment orderly, questions and relevant feedback. Briefly in an expert lecture sessions with different areas of expertise companion turns being a mentor for novice researchers. Furthermore, the implementation of PBL in teaching embodied in the form of modules that contain complex tasks, to help students find and get involved in the problem, solving process, articulating their thoughts, and reflect on their learning. To maintain continuity, each module contains (a) the same structure, (b) overlapping content, and (c) instructions for mentoring students. At the end of the semester students are expected to be a problem solver and able to become novice researchers in diverse field their interest [12].

Another problem encountered is the lack of laboratory training school teachers. One way to dealing lack laboratory training for teachers, can be overcome with a community service program that is conducted by the college. Reference [13] from Yogyakarta State University (UNY-Universitas Negeri Yogyakarta) conduct training activities in the environmental laboratory based on science laboratory SMPN 1 Yogyakarta. The training is followed by 25 secondary school science teacher.

Biology training doing by simple tool demonstration that was able to show nicotine cigarettes dangers in the respiratory organs. The next demonstration is a tool designed to show erosion occurrence on the plateau when there is no vegetation on the plains. Last experiment is about process of capillarity on a plant stem. For selected experiments physics is about measuring density liquids and liquid pressure simulation. Both tools are designed from simple materials and easy to obtain and can use waste in everyday life. For chemical, demonstration begins with the characteristics chemical reaction; gas formation reaction and deposition, changes in color and temperature. Other demonstrations associated with atoms, ions, and molecules; nature of the compounds and mixtures; chemical formula. The whole experiment is able to attract the attention of the trainees and they are welcome to try it themselves. Given this demonstration, science teachers become convinced, they can practice it at school, because materials and tools proved very easy to get in everyday life.

Returned from Indonesia, community service program (PPM-Program Pengabdian Masyarakat) was held to train secondary science teachers a biological practicum training a biological practicum training in District of North Indralaya, Ogan Ilir, South Sumatra. Total participants in these activities amounted to 13 science teachers from five secondary school districts in North Indralaya [14].

The training material including technique of making herbarium, monitoring of water quality based on biotilik methods, surgical techniques, morphology and anatomy fish identification, recognition and techniques production of preparations animal tissue. The training aims to improve the understanding, motivation, creativity of teachers in designing, making and using instructional media that were found in surrounding area for science biology lab activities. This activity is an example, how to utilizing of the natural surroundings for scientific activities, if the school laboratory facilities are inadequate [14].

In addition to using materials found in everyday life and natural surroundings as a practicum matter, much research was done for overcome the problem of practicum obstacles. One is use the PhET. Reference [15] conduct research animation PhET for secondary science physics materials, light. The research objective is to improve students’ understanding. Software can be used to clarify the concepts of physical or phenomena that has been done in the lab.

Research is undertaken at SMPN 7 Bojonegoro. Class with PhET simulations and laboratory work, their learning outcome are better than lab work class without PhET. PhET as virtual media can be explain and demonstrate the light way which form a shadow. Students with laboratory work only, just see shadows generated by beam (light). Students do not know clearly the rays way forming the image because it can not be
captured by the eye. In addition, PhET media can be used to check for student understanding after doing practical work. Thus learning outcomes become more leverage [15].

Another way to overcome the limitations of the physics laboratory equipment is developing instructional media. Reference [16] showed that research conducted to developed a virtual laboratory at class VIII optics material with Basic Competencies 3:11, describe the properties of light, a shadow formation, and its application for explain human vision, and working principles of optical devices. Multimedia contains material combined with images, text, background music, animations, and sounds made in the form of flash. Flash will explain how to determine focus of the concave mirror, convex mirror, a concave lens, and a convex lens.

**Nigeria.** Researcher [17] on request by NCE - national commission college of the education, investigating in the education of elementary and secondary teachers problems. Based on problems analysis, Agoro and Akinsola designed reflectif method reciprocal peer tutoring (RRPT). Reflective teaching based on constructivism and metacognition. Lecturers and students teaching and learning under the supervision of their colleagues and university mentor or supervisor who criticizing their ideas. Reflection, according to Clarke [17], involves the mind pre-service teachers before, during and after the lesson. Reciprocal teaching (RT) is a cooperative learning instructional methods.

Pre-service teachers take an active in planning and performing as a teacher. Students switch roles with teachers so that enhance confidence and level of understanding. The strategy is to encourage preservice teachers for feel comfortable expressing ideas and their opinions in an open dialogue. This finding is consistent with results of previous studies by Fantuzzo, King and Heller (1992), Slavin (1996) Griffin and Giffin (1997), Fuchs and Fuchs (2003) and Mayfield and Vollmer (2007) [17].

**Turkey.** Problems in social scientific issues are problem ill defined (not yet have clarity), full of values, linked to the aesthetic, ecological, economic, moral, education, culture, and religion is limited by the the loss of knowledge. Sadler (2009) stated that the ability to handle social scientific issues has been recognized as an important goal of science education [10].

So that pre-service teachers were able to teach the SSI, researcher [10] designed the curriculum course with assistance the module. The first module of Global Warming, is designed to help pre-service teachers understand the nature SSI problem. Students are assigned to specific roles (environmentalist, politicians, automobile manufacturers, scientists). Students should use a worksheet to record evidence and resources. Scientists, environmental activists and politicians present their respective arguments. The posters presented during discussion session. Then they were asked to collect information necessary to argue about the solution of the assigned role. After the debate the participants doing reflection about nature of the problem being addressed, and other issues that are considered controversial [10].

The second module focuses on the controversial issue. This second module has two purposes: 1) To help pre-service teachers recognize and explore various pedagogical strategies in teaching SSI. 2) Provides support for pre-service teachers to identify problems that may not be included in the national curriculum explicitly, but has relevance for teaching social issues scientific [10].

### III. Conclusion

- The research findings from Nigeria, Indonesa, Turkey and the United States, shows that teacher preparation is a very important issue to be considered. Teachers need training in order to understand the integrated science and skilled to teach according to the rules of science. The ability is gained from education and training relevant to the area that will be taught.
- Expectation that the implementation of integrated science teaching goes according to curriculum objectives require assistance tools such as books that support learning, laboratories and the appropriate allocation of time. It is intended that the teacher able to design a scientific work experience (inquiry) for students.
- The arrangement of the curriculum material less structured, consequently students hard to understand. This problem is compounded by the density of integrated science curriculum thus difficult for teachers choose teaching methods. This is a dilemma for teachers, whether teaching to achieve excellent test
scores, or teaching to train scientific skills (science as a process and attitude), critical thinking, creative thinking (able to solve problems in life).

- Efforts to overcome the challenges in the implementation of the integrated science based on description: a) Designing curriculum classes to boost confidence preservice teachers to teach inquiry. b) Develop research skills for preservice teachers, in order to be able to solve problems and guide the students doing eksperimen. c) Develop a learning method to increase confidence and level of understanding of the content of integrated science preservice teachers. d) Conducting community service activities to overcome the limitations of equipment and lab materials. e) Develop media or virtual lab for areas that lack the laboratory facilities. e) Designing a curriculum of courses and modules to help teachers teach social scientific issues. f) Develop training programs and provide books (teaching material) to help teachers be able to teach science. g) Increase the time allocated for the integrated science so that students can develop the ability to observe, experiment, discussion, hypothesize, and draw conclusions.

REFERENCES
ANDROID FOR THE 21ST CENTURY LEARNING MEDIA AND ITS IMPACT ON STUDENTS

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Abstract—The era of globalization is characterized by the development of science very rapidly, particularly in the advancement of increasingly sophisticated technology. Advances in technology can be seen from the development of increasingly sophisticated mobile phone from generation to generation. One type of mobile phone that is widely used by most people this globalization era is kind of android. With a variety of features offered by this type of smart phone, allowing people to access the information needed. A new breakthrough in the world of education is the use smart phone type of android as a medium of innovative learning for learning a subject, as well as allowing students to access learning material anywhere and anytime without being limited by a classroom. The development of media on android smartphone can be used as a new breakthrough in classroom teaching and learning process interesting and fun. The use of Android-based learning media is one application of the learning styles of the 21st century. But a lot of the impact of the use of android-based instructional media in teaching and learning in class. One is addicted students to the smartphone itself. The purpose of writing this article is to examine the use of Android as a learning medium that supports the learning style of the 21st century, and to investigate the impact of the use of type android phone smart phone in the learning process.

Keywords: Android, Learning Media, Impact Use of Android

I. INTRODUCTION

The era of globalization is characterized by the scientific progress very rapidly, especially in the field of increasingly sophisticated technologies such as mobile phone progress. One type of mobile phone that is used by most people this is an android globalisation era. Android introduced the approach of higher and more complete with variety of important applications that allows users to access information [14]. Android is a software framework that includes overall mobile device and consists of an operating system, middleware and key applications set [7]. A new breakthrough in the world of education by utilizing smart phone is to be used as a kind of new media in teaching and learning. The results showed the use of media types android in the learning process is able to provide a positive impact to the indicated increase in the desire to learn new ones, and provide a major influence on students’ psychological [8]. Reference [2] explains that the use of the android system to help the learning process in schools has changed the primary function of manufacture is used as a communication tool has turned into a means of socialization, entertainment and learning. New features that have been developed in android devices designed to support the teaching and learning environment that is modern. In this environment the teacher can convey the material to be taught through personal wireless devices. This will add the computer-based teaching and learning models. Mobile learning very quickly dispersed and allowed into one of the most efficient ways to transmit the instruction of higher education in the future, and will be a need to examine the intent of the design of teaching and learning [6]. Development of instructional media based android smartphone can be used as a new breakthrough in the learning process.
interesting and fun class. The use of e-learning environment based on Android to adapt to the learning styles of the students of the 21st century [3]. The results of the study explained that the android-based mobile phone devices to support learning anywhere and anytime without being limited by classroom. From the description above background, this paper will discuss the use of android smartphones as a new breakthrough in the 21st century learning media education and its impact on students. This paper is a scientific study that examines the theory - the theory of the android smartphone use as a learning medium that helps in the process of learning and teaching.

II. METHODS

A systematic review and analysis was conducted from a data pool consisting of computerized bibliographic databases (e.g., Wiley InterScience, SAGE, SDOL, and ERIC). The steps for inclusion/exclusion criteria, data sources and search strategies, and data coding and analysis are discussed below.

Data sources and search strategies

The studies included in this meta-analysis were located through a comprehensive search of publicly available literature, mostly through manual electronic searches of the following databases: ERIC, Science Direct Onsite (SDOS), SAGE Journal Online, ProQuest, Wiley Inter-Science, ACM Digital Library, JSTOR, Elsevier Science (Elsevier)/SDOL, and informaworld. Manual searches were also conducted for Journal of Computer Assisted Learning, Computer in Human Behavior, British Journal of Educational Technology, Journal of Educational Technology & Society, and The International Review of Research in Open and Distance Learning. Although search strategies varied depending on the tool used, search terms included the keywords “mobile learning” or “M-learning” with “instruct,” “teach,” context-aware” “adaptive,” “wireless,” “situated learning,” or “activities”.

Data coding and analysis

Ten features related to the quality of study research methodology were coded including (a) research purpose, (b) learner demographic (e.g., elementary, secondary, post-secondary, higher education, adult, or disabled), (c) method (e.g., survey, experiment, etc.), (d) use of mobile devices, (e) discipline-orientation (e.g., humanities, social sciences, natural sciences, formal sciences, applied sciences and professional studies), (f) courses, (g) educational contexts (i.e., formal learning, non-formal learning and informal learning), (h) learning outcome (i.e., positive, negative and neutral), and (i) article citation counts. During data analysis, low-quality studies were excluded from the synthesis. In the current analysis, a quantitative study was considered low quality and excluded if it did not depict its methodological design features such as sample size and procedure. Qualitative studies were excluded if they failed to provide a rich description such as mobile learning outcomes, or appeared to rely more on the author’s experience rather than field observations.

III. DISCUSSION

Definitions of Android

Android was originally a specially designed operating system for smart phones and tablets, developed into additional applications in televisions, game consoles, digital cameras, and other electronic devices. Android is open has prompted the emergence of a large number of the application developer community to use open source code as the basis for the project of making applications, by adding new features for advanced users or operate Android on the device which was officially released by using another operating system.

Android can master the global market share, led by products from Samsung, with a percentage of 64% in March 2013. In July 2013, there were 11 868 Android devices with various versions. Android's success also make Android as the target of patent litigation "smart phone wars" among technology companies. Until May 2013, there are 900 million Android devices have been activated worldwide, and about 48 billion apps have been installed from Google Play.

Benefits of Android

If we talk about what the use of Android there are features that exist on Android such as:

1) Handset layout
   This platform can be adapted to larger, VGA, 2D graphics library, 3D graphics library based on OpenGL ES 2.0 specifications, and traditional smartphone layouts.
2) Storage
   SQLite, a lightweight relational database, which can be used to store data.

3) Connectivity
   Android supports connectivity technologies including GSM / EDGE, IDEN, CDMA, EV-DO, UMTS, Bluetooth, Wi-Fi, LTE, and WiMAX NFC.

4) Message
   SMS and MMS are available in the form of a message, including threaded text messaging and now Android Cloud to Device Messaging (C2DM) is also a part of Android Push Messaging service.

5) Multiple language support
   Android can support with several languages, making it more flexible.

6) Web browser
   The web browser provided by Android is based on the open source WebKit layout coupled with Chrome's V8 JavaScript engine.

7) Java Support
   Java classes are compiled into Dalvik executable and run on Dalvik, the virtual machine specially designed specifically for Android and optimized for battery-powered mobile devices with limited memory and CPU.

8) Support media
   Android supports the following audio / video / still media formats: WebM, H.263, H.264 (in 3GP or MP4 container), MPEG-4 SP, AMR, AMR-WB (container 3GP), AAC, HE-AAC (in MP4 or 3GP container), MP3, MIDI, OggVorbis, FLAC, WAV, JPEG, PNG, GIF, BMP.

9) Streaming media support
   Streaming media support in the form of RTP / RTSP streaming (3GPP PSS, Isma), progressive download HTML (HTML5 <video> tag).

10) Additional hardware support
    Android can use video / still camera, touch screen, GPS, accelerometer, gyroscope, barometer, magnetometer, controls a special game, a proximity sensor and pressure, thermometers, accelerated slightly blits 2D (with hardware orientation, scaling, pixel format conversion) and 3D graphics accelerated.

11) Multi-touch
    Android has native support for multi-touch which was initially available in handsets such as the HTC Hero.

12) Bluetooth
    Android supports Bluetooth A2DP, AVRCP, sending files (OPP), access the phonebook (PBAP), voice dialing and sending contacts between phones.

13) Video calls
    Although Android is not able to support the original video calls, but some handsets have a customized version of the operating system that supports both the UMTS networks (such as the Samsung Galaxy S) or over IP.

14) Multitasking
    Android can do several tasks at once, or multitasking.

15) Feature-based voice
    Android since its inception has been to provide Google search by voice, Voice actions for calling, texting, navigation, etc. are supported on Android 2.2 onwards.

16) Withdrawal
    Android supports the withdrawal, which allows the phone to be used as a wireless / wired Wi-Fi hotspot.

17) Screen capture
    Android has native support for the ability to capture screenshots by pressing the power volume and at the same time on Android devices.
Android as an Education Media

One type of mobile phone that is familiar today is android. Android introduced the approach of higher and more complete with the availability of a variety of important applications [14]. Almost all walks of life have to have android from both adults and children. Android is a software framework that includes overall mobile device and consists of an operating system, middleware and key applications set [7]. Android applications provide features that are informative, and this is the feature that pamper users. If you do a development on the features and more in this android app, then it will certainly attract more attention and interest of users. The benefits are no less important when it is developed for education in Indonesia, especially physical education.

The development of technology has provided an advantage in education that encourages students to learn anytime and anywhere without being limited space and time [4]. The studies conducted have provided benefits and convenience by applying mobile technologies (such as personal digital assistants, smartphones, and laptops) to the learning activities in various subjects such as science, social science, and linguistics [4][18][10][19][20][16][9]. Mobile phone has a wide range of features simple and continue to evolve over time: mobile phones not only for just a communication [11]. Students and teachers in learning to access the Internet, send and receive text messages and then check email and video chat from the hands of students and teachers.

Reference [1] conducted a study on the use of Mobile Learning on teacher education. Six playing findings emerged: (a) there is an increasing trend in integrating mobile learning in teacher education Contexts; (B) theoretical and conceptual perspectives are scarcely Reported; (C) variations exist in perceptions, attitudes and usage patterns; (D) engagement with mobile learning and devices is primarily Reported as being beneficial; (E) the challenges were scarcely Reported; and (f) Several pedagogical affordances integration into mobile learning support teacher education settings.

Reference [5] found that "introducing new forms of teaching (Mobile Learning) Make students spend more time in working on that subject, Comparing to the other subject. Also overall students' results are becoming better ". Learning that will make students saturated monotonous and lackluster in the learning process. So, we need new innovations in learning so enthusiastic students in the course. "Meanwhile the new technology Gives new chances to students and to teachers to train Reviews their ingenuity [15]".

Evaluation and analysis of research on mobile learning until now showed positive results. However [15][17] states that the technological devices used in the study should be seen as a supporter and can not replace the existing learning tool. In addition, not all types of learning content and learning activities appropriate for technology devices [12].

Maximizing Android as an Education Media

These features are provided in a very supportive learning Android because it is very useful to help students understand the subject matter. This feature also allows teachers to explain the lessons learned through the media, so the teacher does not need to explain repeatedly. Teachers need to choose the type of media or features that will be used in learning so that teaching and learning can be maximized. Some factors to consider in order to use Android Master becomes more leverage in learning as a learning medium, namely:

- Choosing the Appropriate Application
  Using android maximally necessary adjustments between the proper application used by the subject matter to be taught.

- The Usefulness of the Application
  The selected applications should be obvious usefulness, so do attempts to use it optimally. If the user does not know the usefulness of the application to be used, this will cause confusion and learning objectives can not be achieved effectively and efficiently.

- How to operate this Application
  If we are going to use a medium the most important thing is to know how to operate the media to be used. Can we imagine if we did not know how to operate a media that will be used in teaching, might just be ridiculed by his teacher. A subject matter that should be more easily understood if it is delivered through the media would be very difficult to understand the students if the teacher does not mastered how to use the
media or applications used. Therefore, we must know how to use the application to be used so that the use of media can be efficiently and effectively.

- Advantages and disadvantages of the Application
  
  Advantages and disadvantages of the application used must be known for the user who will use the application to learning so that learning is more effective and can reduce the negative impacts of the application used.

- Whether or not the application is easy to use
  
  Good learning media is media that can be easily operated so that the teacher is not confusion and more time efficient. Some applications or learning media is difficult to operate the teachers feel complicated. It will interfere with learning and learning objectives can not be achieved easily. Therefore, a teacher must know whether an application to use easy to operate or not.

- The effectiveness and efficiency of Application
  
  Teachers need to choose the medium of learning to be more effective and efficient. If learning to work effectively and efficiently, the learning objectives will be easily achieved and students can better understand the material presented. These factors can be a guide teachers in implementing android application as a learning medium. Application of android apps are also expected to contribute to the achievement of learning objectives.

Advantages and Disadvantages

1) Advantages
   - Android is open source but free in use, all the applications made for android phones are not as free, depending on the manufacturer.
   - Smartphone android at designated to facilitate internet access especially social. If networking buddies just want to use the smartphone for call and send message just happens to be mubassir.
   - Android smart phone is equipped with a variety of features for social networking and internet access

2) Disadvantages
   - Many people who first once using Android will feel confused operate it. Most people think that the sophistication of Android Smartphone because confusion for users in operating.
   - On the Android OS, data synchronization and email were behind the system, thereby pulse Android users would automatically be used. However, these events can be minimized by shutting down internet connection.
   - Data access is not restricted and has no compression, so that they can be hurt when a user of downloading large files.

Overcoming the Negative Impact of the Use of Android As Media Education

The use android as a medium of learning will bring both positive and negative impacts. The positive impact that the presence of the teacher assisted learning media in his teaching, because through a medium of learning students can more easily understand the material presented. The negative impact that the difficulty teachers to monitor the use of android by students. Android provides many features, so it is possible that students turn to other features not related to learning. This is certainly a problem for the teacher in the classroom condition.

How to overcome the negative impact of a media that is used so as not to interfere with or impede the learning process needs to be minimized. Teachers need to supervise children in the use of android applications, because if not supervised children can open applications that are not good and can interfere with learning. In addition, teachers should also continue to combine teaching, do not always use the media or applications that remain creative teachers and students do not become dependent.

IV. Conclusion

The development of technology has given new innovations in education so that students can learn anytime and anywhere without being limited space and time. Studies of the technology that has brought benefits and convenience by applying mobile technologies (such as digital personal assistants, smartphones, and laptops)
to the learning activities in various subjects such as science, social science, and linguistics. The technological devices used in the study should be seen as a supporter and can not replace the existing learning tool. In addition, not all types of learning content and learning activities appropriate for the device technology. So that the necessary measures as the spearhead education teachers in selecting appropriate technologies with their lessons. Developing technology in education must continue to be made for the creation of a quality education.

REFERENCES

DIFFERENCES IN STUDENTS’ CRITICAL THINKING SKILL USING LEARNING MODEL OF NHT WITH TPS

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Abstract—This study aims to determine the differences in critical thinking skills of students who use the learning model of NHT with TPS in animal development course. The research was conducted at the University of Muhammadiyah Bengkulu with participants were students in the 7th semester who are following the animal development course. The study used a quasi-experimental with pretest - posttest control group design, with a class as control and two classes as an experimental class with the total number of students are 143 people. The treatment is given in the form of animal developments learning development of animals by using Numbered Head Together and Think Pair Share. Data were analyzed with normality test, homogeneity test, ANOVA test one lane, and post hoc test. Based on the results of the study showed that: 1) There is a real difference of students' critical thinking skills that are taught with NHT and TPS methods compared with students who are taught Conventionally; 2) learning model thats more effective to improve students' critical thinking skills is NHT model.

Keywords: Critical Thinking Skill, Learning Model NHT, TPS

I. INTRODUCTION

Education is an important factor in the development of the nation. The education required to further improve the quality of education along with the development of science and technology in the era of globalization are increasingly advanced. Reference [1] was also explained that in the life of a country, education plays a very important to ensure the sustainability of the state and nation, because education is a vehicle to improve and develop the quality of human resources.

Reference [2] was stated that in the 21st century learning skills, creative thinking, making decisions, and solve problems will be much needed in finding a job. Problems that arise are of our education is still dominated by the view that knowledge as a set of facts to be memorized, including the subjects of biology. On the other hand the fact that a lot of learning still centered on the teacher. This happens because these activities are not based on specific learning model so that it also causes a lack of development of students' critical thinking skills.

Reference [3] in his research entitled Collaborative Learning enhances Critical Thinking stated that the definition of critical thinking about is a matter that involves the analysis, synthesis, and evaluation of the concept and stated that critical thinking is also called logical thinking and analytical thinking. Reference [4] was explains that critical thinking is a process and the ability to be involved in making rational decisions about what to do and what to believe. Based on observations of researchers in the learning process subjects animal Development Course at the Faculty of Biology, University of Muhammadiyah Bengkulu, some students have the same weakness, that students tend to pay more attention to learning materials displayed through power point, even some of them are more indifferent to the material presented and has not been able to decipher critically. Therefore, this study aims to look at the different of critical thinking skills students are taught using a model Numbered Head Together and Think Pair Share in the subject of animal development.

II. METHOD

The method used in this study is a quasi-experimental, by dividing the group into two experimental groups and the control group, the experimental group's first with cooperative learning model of Numbered Head
Together (NHT) and the experimental group both with cooperative learning model Think Pair Share (TPS) and the control group with conventional learning or regular. Participants in this study were all students of the 7th semester the Faculty of Education totaling 138 students. The focus of observation in this case study is to see the difference critical thinking skill of students with critical thinking test instrument.

III. RESULTS AND DISCUSSIONS

According to the Table 1 can be seen that for the results of critical thinking skills with significant value is 0.005 <0.05, it could be concluded that the test scores of students’ critical thinking skills in the development of animals are significantly different. This means that the group of experimental class and control class has the ability to think critically is significantly different, which means null hypothesis is rejected, so it is necessary to further test (Post Hoc).

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<th>TABLE 1. ANOVA</th>
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<td><strong>Critical Thinking Skill</strong></td>
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<td>Between Groups</td>
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Based on the research results obtained by data showing at Table 2 that the critical thinking skills of students of biology on the subject of the division and blastulasi there is a significant difference between the classes taught by learning model TPS with conventional this is shown on the probability value sig is 0.006, therefore the probability value (sig) less than 0.05 then the null hypothesis is rejected. Thus, it means the critical thinking skills of students in the subject of animal development between classes TPS – Conventional on the subject of the division and blastulasi significantly different after treated namely learning model TPS.

<table>
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<th>TABLE 2. POST HOC</th>
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<td><strong>Class</strong></td>
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The cause of the differences in the results of critical thinking as presented above is because students who are taught by learning methods Think Pair Share more have more opportunities to explore their critical thinking skills which with a membership of only 2 people only (pairs) so that students have a sense responsibility for what they are learning and methods Think pair Share this requires students to be able to express their ideas in other words, each member (partner) has the same responsibility, so that the student is trying to think of solving a given problem. Unlike the case with classes taught by methods Numbered Head Together which has a total membership of more and does not require each student because the student numbers called which will convey the ideas of the group (call random and luck alone system).

This is supported by the publication of the Journal of Education and Learning Vol. 16, No. 2, October 2009 - See more at: indicates that learning with TPS strategy significantly affect students’ critical thinking skills [5]. Students who learn the TPS strategy to increase average score higher critical thinking skills than students who studied with conventional strategy. Improving the ability of critical thinking can be seen from the increase in the average score of critical thinking skills before treatment (pre-test) compared with an average score of critical thinking skills after treatment (posttest). When exposed on the average score was corrected, then students who studied with TPS strategy is higher than students who studied with conventional strategy.
This is also corroborated by the results of research stated that the implementation of cooperative models learning Think Pair Share is proven to drive the critical thinking skills that increase rise of average value at 1.75 pretest posttest increased to 3.125, an increase of approximately 78.5% [6].

Additionally once applied learning model Numbered Head Together and Think pair Share as a treatment in the experimental class and conventional learning models for the control class, obtained also the data that is based on the above table it can be seen that for the test scores critical thinking skills that are not significantly different is between classes taught by NHT and conventional methods. This is evidenced by the significant value is 0.148> 0.05. This is because the classes are taught conventional learning model NHT and tend to have skills in critical thinking that is relatively similar course in terms of responsibilities and opportunities. It can be shown from the learning process in which classes are taught by conventional methods that despite giving an opportunity to all students to be able to explore their ability to solve problems when there is a question and answer as well as the class of NHT are not too demanding students to be able to be responsible, so sometimes students just come in, sit down and listen iam only in the sense of students are less active role in the learning process.

IV. CONCLUSIONS AND RECOMMENDATIONS

From the research results with some of the findings it can be concluded that: There is a noticeable difference the critical thinking skills students are taught with methods TPS compared with students who are taught by NHT and conventional methods. The learning model is more effective to increase critical thinking skills is a learning model TPS. For a teacher / lecturer of biology to be more enhanced understanding of the learning models that can improve upon ability to think critically, especially learning model Numbered Head Together and Think Pair Share.

REFERENCES

CHARACTERISTICS OF TEACHING MATERIAL CONSTRUCTION INTERMOLECULAR INTERACTIONS USING CONTEXT BASED INKJET PRINTER COMPARISON OF PRE CONCEPTION STUDENTS AND PERSPECTIVES SCIENTIST

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Abstract--The study was conducted to investigate the characteristics of teaching materials using intermolecular interactions that context inkjet printer. Construction of teaching materials is done based on a comparison between pre-conception learners with scientists perspective of the context of inkjet printers, content intermolecular interactions and relations between them. The method used in this research is descriptive analysis that refers to the Model of Educational Reconstruction (MER), which is limited at this stage of clarification and analysis of science content. The instruments used are pieces of text analysis, and design validation sheet teaching materials. The research data obtained in the form of text analysis results, and the results validate the design of teaching materials. The results of the research are teaching materials that have characteristics (a) was developed based on the reflection of a pre-conception of learners and the perspective of scientists, (b) are developed in accordance with the cognitive level of learners who can meet the criteria for accessible, and (c) Design of teaching materials using a sequence of teaching and learning of Science and Technology Literacy (STL) by adopting a learning phase Chemie in a context (Chik).

Keywords: Intermolecular interactions, Inkjet printers, Model of Educational Reconstruction

I. INTRODUCTION

The educational process in the school have the aim that learners are able to learn about ourselves and the natural surroundings, and are able to develop and apply their knowledge in everyday life [1]. The tendency in science learning is now more emphasis on understanding the concept of matter, without reference to the functions of life such as relationships to the environment, health and society. Learning science is often considered separate from everyday life.

Ability learners in understanding science, communicate and apply the scientific knowledge to solve problems in the environment called the scientific literacy [2]. Literacy is measured on an international assessment programs, namely the Programme for International Student Assessment (PISA). This study was developed by some developed countries in the world that are members of The Organisation for Economic Cooperation and Development (OECD) based in Paris, France. PISA study results show that the mastery of science literacy learners Indonesia in 2000-2012 remained at low levels. The results of the latest PISA study in 2012 revealed that learners Indonesia was ranked 64th out of 65 participating countries.

And the results of PISA 2012 also show that most learners Indonesia was only able to apply scientific knowledge to situations that are familiar to him, as many as 41.9% at the level 1 and 24.7% at the level below 1. While on level 2, 26.3% of students, level 3, as many as 6.5% of learners, and level 4, only 0.6% of students. However, none of learners Indonesia were able to reach level 5 and level 6, which is the ability to identify the components of scholarly life situations are complex, applying scientific concepts and knowledge about science,
compare, select and evaluate appropriate scientific evidence for responding to a situation life. According to the PISA scale applied, the new Indonesian students are able to achieve a low level which is at the stage of the ability to explain the concepts are simple [3].

According to Firman low level of scientific literacy learners Indonesia allegedly for curriculum, learning and assessment is done does not support the achievement of scientific literacy [4]. In this study developed teaching materials to apply the technology of inkjet printers on the learner SMA into the material intermolecular interactions through the principles and framework of teaching literacy in science and technology (Science and Technological Literacy, STL) developed Hollbrook [5][6] and Nentwig [7]. The materials are selected based on the three principles of the selection of the content of science in PISA, the concept is relevant to the situation of daily life are real, the concept would still be relevant at least for the next decade, and the concept is closely related to the competence [8]. The subject matter of intermolecular interactions are SMA material contained in the first half of the tenth grade. The concept of interaction between the molecules is thought to have met the selection criteria in the PISA concept.

The research problems are how the construction characteristics of teaching materials using intermolecular interaction context inkjet printer based on a comparison of pre-conceptions of learners and the perspective of scientists?

II. LITERATURE REVIEW

A. Science Literacy

In the assessment process, there are four aspects of the PISA 2012 include aspects of context, aspects of knowledge, aspect of competence and aspect of attitude. First, an introduction to aspects of the context of situations in everyday life that involve science and technology. The situation can introduce science is through the application of science such as health, natural resources, environmental toxins and the limits of science and technology.

The second aspect is the knowledge-based understanding of the nature of scientific knowledge, including knowledge of science and knowledge about science. Knowledge of science is knowledge needed to understand nature and to create a sense or feeling to the experience of personal, social and global. Measurement of knowledge can be seen from several fields of science such as physics, chemistry, biology and earth and space science. Measurement of this knowledge must meet several criteria: relevance to real-life situations, the use of the concept in the long term, and must comply with the development of the age of learners. Knowledge about science is knowledge related to scientific inquiry and scientific explanations.

Thirdly, aspect of competence is the ability to identify scientific issues, explaining phenomena scientifically, and using scientific evidence and make a conclusion. This aspect is an aspect that is the most priority in the assessment PISA 2012.

The assessment of scientific literacy in PISA is not solely in the form of measuring the level of understanding of scientific knowledge, but also an understanding of the various aspects of the process of science, as well as the ability to apply the knowledge and the process of science in the real situation facing learners, both as individual, community members, as well as citizens of the world.

The fourth aspect is the aspect of attitude, which in this aspect indicates an interest, support for scientific discovery and sense of responsibility of students to science itself. This aspect is very important because the purpose of science education is that the students have fared better attitude after learning science attitude towards oneself, and as part of society.

PISA as one of the programs in science literacy learners assessing scientific literacy divide into three domains in the measurement, the content of science, the science process, and the context of the application of science. Shwartz, Ben-Zvi, and Hofdtein adds aspect attitude (affective aspect) into the domain of scientific literacy [9]. Based on this, the scientific literacy in the PISA assessment not only measures the level of understanding of scientific knowledge, but also an understanding of the various aspects of the process of science, as well as the ability to apply the knowledge and the science process in real situations faced by learners [4].

B. Teaching materials

According to Dick and Carey is a set of teaching materials are arranged systematically, figures show full of competencies to be mastered by learners in learning activities [10]. Toharudin, Hendrawati, and Rustaman
stated about the importance of teaching materials to support learning success [2]. Teaching materials can help connect the experience with the knowledge of learners. In this case the teacher should be able to pick and choose the right things, the right concept and suitability of their application in life. Through teaching materials, teachers will be easier to carry out learning and learners will be helped in learning.

The role of teaching materials is very important for the function of the teacher can be played by the instructional materials. Therefore, teaching materials should be made in accordance with the needs and characteristics of teaching materials that will be presented. According to Anwar [11], so that teaching material has a shape that fits the needs and characteristics of teaching materials, then there are four stages in the creation of teaching materials, one of which is reduction. Reduction is the process of reducing the level of difficulty of teaching materials. At this stage reduced Didactic teaching materials, taking into account the psychological aspect and science, so that teaching materials that have experienced this reduction can be understood by learners easily. There are several ways to reduce the level of difficulty of teaching materials, namely: back to stage qualitative, use of explanation in the form of pictures, use of analogy, use development level history, and generalization [11].

In addition to the reduction, to control the work of writing the text overall teaching materials (textbooks), then of each chapter or subject instructional materials is conducted discourse analysis, which analysis can be done by refining the text [12]. Text smoothing process is done in two ways: removal and insertion of the word. It aims to improve the accuracy and clarity of the text, so that the connection between one paragraph with a paragraph that would otherwise be maintained.

III. RESEARCH METHODOLOGY

The method used in this research is descriptive analysis that refers to the Model of Educational Reconstruction (MER). MER research design developed by Duit consists of three components, namely: 1) clarification and analysis of science content; 2) research on teaching & learning; and 3) design and evaluation of teaching and learning environments [13].

This study is limited to the second component of the MER is at the research stage learning process in the form of an empirical study of pre-conception learners. The subjects were ten students of class X SMA and textbooks related to the content and context. The research instrument is the interview guidelines and format text analysis. The format of interviews and a questionnaire adapted from Laherto to explore the pre-conception learners about the concept of intermolecular interactions, inkjet printers and relations between them [14]. Acquisition of the data in the study came from the results of the instrument validation conducted by five experts.

IV. RESEARCH RESULT

Based on interviews of learners and the content of text-context analysis, results are obtained in the form of an overview of the pre-conception learners and scientists perspective to the concept of intermolecular interactions, inkjet printers and relations between them. Comparison of pre-conceptions of students and scientists into perspective reflections in the construction of teaching materials. In accordance with the MER is used as the design of the study makes the pre-conception of the learner as an important part in the construction of teaching materials.

Duit stated that it understood the pre-conception of learners it is equally important to understand the learning content [13], so that pre-conception learners can not be ignored but rather become an important point in starting the construction of teaching materials. Based on this, the characteristics of teaching materials using intermolecular interaction context inkjet printers are based on a comparison of pre-conceptions of learners and the perspective of scientists described as follows:

A. Instructional Materials Developed by Reflections of Students Pre-Conception and Scientists Perspective

Based on interviews and the results of text analysis that has been done in the study, then the pre-conceptions of learners and the perspective of scientists can be compared as a reflection on teaching materials. Comparisons are made to the concept of intermolecular interactions, inkjet printers and relations between them. Comparison of pre-conceptions of students and scientists perspective to the concept of intermolecular interactions can be seen in Table 1.
Intermolecular interaction term is already familiar to the learner. In general, students have been familiar with the term intermolecular interactions, but do not understand the concept of intermolecular interactions. While scientists revealed that the concept of intermolecular interactions related to the interaction that occurs between molecules that are affected by the distance between the molecule, where each of these interactions have different strengths as determining the physical properties of the material. Therefore, as a reflection of the condition like this, then students should be given a clear and attractive exposure through teaching materials.

Exposure clearly the intermolecular interactions is given by analogy with magnetic poles that will pull if different pole brought near. The magnetic force will be reduced if the distance increases, so does the intermolecular interactions. Exposure of interest presented during the implementation of the concept of intermolecular interactions in the molecules making up the ink.

Furthermore, the reflection of a pre-conception of learners and expert perspectives on the concept of an inkjet printer is shown in Table 2. There are four pre-conceptions of learners who are less precise about the concept of an inkjet printer, which is on the types of printers, where the distance between the ink storage area with paper, important components of inkjet printers and inkjet printer behavior

<table>
<thead>
<tr>
<th>Pre-conception of Students</th>
<th>Science perspective</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Learners view that all printers are the same.</td>
<td>1. The printer can be classified into three types namely dot-matrix, inkjet and laser jet.</td>
</tr>
<tr>
<td>2. Learners describe as though the inkjet printer ink that is applied or added to the paper.</td>
<td>2. Ink droplets sprayed from a nozzle and projected onto the substrate without contact between the printhead with the substrate.</td>
</tr>
<tr>
<td>3. Learners only recognize components of the outside of the inkjet printer.</td>
<td>3. Important components of the inkjet printer is the paper, ink or dye and printhead</td>
</tr>
<tr>
<td>4. Learners who do not know how to work an inkjet printer.</td>
<td>4. Inkjet printers work by spraying droplets of ink are very small on paper.</td>
</tr>
</tbody>
</table>

From Table 2 shows that there are four differences between learners with the conception of scientists against the concept of an inkjet printer, then do a reflection so that students understand the concept of the actual inkjet printer. First, learners assume that all printers are the same because it is seen as a tool that is equally being used to print.

While scientists distinguish three types, namely printer on a dot-matrix, inkjet and laser jet. Dot-matrix printer is a printer that uses the ribbon as a means of printing, inkjet printers use liquid ink and laser jet printer is a printer that uses ink powder and heat. Based on this difference, the reflection is done by providing an introduction prior to the kinds of printer inkjet printer before discussing in particular. It is expected that the students have integrated knowledge about the printer is in the vicinity.

Furthermore, in Table 2 are also visible differences between pre-conception learners with expert perspective in terms of describing the distance between the printhead with paper. Learners assume there is no distance between the printhead with paper, but scientists claim that there is no contact between the printhead to the paper, that is to say between the printhead and the paper contained within. As a reflection of pre-conception learners are then given a clear picture on the teaching materials through pictures

From table 2 also seen the difference between pre-conception learners with expert perspectives on critical components on an inkjet printer. Learners only know that the paper and ink is an important component, but scientists assume there are several important components of an inkjet printer. So, as a reflection of pre-conception of learners, at the beginning of teaching materials were introduced to these critical components.
A final distinction between the concept of inkjet printers pre-conceptions of learners with a scientist's perspective is about how the inkjet printer. Some learners are not able to distinguish between the workings of the inkjet printer by way of the use of the printer, so that a reflection on pre-conceptions such learners. Reflection is done in the form illustrates how an inkjet printer.

B. Instructional Materials Developed in accordance with the Cognitive Level Learners to Meet Criteria Accessible

By knowing the comparison between pre-conception learners with the perspective of scientists can develop teaching materials accessible. Teaching materials are accessible instructional materials easily accessible or easily understood learners. In this study, accessible instructional materials designed to match the cognitive level of learners through three ways:

1) Analysis of PISA 2012 and Curriculum 2013

Developed teaching materials adapted to the four aspects of the measurement of scientific literacy in PISA 2012. The four aspects that include aspects of the context, aspects of knowledge, aspect of competence and aspect of attitude, which aspect of one with the other aspects are interrelated. The fourth aspect is that a reference in designing the indicator and learning objectives in teaching materials.

First, an introduction to aspects of the context of situations in everyday life that involve science and technology. In this study the authors using inkjet printer technology context. Context have been selected for inkjet printers have become technology that is widely used by the community, especially for learners. It can be seen from the results of interviews of students who showed that 100% of students already know and never use an inkjet printer.

Secondly, this text was developed based on the aspects of chemical knowledge which is expected learner is able to bring a sense of their experiences while interacting with an inkjet printer. The concept of intermolecular interaction implemented into the phenomenon of the originators of the ink and ink on paper dependent phenomenon. So that students understand how science affects a printout.

Third, aspects of competence in the teaching materials developed so that learners are able to identify scientific issues, explain phenomena on an inkjet printer, and use the scientific evidence and make a conclusion. This aspect is contained in the indicator and learning objectives.

The fourth aspect is the aspect of attitude, which in this aspect indicates an interest, support for scientific discovery and sense of responsibility of students to science itself. This aspect is also visible on the indicator and learning objectives. The fourth aspect of scientific literacy PISA 2012 above, the only aspect of competence and attitude aspect became a reference in designing the indicator and learning objectives in teaching materials. In addition, indicators and well adapted to the learning objectives of core competence and basic competence in curriculum in 2013.

Curriculum Structure in 2013 for organizing the high school level is a core competencies (KI) and basic competencies (KD), where Kompetensi Inti are formulated into four aspects, namely competence spiritual, social, knowledge and skills. Based on the review of the dimensions of scientific literacy in PISA 2012, KI and KD in curriculum in 2013 we conducted the formulation of indicators and learning goal of cognitive aspects and aspects of attitude. In this study, the content is limited to intermolecular interactions of matter which is sub-chapter of the chemical bonding material. Indicators and learning objectives formulated by analyzing the context of an inkjet printer, the content analysis of intermolecular interactions and analysis of scientific literacy.

Indicators and goal of learning is validated by validator five people consisting of three lecturers and two high school chemistry teacher. Validation is done to the conformity of the indicators with KI-KD, suitability indicators with aspects of competence or attitude aspects of PISA 2012, the suitability of goal of learning with indicators.

Indicators and cognitive aspects of goal of learning are based on the demands of the curriculum where competence basically want learners are able to compare the intermolecular interactions. Cognitive
processes compare involves a process of detecting similarities and differences between two or more concepts. Compare include searching for one-to-one on the concept of intermolecular interactions [15].

This relationship can be achieved in three steps, the first concluded, namely the activities of abstracting a rule of familiar situations, both implemented, the rules that apply in situations that are less familiar, and third comparing, that reasoning by analogy. By doing these three steps, then the learning process is not only focused on memorization, but will create meaningful learning, in which learners will be able to construct new knowledge or resolve new problems. Therefore, the first indicator to a fourth form of the process of concluding and implementing

While indicators of the fifth to eighth form of the process of distinguishing, attribute and analyzing. It is influenced by the demands of basic competence be analyzed. The process of analyzing an activity that involves a process of breaking down the material into small parts and defines the relationships between parts and between each part and the whole structure. The process of analyzing includes cognitive processes differentiate, organize, and attribute [15]. Process distinguish conducted to determine the pieces of information that are relevant or important. The process of organizing a process of determining the ways in arranging the pieces of the information. While the process is the process of determining the attribute information purpose behind it. Thus, the indicator fifth to eighth form of the process of distinguishing, attribute and analyzing. Therefore, for the cognitive aspects indicators obtained 8 and 13 learning objectives are valid.

Indicators and goal of learning attitude aspect created by the demands of the curriculum where competence basically want learners are able to demonstrate the behavior responsive and pro-active and prudent in solving problems and making decisions. Aspects attitude also involves the process of interest, support and sense of responsibility of students towards science. So we get the 5 indicators and five goal of learning attitude aspect valid.

2) Analysis of Literature

In this study, there are several sources referenced in analyzing the qualitative content and context. The following textbooks used :

<table>
<thead>
<tr>
<th>No</th>
<th>Books title</th>
<th>Author</th>
<th>Publication Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chemistry The Molecular nature of matter</td>
<td>Jesperson, Brady, Hyslop.</td>
<td>2012</td>
</tr>
<tr>
<td></td>
<td>(Reference [16])</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Interactions of Digital Inks with Textile and Paper Substrates in Ink Jet Printing (Reference [17])</td>
<td>Dr John Provost &amp; Dr Aidan Lavery</td>
<td>2009</td>
</tr>
<tr>
<td>3</td>
<td>Inkjet Printing Technologies(Reference [18])</td>
<td>Alan Hudd</td>
<td>2010</td>
</tr>
<tr>
<td>4</td>
<td>Ink Requirements and Formulations Guidelines</td>
<td>Shlomo Magdassi</td>
<td>2010</td>
</tr>
<tr>
<td></td>
<td>(Reference [19])</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Solvent Based Inkjet Inks (Reference [20])</td>
<td>Josh Samuel and Paul Edwards</td>
<td>2010</td>
</tr>
</tbody>
</table>

Of the five textbooks on top, just book Jesperson et al "Molecular Chemistry The nature of matter" which is used for content analysis of intermolecular interactions. These books have been selected for content material intermolecular interactions are presented in full and is supported by many pictures that will facilitate the understanding of the content. However, deficiencies contained in the book comes from text books to another.

Meanwhile, four other textbooks used to analyze the context of an inkjet printer. The use of text books for more context than on textbooks for content. This was done in order to obtain information that is as much about the inkjet printer ink, paper and ink interaction with the paper. This information supports the full instructional materials will be developed. The information obtained is not all presented in teaching materials, but the reduction will be carried out to select the main points of an inkjet printer that relate to the content of intermolecular interactions.

The analysis grouped into the analysis of the content and analysis of context. Content analysis based on the book Jesperson, where the material is important that learners should be known to be translated into easily understood language. As well as context analysis, not all the material in context but have taken part
needed by learners only. So found a connection or relationship between the content of intermolecular interactions in the context of an inkjet printer. Connectedness it looks like in the Table 4 below:

<table>
<thead>
<tr>
<th>Content</th>
<th>Context</th>
<th>Related of content-context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding the interactions</td>
<td>Inkjet printer ink</td>
<td>The interaction of molecules of ink</td>
</tr>
<tr>
<td>intermolecular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dipole-dipole interactions</td>
<td>Solvent inkjet printer ink</td>
<td>The interaction between polar</td>
</tr>
<tr>
<td></td>
<td></td>
<td>molecules with polar molecules</td>
</tr>
<tr>
<td></td>
<td></td>
<td>of the solvent inkjet printer ink</td>
</tr>
<tr>
<td>The hydrogen bond</td>
<td>Paper and ink inkjet printer</td>
<td>The interaction between the dye</td>
</tr>
<tr>
<td></td>
<td></td>
<td>with cellulose molecules on paper</td>
</tr>
<tr>
<td>Dispersion London</td>
<td>Dye ink</td>
<td>The interaction between non-polar</td>
</tr>
<tr>
<td></td>
<td></td>
<td>molecules with non-polar in the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>dye inkjet printer</td>
</tr>
<tr>
<td>Surface tension</td>
<td>Quality Print Head</td>
<td>Factor in the ink surface tension</td>
</tr>
<tr>
<td></td>
<td></td>
<td>will affect the quality of the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>printhead</td>
</tr>
<tr>
<td>Viscosity</td>
<td>Droplets of ink on the nozzle</td>
<td>Droplets of ink on the nozzle is</td>
</tr>
<tr>
<td></td>
<td></td>
<td>affected by fluid viscosity ink</td>
</tr>
</tbody>
</table>

After conducting an analysis of the content and the context, it received respectively the content and context of the original text, the original text later merged and became a joint text-context content. The joint text was the result of a direct translation of textbooks, so it might have words or phrases that are less obvious. Therefore, the combined text-context content should be smoothed through the smoothing process and reduction. Smoothing process and didactic reduction is done as the first component of the implementation of the MER ie clarification stage and the analysis of the structure of the content.  

3) Classification and Modify Text

Clarification and modification of the text is one important part that is done on the first stage MER. In this stage, the text elementarisasi process and the reconstruction process text. In this elementarisasi, the structure of science content in the form of the original text is analyzed using a text analysis form, which at this stage will be seen how the concept of intermolecular interactions and the concept of inkjet printers as well as their relationship according to the expert perspective. Text analysis is done in order to obtain the basic concepts. This is in accordance with the purpose for which elementarisasi on MER. Furthermore, the basic concept is validated to obtain valid concepts.

The basic concepts acquired in the process of this elementarisasi rebuilt (reconstruction) into the structure of the learning content in the form of a basic text. This process is carried out with the reduction phases of didactic and discourse analysis. Reduction didactic done to reduce the level of difficulty of concepts to be written in the textbook, so that teaching materials be more easily understood by the learners. There are eight ways in reducing a textbook, but in the design of these materials are not all means are used, but adapted to the needs and the results of the investigation pre-conception learners

In this text the reconstruction process more researchers focus on how the waiver and the annotations in the form of images, as well as the use of the level of development history. After performing the reduction didactic discourse analysis in order to proceed with the delivery of material on teaching materials can be controlled in terms of content and context. In the refining process of discourse analysis is done in order to instructional materials to be more precise and clear, where the words are redundant abolished but not limit the meaning, and then inserts the words in order to be more meaningful sentences.

Having obtained the respective basic text of the content and context, we conducted the incorporation of text, called the composite-context content. Although it has gained the teaching materials have been reduced and smoothed, but the didactic reduction process and smoothing process is still being done continuously as needed to obtain teaching materials are ready to be validated.

C. Subjects Using Sequence Design for Teaching and Learning of Science and Technology Literacy (STL) with Adopt Phase Learning of Chemie Im Kontext (ChiK)

Teaching materials are designed according to the stages of learning Science and Technology Literacy (STL), which was adopted from the stages of project learning Chemie im a context [16],[7]. The order of the stages of learning include contact stage, kuriositi, elaboration, decision-making, and the nexus. By following the stages of learning the STL, it is expected that learners can develop the thinking process and can connect
between the material intermolecular interactions with inkjet printers. Here is the sequence of teaching materials adapted to the STL criteria, namely:

- **Phase Contacts**
  
  At this stage of contact learners are introduced to the development of printer technology ranging from the simple to the most complex. In addition students are also given a description of some types of printers working principle is different from the inkjet printer. This needs to be introduced because generally students considers that all printers are the same. At this stage these contacts submitted that there are three types of printer technology, the dot-matrix printers, inkjet printers and laser printers. So it is expected that learners are able to think about the integral development of printer technology.

  After being introduced to other types of printers, the students focused back on one type of printer is an inkjet printer. Learners are introduced to the definition of an inkjet printer, inkjet printer history, the types of inkjet printers and also some important components that should be known by learners. Contact stage is equipped with pictures to facilitate learners to understand the inkjet printer.

  In addition, at this stage of contact with learners assisted introductory sentences and questions of inquiry. This serves to instill social values and sensitize learners that scientists use scientific concepts to solve the problems and meet the needs of the community. Scientific concepts and social needs will bring forth creativity, learners are expected to be motivated for creativity.

- **Phase Kuriositi**
  
  On stage kuriositi teaching materials designed to present questions that can raise the curiosity of learners. As an example comparing a clear photo (durable) and photos that quickly fade. From this comparison emerge curiosity can cause a long lasting photos and others do not. Questions granted in accordance with the facts that occur in everyday life. With the knowledge they gained from various sources and explanations at the stage of elaboration in teaching materials is expected learners are able to resolve these problems.

- **Elaboration Phase**
  
  At the stage of elaboration of the teaching materials developed based on indicators and cognitive aspects goal of learning and aspects of the attitude that has been validated. Stabilization of the concept given by explaining the concept of intermolecular interactions with its types and implement the concept of the phenomenon on an inkjet printer. Establishment and strengthening of this concept is expected to answer the questions that appear on stage kuriositi.

  The design of instructional materials at the stage of elaboration can be grouped into five sections. The first part of the definition of intermolecular interactions. On teaching materials do not provide special sense, because it is expected that learners can conclude their own definition of intermolecular interactions by the explanation given. The second part of the dipole-dipole interactions. In this section are expected to learners also able to conclude the definition and apply the concept of dipole-dipole interactions in the molecules making up inkjet printer ink. To achieve the goal of learning, learners previously been given a discourse on inkjet printer ink. The third part of the hydrogen bonds. In this section is expected that learners are able to conclude the definition and apply the concept of hydrogen bonds in the molecules making up inkjet printer ink. In addition to applying the concept of the molecules making up the ink, in this part of the concept of hydrogen bonding is also applied to dye interaction with paper.

  The fourth part of the London dispersion. In this section is expected that learners are able to conclude the definition and apply the concept of dispersion London on constituent molecules inkjet printer ink. Moreover, in this part of London dispersion concept is also applied to the interaction of the dye, so that learners can distinguish between good and not ink. Furthermore, the fifth part of the surface tension and viscosity. In this section is expected that learners are able to conclude the definition and apply the concept of surface tension and viscosity of the ink droplets and also in the treatment of printhead inkjet printers. In addition, learners are expected to also be able to analyze the effect of surface tension and viscosity of the resulting image quality.

- **Phase Decision Making**
  
  Decision-making stage is obtained after conducting an analysis of intermolecular interactions making up the ink and dye interaction with the paper. This phase emphasizes the answers to the questions contained in kuriositi stage. Learners are invited to choose the type of solvent and dye inkjet printers are not only
concerned with image quality print-out alone, but also consider the environmental, health, and economic posed of inkjet printer technology.

- **Phase Nexus**
  At this stage there are two phases, namely nexus decontextualization and re-contextualization. In phase decontextualization done making process essence of the explanation of material on teaching materials. Furthermore, the development of the concept with a broader learning context or known as re-contextualization. In this second phase are given a different context However the has a working principle similar to an inkjet printer. In this context it is therefore given on the package labeling of a product, the manufacture of furniture drawings, and graphic format for indoor and outdoor, posters, trade show displays, billboards, and banners.

V. **CONCLUSION**

Teaching materials using intermolecular interaction context developed inkjet printer has the following characteristics: 1) The teaching materials developed by the reflection of pre-conception learners and perspective scientists, 2) The teaching materials developed in accordance with the cognitive level of learners who can meet the criteria accessible, 3) The design of teaching materials using a sequence of teaching and learning of Science and Technology Literacy (STL) by adopting the learning phase of Chemie im Kontext (ChiK).

REFERENCES


**AN EVALUATION OF SCIENCE INSTRUCTION USING CURRICULUM 2013 IN GUNUNGKIDUL**
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Abstract—This research aims to know: (1) the conformity of science lesson plan in Gunungkidul with process standard of education using curriculum 2013; (2) the conformity of science instruction process in Gunungkidul with process standard of education using curriculum 2013; and (3) the conformity of science instruction evaluation in Gunungkidul with process standard of education using curriculum 2013. This research is evaluation research based on CIPP model (context, input, process, and product) with quantitative and qualitative approach. The subjects of this research are science teachers and students in grade VII Junior High School of Gunungkidul. The data were collected by questionnaire, observation, interview, and document checklist. Questionnaire was used to get data about science instruction process: plan, process, and assessment. Observation was used to assess science instruction process. Interview was used to get information about process and problem in science instruction. Document checklist was used to know teacher’s document that was used to support the instruction. Quantitative technique analysis was used to analyze data of questionnaire, observation, and document checklist, whereas qualitative technique analysis was used to analyze data of interview. The result of this research shows that: (1) conformity of science lesson plan using curriculum 2013 in Gunungkidul with process standard of education is appropriate; (2) conformity of science instruction process using curriculum 2013 in Gunungkidul with process standard of education is suitable; and (3) conformity of science instruction evaluation using curriculum 2013 in Gunungkidul with process standard of education is suitable.

Keywords: Curriculum 2013, Evaluation, Science Instruction

I. INTRODUCTION

The good instruction influenced by curriculum that contain programs or lesson plan. Curriculum defined as a guidelines for instruction in the school, so the instruction must be appropriate with curriculum set in a country. In its implementation, curriculum revised and changed for create good quality of education.

Indonesia is one of country that have changed for curriculum in some years. This changed begin in 1947, 1964, 1968, 1973, 1975, 1984, 1994, 1997, 2004, 2006 and 2013. Development of curriculum become curriculum 2013 backgrounded not only by factors about national standard of education but also for draw up productive population who at a guess will be bomb in 2020-2035 [1]. This population be expected become human resources who have good competence and skill through education, and not burden with other human and their country.

Through implementation of curriculum 2013 in instruction process, can be expected that students can integrate knowledge, attitude, and skill for solve phenomena in their live, have curiousity, can formulate the problem and solve the problem, think analysis for decision making, cooperate and colaborate for solve problems, and using scientific approach. Using scientific approach can develop knowledge, skill, and attitude that have activity: observe, ask questions, associate, do experiment, and communicate.

Instruction in school refer to curriculum that implemented at the school, one of lesson is science instruction. According to Permendiknas Number 22 Years 2006 about Standard Content for Primary and Middle Education, science instruction is one of lesson in Junior High School that implemented on integrated science [2]. Science is all about nature that can be investigated by applying scientific method. This is in line with the implementation of curriculum 2013 which puts forward scientific method and the implementation of 5 activity (observe, ask questions, associate, do experiment, and communicate) in all lesson, including science lesson. Through the application of 5 activity in science instruction, students will get learning experience as the scientist in investigate and find natural phenomena and the concept that accompanying.
Through scientific approach, students could investigate natural phenomena there are in daily live. Inquiry in science providing a place to find out and find information as the answer to curiosity arising. Reference [3] science as a way of thinking in the pursuit of understanding nature, as a way of investigating claims about phenomena, and as a body of knowledge that has resulted from inquiry.

Science is one of dioclin that were closely related with daily life. Various a natural phenomena often found is study in science. Reference [4] science is a way of thinking and seeking information to solve problems. Science is both a body of knowledge and a process [5]. Both of the statement can seen that science providing a place to think, search for an information, and solve problems so that it can be form a knowledge through a process. Hence required an inquiry to solve the problem in science to find out the cause and effect that will also caused by the problem using instruction that applying scientific approach or 5 activity.

The implementation of 5 activity at school accompanied by a source of learning. A source of learning of teacher books and student books have provided by the central government so teachers can directly use it in learning and can modify presentation weighting in accordance with the school. Teacher books and student books can be used as a guide to learning science besides also that they are still needed other reference as a companion to furnish or as additional knowledge for students.

The science instruction in junior high school referring to Permendikbud Number 103 Years 2014 about Instruction for Primary and Middle Education. In the minister said elaborated about planning, instruction process, and evaluation in their school’s lessons [6]. Therefore, science instruction in schools are required to be able to make the good instruction planning that can carry out a maximum process of learning and the evaluation process which could reach competence graduates. Planning, process, and the evaluation process that runs well will produce effective instruction of science that would give output having competence, attitude, and skills.

The problems encountered in the real activity are teachers not fully be able to apply curriculum 2013 in science instruction. Teachers Concentration being split when the process learning because have to observe attitudes and student skills and the material that is being taught must be finished soon. The preparation of device of instruction especially lesson plans need a long time in preparing it because adapted to the format of central.

Government regulation related the preparation of lesson plans several times changed so teachers should always adjust by rule the latest. Scientific approach which is typical of curriculum 2013 must be implemented thoroughly that all indicators can observed. In addition, there are instrument of instruction compiled by teachers have not been in accordance with format determined by Mendikbud. Lack of readiness teachers in applying curriculum 2013 in science instruction will have an impact on students as a learners.

Planning to be implemented in a process of science instruction. This instruction was held in three stages, the introduction, the core, and closing. In the implementation of instruction activity, there are students activities that assessed by teachers. Hence to understand the extent of science instruction process, so it need to be evaluation. Evaluation is the process of making judgments about merit, value, or worth of educational programs, projects, materials, or technique [7].

Evaluation model used in this research is CIPP model that include context, input, process, and product. The CIPP model is in line with a system view of education and human services. It concentrates not only on guiding individuas studies, but also on providing ongoing evaluation services to institutional decision makers and other stakeholders [8], so it is fit to evaluate science instruction in junior high school.

II. METHODOLOGY

A. The Kind of Research

This research used a quantitative approach and supported a qualitative approach, the research aimed at gather information on the planning, instruction process, and evaluation of science instruction. Then the information used as the basis or consideration to make policy or decision in relation to the program
concerned. Evaluation model used in this research was model evaluation context, input, process, and product (CIPP). This model suited used in education system because it not only focus on teaching but provide the evaluation services to decision making in an institution and stakeholders.

B. Place and Date of Research
This research is done in Junior High School in Gunungkidul that implemented curriculum 2013. This research was conducted on 2015/2016 years lesson, that is on March until June 2016.

C. Population and Sample
The population are all of teachers and students in Junior High School in Gunungkidul that implemented curriculum 2013 in science instruction which consisted of 5 schools. The sample of this research used purposive sampling that is especially for science teachers who teach in grade VII. This sample are 5 teachers.

D. Data Collection Technique And Instruments Used
Data collection technique in this research is a non test technique, used combine of observation, questionnaire, interview, and documentation. The instruments used in this research are observation sheet, questionnaire sheet, document checklist, and interview.

Observation sheets was used to know instruction process and to know the conformity of implementation of instruction with the lesson plan designed by teacher. Questionnaire sheet were the instruments which include perception of science teacher about process of science instruction in Junior High School involving lesson plan, instruction process, and evaluation of science instruction, also perception of students in the implementation of curriculum 2013 on instruction process and evaluation of science instruction. Document checklist was used to know teacher’s documents for design and evaluate science instruction and the availability of instruction facilities, like books and media that used for science instruction. Interview was used to know lesson plan, instruction process, and evaluation of science instruction, also problems in science instruction process.

E. Data Analyze Technique
This research used quantitative and qualitative technique, that is described data from each aspects evaluated. Data from questionnaire, document checklist, and observation analyzed by quantitative technique, whereas data from interview analyzed by qualitative technique.

Data from respondents answer was scored then totaled, in average, and sought the standard deviation. Then, sought Z score to know the distance of mean in the unit of standard deviation. Calculation of Z score produce negative and positive. Score under mean are negative, to deprive of negative sign so Z score converted to T score. Then the T score grouped in accordance instruction aspect that researched, that are lesson plan, instruction process, and evaluation of instruction. The next step is to do weighting on the T score value and categorized it. Result of interviews analyzed by descriptive qualitative and concluded.

F. The Criteria of Success
The criteria of success in this research should meet the context, input, process, and product. Criteria of success for science instruction reviewed based on characteristics curriculum 2013, that is lesson plan, instruction process, and evaluation of instruction. This characteristics based on Permendikbud Number 103 Years 2014 about Standard Process for Primary and Middle Education. This research is used 5 categories which inludes very appropriate, appropriate, suitable, inappropriate, and very inappropriate.

III. RESULTS AND DISCUSSION

A. Result
The result of the interview to teachers shows that all respondents well understand on the implementation of the curriculum in school as a guidelines for science instruction. The interviews also shows that teachers have some problems during teaching science.

1) Planning Aspect
School that implementing curriculum 2013 are Patuk 2 Junior High School, Wonosari 1 Junior High School, Paliyan 1 Junior High School, Karangmojo 1 Junior High School, and Semin 1 Junior High School. Evaluation of planning aspect of instruction known from questionnaires that filled by teachers consisting of 23 statements and document checklist consisting of 9 completeness documents.

The results of planning aspect evaluation from questionnaires obtained T score model of 55.61, while the evaluation from documents checklist obtained T score model of 56.62. Both of that score given weighting so obtained the number of score 56.11 which are categorized as appropriate.

2) Process of Science Instruction

Instruments used in evaluating process of science instruction are teacher questionnaire, students questionnaire, and observation sheet. Observation sheet was used to observe learning activities ongoing in order to know the aspects or indicators that appear and does not appear during the process of learning.

The results of this evaluation produce T score model from teachers questionnaires 50.09, from student questionnaires obtained T score model of 53.78, and from observation obtained T score model 50. That score given weighting so obtained the number of score 51.11 which are categorized as suitable.

3) Evaluation of Science Instruction

Evaluation for this aspect used teacher questionnaires, student questionnaires, and document checklist. Evaluation results from teacher questionnaires obtained T score model 41.86, from student questionnaires obtained T score model 48.56, and from document checklist obtained 45.04. That score given weighting so obtained the number of score 44.91 which are categorized as suitable. The evaluation of overall obtained for a sum of the number of every score aspect of science instruction in order to obtained 50.71 who are categorized as suitable.

B. Discussion

The results of interviews to five teachers show that in general the teacher understand about the curriculum applied in schools. Teachers also have guidelines standard in the form of a process standard used as a reference in the implementation of the science instruction in school. The results of interviews also showed the problems in science instruction.

The problems that have been experienced by teacher are different, but the majority of teachers says that time that have been prepared for remedial and enrichment used to finish material because of the time learning truncated by preparation class IX for national examination. In addition, there is one of the teacher who had difficulty in carrying out the evaluation for students in science instruction. For the evaluation of three aspects of learning elaborated as follows.

1) Planning Aspect

Evaluation of planning aspect of science instruction was done on the subject of Interaction Living Things to The Environment. The results of planning aspect evaluation shows that planning for science instruction is good, this can be seen from T score of 56.11. Questionnaire hosted by teachers consists of 4 aspects used as indicators to judge planning aspect of science instruction.

In general, planning aspect for science instruction which designed by teachers are good, but one point that are not being met by 4 school that is conformity format lesson plan with format imposed in appendix Permendikbud Number 103 Years 2014 about Instruction for Primary and Middle Education. The results of interviews with science teacher in Wonosari 1 Junior High School, teachers that implementing curriculum 2013 have not fulfilled rules format in the preparation of lesson plans although there was training for the establishment of lesson plans using new rules. This is in accordance with the results of the study that competence of teachers for preparing science instruction need to improved [6].

2) Process of Science Instruction
The result of evaluation of science instruction on subjects of Interaction Living Things to The Environment shows that the process of science instruction is suitable with standard process of education. This category can be seen through the teacher questionnaires, student questionnaires, and observation the process of instruction. In evaluate the performance of learning science there are three the aspects regarded as by teachers, students, and observer, there are the introduction, core activities, and closing instruction.

The evaluation of instruction process shows that teachers have would be good enough in preparing students for the instruction, explain competence to be reached, and give apperception. On core activities, the teacher had been good enough in guiding students do five activity which is typical curriculum 2013. But not all schools can do 5 activity in full, it was because time to learning subjects of Interaction of Living Things to The Environment has been much truncated by preparation national examination for class IX so instruction can’t conducted with lesson plan.

For preparation of class IX to final examination, there are a school that fixed teaching subjects of Interaction Living Things to The Environment. The school have a solution that students class VII and VIII keep learning effectively in school. At the same time to the preparation of national examination, class VII and class VIII study in a certain room so instruction can still effective.

3) Evaluation of Science Instruction

This evaluation using teacher questionnaires, student questionnaires, and document checklist. The result of this evaluation is appropriate enough with standard process of education, which include the application of cognitive, afective, and psychomotor assessment, the technique for assess, and follow up the assessment. Evaluation of science instruction is good enough with T score 44.91. the score is suitable indicates that need to improvement in this aspect, this is accordance with the findings of Ariyanti’s study that the capability of teachers to prepare an authentic assessment still need to be improved [9].

In operations, assessment was done by teachers during science instruction process. In the end of instruction, teachers give assignment project and examination as an assessment for students understanding to subject matter. Based on interview with teacher in Wonosari 1 Junior High School, evaluation based on curriculum 2013 have simplified. In its implementation, teachers do not have to provide an assessment to each students for learning, but the teachers can give special notes for students that have not in doing learning activities. It is easy for teachers in assessing, besides science instruction process also undisturbed.

IV. CONCLUSION

The conclusion of this research shows that:
1. Conformity of science lesson plan using curriculum 2013 in Gunungkidul with process standard of education is appropriate.
2. Conformity of science instruction process using curriculum 2013 in Gunungkidul with process standard of education is suitable.
3. Conformity of science instruction evaluation using curriculum 2013 in Gunungkidul with process standard of education is suitable.

V. SUGGESTION

Based on conclusion, there are some suggestions that can be given:
1. Science teachers in junior high school of Gunungkidul are expected to instruction instruments to the rules of the goverment so that every school have a same format.
2. Science teachers in junior high school of Gunungkidul should carry out science instruction accordance to lesson plan that has been done so there match between lesson plan and its implementation in science instruction.
3. The curriculum department in school should provide understanding and motivation to science teachers to improve the performance in science instruction, so the science instruction process can be effective based on process standard of education.
DEVELOPMENT THE ECOLOGY WETLANDS MODULE AND MEDIA BASED OF MULTIMEDIA AS A SUBJECT LOCAL CHARGE IN HIGH SCHOOL

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Abstract—Research on the use of modules and the media in learning and its effect on high school students study results have been conducted, but not many works to develop learning module and media biology based local potential and based characteristic of students. High school in The Hulu Sungai Utara District of having students who are mostly society Dayak Bakumpai tribe in habitating the area of the banks of streams and swamps by utilizing flora and fauna in the area. Therefore instilling the concept of conservation in preserving environment need done early, especially the effort to develop concern of high school students in The Hulu Sungai Utara District against the preservation of the streams and swamps that is a source of community life Dayak Bakumpai. This study attempts to develop ecology wetlands module and media based of multimedia decent and can be taught in high school class XI as a subject charge localized in an effort to form the conservation. The kind of research use is Research and Development (R&D). Eligibility will be assessed based on the validity of module and media obtained from the assessment three experts, two teachers partners and 10 students. Data evaluation experts and partner teachers analyzed using validity criteria of Akbar (2013) and Arsyad (2013). The result showed that module and media developed expressed very valid by three experts and two teachers partner, and students read test were excellent.

Keywords: Validity, Module Ecology Wetlands, Multimedia, High School

I. INTRODUCTION

One of the application of learning individually is to use module. Module can be used to learn independently or individual, because module contain the purpose of learning, sheets a clue about reviewing with modules, media, reading materials, sheets of the answer as over, and assessment. Thus, study results students using module appropriate expected higher than learning conventionally [3]. The use of biology module in school year to year began to increase, but the contents of the module has not been directed. One that can be used to address this issue is the preparation of the modules based local potential so the students get an example or perform learning activity potential in accordance with local [4].

Learning model will go well as the when endorsed by the media in accordance with the character model, material and character students. Media uses proper would cause students can focus on the topic to be learned with the help of the media, so interest and been the motivation can be improved, concentration not easily perturbed, and is expected to learning get better, and consequently the student achievement can be improved [5].

Made enormous gains in information technology and communication able to benefit positive in the development of information technology and hovering important in the days is in the field of multimedia with its convergence of audio and video into one whole to harnessed and applied in education sector. Lessons ecology wetlands relating, to seeking, to some thing information about wetlands are characteristic in South Kalimantan. So Ecology Wetlands not only mastery of knowledge of facts, concepts, or principles but is also a discovery proceedings. Subjects ecology wetlands is expected to become the spacecraft for learners to learn ecosystem are around him, and the prospect of a further development in apply them at in the day.
High schools in Amuntai The Hulu Sungai Utara District have a kid who are mostly the tribe Bakumpai Dayaks. The Dayaks Bakumpai is a nickname for dayaks inhabiting the area of its edges and bogs mostly use of the area. Therefore education and environmental conservation absolutely necessary to improve concern for sustainability natural resources like Undang-Undang Number 5 Years 1990 on the conservation biodiversity, including resource management organic natural. Therefore education and environmental conservation absolutely necessary to improve concern for sustainability natural resources like Undang-Undang Number 5 years 1990 on the conservation biodiversity, including resource management organic natural. It is supported by the results [6] reported that the indigenous knowledge of the community Dayaks Bakumpai to preserve their environment to the children has degredation, especially high school graduates no longer aware of the importance of plants around it, moreover alternative to preserve it.

Based on the above analysis efforts are required to develop concern young generation especially siswa-siswa district high school in the upstream north against the preservation of swamp that is a source of community life Dayak Bakumpai in the area. This report aims to obtain feasibilitly module Ecology Wetlands and media multimedia based learning Ecology Wetlands can be taught in high school class XI as a subject local charge in forming conservation cadres high school students in The Hulu Sungai Utara District research aims to obtain feasibilitly module Ecology Wetlands and media multimedia based learning Ecology Wetlands can be taught in high school class XI as a subject local charge in forming conservation cadres high school students in the upstream northern district.

II. RESEARCH METHOD

Research by is the kind of Research and Development (R&D) who developed module ecology wetlands by Dharmono [7]. The procedure research development adopt procedure Borg and Gall [8] involving five the main steps: 1) an analysis of products will be developed, 2) develop early products, 3) validation experts and revision, 4) testing the field a small scale and revision products, and 5) field trials a large scale and the final product. At this stage new research was undertaken until with validation expert step, validation teachers partner, students read test and the revision of the product. Data collection techniques in accordance with the procedures research development learning. Technique evaluation on the module and technique evaluation on the media using of modification criteria [1]. Research conducted in diskriptif analysis based on library.

<table>
<thead>
<tr>
<th>Score</th>
<th>Point</th>
<th>Expert Validity</th>
<th>Students Read Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>85 - 100%</td>
<td>5</td>
<td>Very Valid</td>
<td>Excellen</td>
</tr>
<tr>
<td>70 - &lt; 85%</td>
<td>4</td>
<td>Valid</td>
<td>Good</td>
</tr>
<tr>
<td>60 - &lt; 70%</td>
<td>3</td>
<td>Quite valid</td>
<td>Passable</td>
</tr>
<tr>
<td>50 – &lt; 60%</td>
<td>2</td>
<td>Less valid</td>
<td>Deficient</td>
</tr>
<tr>
<td>&lt;50%</td>
<td>1</td>
<td>Invalid</td>
<td>Not good</td>
</tr>
</tbody>
</table>

III. RESULT AND DISCUSSION

Based on the assessment by the teachers partners students read test to module developed, can summarized as on a Table 1 the following.

<table>
<thead>
<tr>
<th>No</th>
<th>Criteria</th>
<th>Validity of Expert</th>
<th>Validity of TeacherPartners</th>
<th>Students Read Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Highest</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>2</td>
<td>Lowest</td>
<td>4.0</td>
<td>4.5</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>4.5</td>
<td>4.7</td>
<td>4.7</td>
</tr>
</tbody>
</table>

The Table 1 above it can be concluded, that modules developed according to experts and partner teachers are very valid and according to students is excellen. In other words theoretically procedural ecology and module wetlands developed can be used or worth as teaching material based local on high school student class xi to improve knowledge the conservation of the land and rivers in their area. This is in accordance with [9], stating that matter locally material is the subject matter originating from environmental conditions and the
real and phenomenon be within students arranged systematically which included physical environment, social (cultural and economic), understanding, confidence, and insight local learners itself.

Based on by the assessment, teachers partners and students read test to the media audiovisual developed, can summarized as on a Table 2 the following.

<table>
<thead>
<tr>
<th>No</th>
<th>Criteria</th>
<th>Validity of Expert</th>
<th>Validity of Teacher Partners</th>
<th>Students Read Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Highest</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
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<tr>
<td>2</td>
<td>Lowest</td>
<td>4.5</td>
<td>4.5</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>4.7</td>
<td>4.7</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td>Validation</td>
<td>Very Valid</td>
<td>Very Valid</td>
<td>Excellen</td>
</tr>
</tbody>
</table>

The Table 2 above it can be concluded, that media audiovisual developed according to experts and partner teachers are very valid and according to students is excellent. In other words theoretically media and procedural audiovisual ecology wetlands developed can be used or worth as audiovisual locally media in high school student class XI to improve knowledge the conservation of the land and rivers in their area. Validation users who aims to understand excess or deficiency from the relevance, accuracy, language, also alignment with learning that focused on students, based on this assessment users can inform the improvement developed [1]. Therefore in this research teachers a partner as leading perpetrator material for assess the media developed. Input from experts, teachers partner, and students to perfection media the audiovisual ecology wetlands developed.

Revisions aims to do work or refinement comprehensive to products, so the media in accordance with inputs obtained from activities validation. This activity is request approval process or attestation against conformity with the needs of the media. As confirmed by [10] validation products that aims to obtain recognition of products or endorsement needs so it can and suitable in learning. It is supported by Novana (2014), that media may be prepared based local potential that students get an example or do the learning according to potential local region.

The tests of modules and media at students help scientists determine parts that need revision, so that later produced module and media who easily understood students. The purpose of the individual (students read test) namely to repair a keyboard, sentence unclear, guidance lost or unclear, an example is not appropriate, vocabulary unknown, any figure or yard, and pictures uncommunicative [11].

Students read test in terms of read components, components interactive, the ease of use, students said totally agree module and media developed used in learning Ecology Wetlands. The results of response show that media an easy enough unintelligible because the presentation of the material accompanied picture, associated with knowledge and adapted to experience students. The media can draw, if using illustrations clarify the material understandable students.

IV. CONCLUSION AND SUGGESTION

The result showed that, the module assessment and media average was very good used as learning Ecology Wetlands validator expressed by very valid, scoring by teachers partner very valid, the students read test was excellen. However that module and media developed can be used as required by in the field, need to be taken continuation of this research development, in the pilot or implementation and event.

ACKNOWLEDGMENT

Praise and thanksgiving us prays before The Allah SWT that has been giving mercy and grace, so that this article can be arrayed in accordance with the plan and the time specified. In implementing this research, researchers have received many assistance from various parties both in terms of moral and materially. Therefore on this occasion we thank you and appreciation to all parties involved, either directly or indirectly in the implementation of this research. I realized that the results of this research is not yet perfect, because of that criticism and suggestions for improvement in the future very we expect. Hopefully the result of this research to benefit the education world and improving the quality of Indonesian human resource.
REFERENCES

THE DEVELOPMENT OF ELECTROCHEMISTRY MODULE USING GUIDED INQUIRY APPROACH FOR GRADE XII SENIOR HIGH SCHOOL STUDENT OF RSBI PROGRAM

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Abstract—The content of Electrochemistry topic at RSBI program is deeper and broader compared to that in regular program. The teaching of this topic at RSBI program is student centered and using ICT optimally. A proper learning material is required for chemistry teaching at RSBI. The purposes of this research are to develop Electrochemistry module based on guided inquiry approach and to find out its appropriateness and effectiveness for chemistry teaching at SMA implementing RSBI program. The development of the module adopts 4-D model of Thiagarajan et al. The development consists of four stages, define, design, and develop. The fourth step, disseminate, isn’t done because the developed module is limited to be used for chemistry teaching at SMA Negeri 8 Malang. The appropriateness of module is based on its content, language, and presentation using an instrument developed based on learning material evaluation instrument formulated by Bureau of National Standard of Education (Badan Standar Nasional Pendidikan = BSNP). The effectiveness of the module is based on achievement of minimum completion criteria. Trying out of the developed module to 34 year XII students of SMA Negeri 8 Malang was done to find out the effectiveness of the module. Chemistry lecturers and chemistry teachers assessment give 87.5% appropriateness of content, 85.5% appropriateness of language, and 90.2% appropriateness of presentation. The average score of students’ learning outcome is 78.7 and 55.9% of students achieve minimum completion criteria. Based on this the developed module may be regarded to be appropriate and ineffective to be used in teaching of Electrochemistry topic.

Keywords: Development, Electrochemistry Module, Guided Inquiry, Appropriateness, Effectiveness

I. INTRODUCTION

Electrochemistry is one of chemical topic given to high school students applying RSBI program. Some studies showed that most students have difficulty and misconception in this topic [1-3]. The difficulties were caused by several things. First, most concepts in electrochemistry are an abstract concept that tends to be mastered by the students who have achieved formal thinking level based on the theory of Piaget's intellectual development. Student difficulties in learning abstract materials were presented by many experts [4-6]. Students from different countries and level of electrochemistry topic had the same difficulties, determine electrode and cell potential, identify the cathode and anode, assign the electrons flow in electrochemical and electrolysis cells, also the equilibrium in the electrochemical cell, and predict the electrode and reactions occurred in the electrolysis cell [2]. Second, most of the students who study the electrochemical material have not yet reached the level of formal thinking [8]. Third, the teacher-centered learning generally used verification approach started by an explanation of the material by the teacher followed by an experiment. Fourth, learning process that does not involved models to concrete abstract material to be more easily learned by the students.

Student difficulties in learning electrochemistry may result misconceptions as reported by several studies. Identified misconceptions about the ionization process of electrolytic solution in water, salt bridge functions and reactions that occur in the Galvanic cells, and properties of the electrodes in the electrolysis cell has been
Some misconceptions in electrochemistry topic for high school students related to the identification of the anode and cathode in the electrochemistry cell, understanding the use of electrode potential standards, the direction of electrons movement in the electrochemical cell, charge of anode and cathode, identify the anode and cathode in the electrolysis cell, and predict the result of electrolysis [3].

Implementation of guided inquiry approach in the learning process allows the students active in the learning process and gain a deep understanding. It is believed increasing the student's intellectual capacity. Learning process based on guided inquiry or POGIL (Process-Oriented Guided-Inquiry Learning) emphasized that learning is a process of precise thinking, discuss the ideas, refine the concept, practice skill, reflects the development, and performance assessment are interesting for the students [9]. Research [10] showed that 89% of students who use guided inquiry approach in laboratory activities find it helpful to correlate the chemical concepts with the phenomena occurred in the real world. Learning process using guided inquiry approach is more effective and better engage students in learning [11]. Research [12] showed that the number of students who passed in chemical subjects using guided inquiry learning increases

Supporting the learning process using guided inquiry approach requires a learning material to support the learning process that is able to improve student comprehension and meet the criteria at RSBI schools. Module is one of the learning materials which consists a set of teaching materials presented systematically. It allows the students to learn according to their learning ability without being dependent on others or with very limited guidance from a facilitator or teacher, if necessary. The module is simple, the sentences are easy to understand and able to explain themselves so the students are able to learn independently. The module also makes students actively doing something while learning, such as doing exercises, tests, or practical activities. As a learning material in schools RSBI, the development of module should meets the criteria of RSBI schools. Module was developed using English language, animation, and video to enhance students' understanding at the microscopic level. Students who use animation conceptual learning has a better understanding than students who did not use animation [13,14].

The aims of this research are to develop electrochemical module using guided inquiry approach for high school students of RSBI and determine the appropriateness and effectiveness of electrochemistry modules developed.

II. RESEARCH METHOD

A. Development of Module

Development of Electrochemistry module using guided inquiry approach is based on the model of development of the 4-D (four D model) by Thiagarajan and Semmel. This development consists of four phases: Define, Design, Develop and Disseminate. The fourth stage of the 4D model, disseminate, have not done because the development product is still limited use in SMAN 8 Malang. The purpose of the define phase is set up the instructional design. The main stage in this phase is analysis. The objective of the second stage, design, is to create the basic design of the modules. The third stage aims to produce and develop modules in accordance with the basic design that has been made.

B. Appropriateness Test of Module

The purpose of appropriateness test is to determine the feasibility of the content, language, and presentation of the module developed. Appropriateness assessment instruments used were developed based on the one set of by Badan Standar Nasional Pendidikan (BSNP). Appropriateness assessment was conducted by two lectures and two teachers of chemistry. The data obtained are quantitative consisting of scores and qualitative data consisting of feedback and suggestions from the validators. Module is appropriate to use when it reach score 76 or more of the total score of 100.

C. Effectiveness Test of Module

The effectiveness of the module is determined by the student score to achieve the minimum criteria standard or Kriteria Ketuntasan Minimal (KKM). Module is effective if at least 80% of students get a score of KKM, which obtained a score of at least 78. The module was tested to 34 students of class XII SMAN 8 Malang in order to determine the effectiveness of the modules. The data collected are the score of student learning outcomes after using the module. The instrument used was a multiple choice test consisting of 24
items with content validity of 0.93 and reliability coefficient of 0.88 as measured using Alpha Cronbach equation. The module was used as a learning material for students in remedial teaching. Students did the pretest then they were given remedial teaching using module. Furthermore, the students did the post test. The score of pretest and post test were tested the normality and the differences using Wilcoxon test [15].

III. RESULT AND DISCUSSION

A. Description of the Module

Learning modules of electrochemistry consists of four main parts, pre introduction, introduction, contents, and closing. Pre introductory section contains the cover, preface, table of contents, learning approaches, guides for users (teachers and students), and the curriculum. Introduction consists of mind map, schemes and review of the redox reactions material. The main section consists of two main sub-chapters, Galvanic cells and electrolysis. The first section, Galvanic cell consists of 6 materials, spontaneity of reactions, Galvanic cells, standard reduction potential, cell voltage, Galvanic cells in daily life, and corrosion. The second section, the electrolysis consists of three materials, basic principle of electrolysis, Faraday's law, and electrolysis in daily life. The closing part consists of evaluation tests, answer key, feedback, glossary, and list of references. There are some addresses of websites that can be visited by the students to learn the material with applications, animation, and virtual labs.

B. Appropriateness Test Result

Validations of experts were conducted by chemistry lectures and senior high school chemistry teachers. This assessment includes three criteria, appropriateness of content, language, and presentation. Modules can be considered appropriate to use if the average score of validator more than 75%. Assessments by expert result are 87.5 % for content, 88.5 % for linguistics, and 90.2 % for presentation. Based on these data, module that has been developed are appropriate for student in RSBI high school. Validation summary assessments can be seen in the table 1. In appropriateness test, qualitative data are comments and suggestions from expert validators are used for further revisions.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content</td>
<td>87.5</td>
<td>Appropriate</td>
</tr>
<tr>
<td>Language</td>
<td>88.5</td>
<td>Appropriate</td>
</tr>
<tr>
<td>Presentation</td>
<td>90.2</td>
<td>Appropriate</td>
</tr>
</tbody>
</table>

Qualitative data consist of the comments and suggestions from two lectures and two teachers of chemistry. The module developed was good, but it needs to be added by Nernst equations material. There are some mistakes in writing some words and need to be revised, Print quality must be improved so that will be better and more attract readers. There are some incorrect grammar and need to be revised. Based on the qualitative test results, the learning material was good, language used is easy to understand, but it would be better if use bilingual language, Indonesian and English language. In this case, Bilingual language cannot be implemented because of the purpose of this module to prepare student used to learn in English and Indonesian electrochemistry module are already developed. If using bilingual language likely that most students will choose to read the Indonesian version.

Based on the learning process criteria in RSBI schools, this module was appropriate to use. The contents were deeper and broader because it combines the standard material in Indonesian curriculum, Kurikulum Tingkat Satuan Pendidikan (KTSP) and international curriculum, A-Level Chemistry. Module using guided inquiry approach is believed to improve the thinking ability of students because students are actively involved in learning, such as doing an experiment and gaining knowledge that allows students to discover important concepts. In addition, the students' understanding on the symbolic level, the macroscopic and microscopic is expected may be formed as a full concept by using guided inquiry approach, so it can be avoid the misconception.
Besides using guided inquiry approach, using animation and video are able to enhance students' understanding at the level of microscopic, macroscopic and symbolic level. Animation and video can be downloaded for free on the internet. The learning process is more interesting and students also have a longer time in the learning process due to the use of ICT is not limited in the classroom [16]. The implementation of multimedia in the intermolecular forces material is effective in improving student learning outcomes [14]. Students who use animation have a better conceptual understanding than students who did not use animation [13].

Language problem which often encountered in international schools was the students and teachers ability using English are still limited, consequently the learning process is still dominated by Indonesian. A chemistry teacher said that many students cannot understand the material clearly if the delivery of chemistry lessons using English. This is because the English language proficiency of teachers and students are poor. The students also declared that Mathematics and Science lessons are more difficult when it was delivered in English [17]. It seems that the use of English language was hampered in learning process. It is supported by the results of research [18] which stated that there was a significant positive correlation between language skills (English) with student achievement in chemical bonding material. The development of this module is expected to overcome the language problems. The weakness of the modules is there are some errors of English grammar that cause little difficulty in understanding. Therefore it need to be revised to improve vocabulary and grammatical errors in the module.

In general, the modules have been developed covering all aspects required in learning at school of RSBI. By the development of this module, it is expected that the implementation of learning in RSBI schools can be better and in accordance with the quality standards set by the government.

C. Effectiveness Test Result

The effectiveness of the module is based on the percentage of achievement of KKM. Module considered effective if the amount of the percentage of students who achieve a minimum of 80% KKM. Based on the research results, obtained the value of the average pretest and posttest students at 65.5 and 78.7. Furthermore, this value tested the difference in significance. Test of difference used was Wilcoxon test. Based on the analysis Wilcoxon test using SPSS 16.0 for Windows was obtained value of sig (2-tailed) is 0.00, so the sig (2-tailed) < 0.05. The conclusion is there is a significant difference between pretest and posttest results.

The average score of student learning outcomes after using the module was 78.7 and 55.9 % of students achieved a score above KKM. The average score of student pretest and posttest was increased. The number of students who reached the KKM is less than 80 %. Based on these results, module development results can be considered ineffective for use in learning Electrochemistry.

The weakness in this research is the application of module. The module is used use as learning material in remedial teaching because of the limited time provided by the school. The study should be performed in the classes which have not received the Electrochemistry material. Students learn sequentially using modules that have been developed and analyzed the learning outcomes. Furthermore, the results of student learning compare to the control class that does not use developed module as a learning material. Thus, it can be determined more accurately the differences in student learning outcomes between the using the developed module and do not use. It is expected that the effectiveness of the modules can be known.

IV. CONCLUSION

Based on the discussion result, the module developed is appropriate to use in learning activities in terms of the results the appropriateness assessment of content, language, and presentation by the chemistry lecturers and teachers, but is not effectively used in learning activities because of the limited time in this research. It needs to be tested on grade XII RSBI high school students who have not received Electrochemistry material.

REFERENCES


ANDROiD BASED MOBILE LEARNING AS ONE OF INSTRUCTIONAL MEDIA FOR SCiENCE MATERIALS IN THE 21ST CENTURY

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Abstract – Android based mobile phone is technology which developing rapidly and dynamically. User of android based mobile phone have been increasing every day. The increase was due to some profit for user, such as easy to acces and many features like computer. It does not possibility that mobile phone can used in learning process. One of the benefits mobile phone for education as instructional media that be know as mobile learning. Mobile learning can facilitate learning both in the classroom and outside the classroom that can be accessed anywhere and anytime. The use this instructional media can be support learning process which recommended in the XXI century, where students are asked to learn independently without ignore the technological advances. The purpose of this paper was to determine the extent of android based mobile learning has been used as instructional media for learning science and support as one of the media that is recommended in this XXI century. Literature obtained such as journal, results of research, book, and articles was explained that mobile learning based android can support student learning, especially learning science material related to natural phenomena. By using the mobile learning based android some natural phenomena can be described and explained more detail, so that students more easily understand the subject matter.

Keywords: Mobile Learning, Android, Instructional Media, The 21st Century

I. INTRODUCTION

Education in the XXI century is characterized by an emphasis on a wide variety of skills that must be possessed by students, these skills are: 1) life and career skills, 2) learning and innovation skills, and 3) information media and technology. Life and career skills include flexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, as well as leadership and responsibility. Learning and innovation skills include creativity and innovation, critical thinking and problem solving, and communication and collaboration. Information, media and technology skills include information literacy, media literacy and ICT literacy. All of these skills will not trained easily without applying teaching and learning process appropriate, whether it is from the selection of methods, models, and even instructional media used. XXI century education emphasizes on the use of scientific methods in any models applied learning in the classroom. Through the scientific method inductively students learn to solve problems that appear just like a scientist, so that students can learn actively and more meaningful in understanding a given subject matter. Selection of appropriate learning models merely is not enough to train a wide range of student skills as expected, the selection of instructional media as a means of student learning is also important. Science is one of the subjects who learn about nature in a systematic also emphasized the achievement of XXI century skills, therefore, such a study should require collaboration in the selection of methods, models and instructional media. Studying science means learning everything related to daily life, science learning resources is not only available at the school or in the classroom, but also in the environment. Therefore it requires the appropriate learning resources that students skills can be trained to maximum. One of learning
source that would learn science and in accordance with the progress of science and technology is use of instructional media mobile learning.

A. Learning Science

Science is an organized body of knowledge about nature, it is the product of observation, common sense, rational thinking, and brilliant insights [1]. Science is knowledge or set of concepts, principles, laws, and theories are formed through a process of creative and systematic. Learning science through inquiry, followed by the observation process (empirical) continuously. Science is a human effort that includes mental operation, skill, and strategy to manipulate and calculate which may be tested again the truth and based on the attitude of curiosity (curiosity), strength of the (courage), perseverance (persistence) were carried out by individuals to reveal the secrets of the universe [2].

In learning science, students are directed to act like a scientist using the scientific method to find answers to the concerns raised by a teacher. Learning science using science process skills approach that is divided into basic skills and integrated skills. Science process skills focused on the mindset of scientists in building the knowledge, ideas, information, and communication. These skills can certainly equip students to solve problems, learn on their own, and can appreciate science [3]. There are three elements of science: processes or methods, product, and human attitudes. Processes or methods such as: investigating problems, observing, designing, and carrying out experiments, evaluating data, measuring, and others. Products such as: fact, principles, laws, theories. Human attitudes such as: beliefs, values, and opinion [4].

B. Instructional media

Instructional media is one very important component in the learning process, which became one of the alternative strategies are effective in achieving the learning objectives [5]. Application of media in the classroom can not be separated from the development of science and technology. Media that initially only form only audio or visual, gradually developed into a medium of audio-visual learning. Teachers can incorporate media based visual, audio and kinesthetic convey a subject matter, the incorporation of a variety of media is intended for students with a wide range of modalities can absorb the information conveyed to the maximum [6]. The combination of a wide variety of instructional media is what lies behind the emergence of multimedia. In general, multimedia is the use of multiple media to convey information in a variety of combinations, such as include text, graphics, animations, images, video, and sound. Multimedia project allow students to focus on course content like promote active and cooperative learning, engage students in higher order thinking skills, present and represent the idea though variety of media, manipulated various technology tools on screen objects and information models, locate and determine the best tools and resources for gathering and producing information, critically analyze, evaluate, and organize information [7].

C. Android based mobile learning

One example of multimedia learning emerging today is mobile learning, we known as m-learning. M-learning is a portable media that can be applied on a smartphone. Smartphones use android system, iOS, or Windows Phone. The benefits of the use of mobile learning is: (1) a relatively low cost compared to using a computer or laptop, (2) multimedia fun with a variety of options, (3) continuous and supportive learning situation, (4) decrease in the cost of education, (5) have potential to create a learning experience becomes more meaningful, (6) promote literacy, and participation in education from various circles, (7) using the communication features of a mobile phone as a part of the learning activities such as sending media or text in a file portfolio [8]. Mobile learning is one of innovation that supports education policy world of lifelong learning, which can be done without having to be in school. Mobile learning is an instructional media that is connected with the connection of learning resources both online and offline, so as to increase knowledge anywhere and anytime [9].

According Sugiyarto breakthrough for the development of mobile learning even easier with their various way smartphone or usually referred to by smartphone [9]. Based on data from the Statistics Portal shows that smartphone sales in 2015 was 81.61% for the android system, 15.89% for the IOS system, 1.88% for the system microsoft, 0.31% for RIM system, and 0.32% for other systems [10]. This shows that the smartphone with android system more widely used among the community. Android is an operating system for linux based mobile devices that includes an operating system, middleware and applications that provides an open platform.
for developers to create applications [10]. Android devices combined with a sell more than windows, iOS, and Mac OS devices combined, with sales in 2012, 2013 and 2014 closer to the installed base of all PCs. On July 2013 the Google Play Store has had over one million android apps published over 50 billion apps downloaded [11]. There are many applications relating to media with a wide range of scientific disciplines, mathematics, language, history, science, and others. One form of the optimization the smartphone operating system android is fast program operation and special features a touch screen can be utilized in making a decent learning applications for user [12].

The learning process by using android based learning media can be easily implemented. Android operating system to run on mobile devices is easy and available without coast, Thus making of android application and a simple installation. Also available are many applications that contain learning material is constantly evolving and can be easily accessed by students. For example, students can download and practice short test or quizzes on mobile phone where they prompt feedback is instantly displayed to improve comprehension [13].

D. Android based mobile learning in science education
Mobile technology provides a variety of learning experiences that enable children to make connections based on what they observe, collect a variety of information, and access it at anytime, anywhere, and with anyone [14]. Mobile learning has students in classrooms often working interdependently, in groups or individually to solve problems, to work on the project, to meet individual needs, and to allow for students of voice and choice [15]. Using mobile learning raises new experience in learning that feels quite different from conventional computer based learning system, known as e-learning. Basically, the technology oriented approach allows the achievement of the three pillars in learning activities, namely: individual, collaborative, and situated learning [16].

II. RESEARCH METHOD
The method used in this paper is the method of literature. The literature used include books, journals, and articles. The paper is expected to be used as a resource for other writers, especially for studies related to the instructional media android-based mobile learning.

III. RESULT AND DISCUSSION
Table 1. are shows some results of research on the development of instructional media such as mobile learning. The research obtainable from some literature.

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Year</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The development virtual physic laboratory application “ViPhyLab” based on android smartphone to improve the learning independence and conceptual understanding of rotational dynamics for senior high schiil students</td>
<td>2016</td>
<td>Fitria Suci Arista</td>
</tr>
<tr>
<td>2</td>
<td>The development an android assisted electronic module to improve critical and creative thinking skills of class XI students</td>
<td>2016</td>
<td>Prabawati Budi Utami</td>
</tr>
<tr>
<td>3</td>
<td>The development of interactive multimedia based android on hydrocarbon compound try as chemistry learning for X grade senior high school</td>
<td>2015</td>
<td>Nursetya Danusaputra</td>
</tr>
<tr>
<td>4</td>
<td>The development of android game “chemist to be a millionaire” as learning media on chemical bonding for senor high school grade X</td>
<td>2015</td>
<td>Febry Kurniawan</td>
</tr>
<tr>
<td>5</td>
<td>The development of android mobile learning with app inventor as learning media for students of SMP/MTs on VII grade</td>
<td>2015</td>
<td>Armanda Setyawawan</td>
</tr>
<tr>
<td>6</td>
<td>The development of android based media CAI in sciences subject structure and function of plants networks to grade VII SMPN 1 Tambelang Jombang</td>
<td>2014</td>
<td>Dian Saiful Adiatma</td>
</tr>
<tr>
<td>7</td>
<td>The development of android based media CA in science subject material optical instruments subject eye for class VIII SMPN 1 Plandaan Jombang</td>
<td>2014</td>
<td>Muhammad Hafiz Yusuf Annasas dan Danang Tandyonomanu</td>
</tr>
</tbody>
</table>

Arista make instructional media called the ViPhyLab an android based mobile learning. It can be used for learning everytime and everywhere, contain subject matter explanations, virtual laboratory, exercise, and interactive media display. Validity of ViPhyLab are very decent regarded as a media of learning. There is an improvement of the students learning independence after using the ViPhyLab with p-value <0.05, p-value =
0.000. There is an improvement of students conceptual understanding of the dynamic rotational after using the ViPhyLab with p-value<0.05, p-value=0.000 [12]. Utami conduct research of instructional media development. He developed instructional media is an electronic module android assisted physics. From the media aspects and matter aspect shown about the products is very good category. The results of research also show that there are differences between the experimental class and control class with significance <0.05, it’s describe obut the electronic module android assisted physics can improve critical thinking skills and creative learners [17]. Danusaputra has developed an interactive multimedia android based on the material hydrocarbon compounds. Based on the evaluation the reviewer, who created the interactive multimedia included in the excellent category with ideals percentage of 95%, so the android based multimedia can be declared fit for use as a media of learning and self learning resources [18]. Kurniawan has developed games android, it called chemist to be a millionaires as a medium of learning materials chemical bonds. Based on the assessment of the reviewer found that the developed learning media is very good category with a percentage of 86.4% ideals. Based on the assessment of student learning media included in both categories with a percentage of 80% ideals. Thus, this learning media can be declared fit for use. Students stated that instructional media to be a chemist millionaires an interesting learning media, loving, and increase interest in studying chemistry [19]. Setyawan has developed an android application mobile learning as a medium of learning science. The quality of android mobile learning applications that are developed in very good category, while the response of students to these applications included in the excellent category with a percentage of 90.97% ideals. Thus android mobile learning application that was developed was declared fit for use as a medium of learning [20]. Adiatma has developed android based media CAI on material structure and function of plant tissues. Individual test results are categorized very well with a percentage of 91.18% value, great kelomok test results are categorized very well with the percentage value of 91.91%, and the test results of a large group very well categorized by perentase value of 89.95%. Products developed obtaining excellent category, both media expert validation and validation. This shows that the developed learning media declared eligible or can be used as a instructional media [21]. Annasas and Tandyonomanu has developed an android based CAI media with material optical instruments. The products developed have been validated and tested in class VIII SMP 1 Plandaan Jombang. The results showed that the learning media can improve learning outcomes expressed students with t_cmont > t_table, it is 2.393 > 2.000 [22].

Emphasis achievement against some of the skills that must be possessed by the student makes a teacher or learning developer must be more active in creating innovative learning process. One example is to develop a wide range of learning media as has been done by some researchers that are shown in Table 1. Instructional media created is based instructional media technology, the use of mobile phone based on Android. According to Rosenberg the development of science and technology led to friction in learning, namely: (1) from training to performance, (2) from the classroom into anywhere and anytime, (3) from paper to online, (4) of physical facilities to network, and (5) of the cycle time to real time [23]. The best instructional media is media support the classroom for learning process, with the result that information relating to the subject matter can be delivered for students. Each student in the class has a different learning style, such as learning style of visual, auditory, reading-writing, kinesthetic, or combination of all. The different learning styles of the students’ cause a teacher should be more careful in using or choosing instructional media, especially for subjects that usually requires a visual aid. Science is one branch of knowledge that closely related with our lives. The object of the science is not only concrete that can be studied directly, but also is abstract that can be studied with visual aid. In learning science to describe something that abstract material has needed help use appropriate instructional media. Instructional media that would appropriately used are media that includes multiple learning styles of students, such as used instructional media android-based mobile learning. Today, childrens are already familiar with the use of smartphones based on android, and everyday almost never out of life. Teachers or educational technologist should use this media as a instructional media for students. Thus, students with different learning styles can learn anywhere and anytime.

Development of several android based learning applications on materials science, it show in Table 1, it is describe fact about android based mobile learning can be used as instructional media that can improve student learning outcomes. Android based mobile learning independently support the learning process for their students, because students are using this media can be learn anywhere and anytime. One application learning on android based mobile learning not only can display materials science, but also can display education game.
and video for learning. Video games are existing in the android based mobile learning is usually a set of questions or a problem that deliberately presented by the developer to train thinking skills of students. The end of each game, students will be given score that directly visible, so students can determine the extent to which they understand of the material. Beside that, science material that is abstract can be explained by using video. Some materials of science can not be observed directly using the sense. For example explain material science of solar system. Conventional learning usually explained this material or used visual aid in the classroom. Students were told to imagine “what are explained by teacher”. Learning materials science like that is not apply learning with scientific method and just learned while in the school, so that the XXI century skills of students are not trained well. Using android based mobile learning can resolve this problem. Explanation of abstract material can be helped by using video. Developer of android mobile learning can be apply step by step of learning model with using scientific method, so that students can learn with though step by step of scientific method. Therefore students can train the XXI century skills, in other that using android based mobile learning make students technology literacy.

IV. CONCLUSION AND SUGGESTION

As a teacher and educational technologist is important to develop or using instructional media that takes into account learning style of students. Instructional media appropriate and demands of the times is android based mobile learning. Using android based mobile learning, students can learn everywhere and everytime. Therefore, equalization internet network needs to be done, so that students can more easily to access this media. Research or depelopment of android mobile learning is indispensable to support the adequacy of instructional media in education. Some research has been done can be reference for researchers or other authors.

REFERENCES


ENVIRONMENTAL EDUCATION AT EX-SITU SUMATRAN TURTLE CONSERVATION AREA

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Abstract—Research on development of a learning model for environmental education at ex-situ Sumatran turtle conservation area in the campus of Bengkulu University has been conducted. The research methods were performed to refer on the standard steps of Research and Development. Stage activities were (a) needs analysis, (b) observation of the ecological aspects of the turtle conservation area as a learning resource, and (c) instructional design based on Sumatran turtle conservation area for high school students. Results of observation on the ecological aspects revealed that diversity of plants and aquatic animals (nekton) at the conservation area were sufficient to be used as the learning resource. The instructional design was prepared in three phases activities namely Introduction-Exploration-Explanation (INEXEN), and then it was compiled in a form of book entitled “Out-door Learning Activity based on Surrounding Natural Environment” (OLA-SNA). Results of trial on a limited scale to high school students in Bengkulu City whom were learning to use the INEXEN model at the turtle conservation area indicated that they have a good paradigm to the environment and a tendency to participate on the activities of environmental conservation, Sumatran turtle conservation particularly. The obtained book of OLA-SNA is an alternative for teachers and conservation practitioners in doing the learning activities on environmental conservation which involved public participation.

Keywords: Learning Model, Environmental Education, Ex-situ Conservation

I. INTRODUCTION

Environmental education program in Indonesia has been developed since the international conference of environmental education in Belgrade in 1975. One of the commitment forms to environmental education is the enactment joint memorandum between the Ministry of Education and Culture with the Ministry of the Environment, on the Fostering and Development of Environmental Education. In the implementation phase of the program there are still many obstacles, among others: (a) the school’s commitment in implementing environmental education as well as monolithic integrated is still lacking, (b) teacher education background environment is still lacking, (c) learning tools and teaching materials is still limited. The condition is the determining factor that can affect the sustainability of formal environmental education.

Environmental education in the five ASEAN countries including Indonesia has not been successful. Various factors that caused the failure was partly due to: (a) a curriculum that is limited to the depth and the breadth of the scope of the study, (b) Teachers are less or not trained in teaching environmental education, (c) Teachers are limited by the desire to teach on demand the material that being tested, and therefore does not provide special attention to environmental education, (d) Teaching environmental education tend to the cognitive aspect has not touched the aspects of values and environmental norms that developed in the community, (e) Learning strategies is more oriented on material, (f) Knowledge of local and environmental conditions are less to be used as a source of learning [1]. The conclusion of the study explains that these factors almost found in every Asian country.

The advantage of the environment as a source of learning is very important in supporting the process of student development as a whole because it can involve all aspects of cognitive, affective, and psychomotor of
student. Student involvement with nature during the teaching and learning process will provide the experience and optimal learning results and instill a love of nature around [2]. The availability of learning tools by functioning the environment as a natural laboratory supports the implementation of learning with environmental approach. One example of the environment as a learning resource is a turtle conservation area in campus environment of University of Bengkulu (UNIB) which conducted by Magister Program of Education Science, Faculty of Education, UNIB. The conservation program aims to conserve turtle and as a vehicle for research, education and teaching for students and all students in every level of educators.

Conservation programs that developed is in line with the objective of environmental education which is creating a global community with a concern for the environment and the problems associated within, as well as having the knowledge, motivation, commitment, and skills to work, either individually or collectively in seeking alternatives or giving the solution to the present environmental problems and to avoid the emergence of new environmental problems [3,4]. The approach through education becomes a part that can not be separated from ex-situ conservation programs of Sumatran turtle at the campus of UNIB.

In accordance with the goal of environmental education and efforts to optimize the function of a turtle conservation area, as well as improving the quality of educational learning environment, the learning model is designed to advantage environmental conservation area as a learning resource. Learning model that developed refers to the environmental approach so that learning becomes more meaningful. Learning model that developed is expected to change the student perspective about the environment and encourage the student's participation in conservation activities as a form of environment awarness.

II. RESEARCH METHODS

The development research of learning model refers to Research and Development [5, 6]. The initial step to analyze the need by gathering the information about the environment-based learning in secondary education and the study of ecological aspects in turtle conservation area for learning resources. Based on the information obtained, a scenario designed for environmental education learning model with surrounding natural approach and validated by a science expert and 5 practitioners, who are high school teacher.

Small scale testing of learning models involves 15 high school students and 3 teachers. Learning scenarios is implemented through three stages, the first stage is gaining prior knowledge of students and provide information on work procedures which must be observed at exploratory stage, the second stage is aspect observation aspects of ecosystem ecology of turtle conservation area, and the third stage is verification and clarification of observation data of students, understanding and application of concepts.

The research instrument is a questionnaire about perspective (paradigm) and the tendency of student participation for the environment and the conservation activity of Sumatran turtle. Paradigms data and tendency of student participation on the environment is analyzed qualitatively. The findings in the learning activities becomeevaluation and reflection material of learning models that are being developed.

III. RESULTS AND DISCUSSION

A. Turtle Conservation Area As Learning Resource

Ex-situ conservation area of Sumatran turtle begins to be developed in November 2013 by Graduate School of Science Education with the support of the Dean of faculty of Teachers Training and Education and the Rector of UNIB. Conservation Area consists of three areas, which are, (1)"Taman Pintar", the species of turtle that is released in this area is a Patah Dada (Cyclemysoldhamii) turtle, (2)"Forestry Pond", a conservation area of Batok (Couraamboinensis) turtle, (3)"Pendipa Pond", a conservation area of Pipi Putih (Siebenrockiellacrassicollis) turtle. The conservation area can be seen in the following Figure 1.
In each area there is a pond and marsh ecosystem as a habitat of a type of turtle that is conserved. Physical and chemical conditions in an ecosystem of “Taman Pintar” for over 10 weeks starts from March to May 2016 can be seen in Table 1.

<table>
<thead>
<tr>
<th>No</th>
<th>Parameter</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water temperature (°C)</td>
<td>25°C – 30°C</td>
</tr>
<tr>
<td>2</td>
<td>pH water</td>
<td>6 – 7</td>
</tr>
<tr>
<td>3</td>
<td>Humidity</td>
<td>62% – 67%</td>
</tr>
<tr>
<td>4</td>
<td>Soil pH</td>
<td>6.2 – 6.5</td>
</tr>
<tr>
<td>5</td>
<td>Altitude Air</td>
<td>1.40 – 1.80 cm</td>
</tr>
</tbody>
</table>

Pendipa as conservation areas consist of an area of land with good vegetation, so it’s supportive as a conservation area. These conditions are very different from those in Taman Pintar, vegetation in turtle conservation area types Patah Dada (Cyclemysoldhamii) is very minim, so that some areas needs some plants planting. The results of inventory is the plants that must be collected is preferably the species of plants that can be used as a learning media.

The diversity of animals that are often found in an ecosystem conservation areas includes several groups of swamp fish such as “gabus”, “Sepat”, and “mujair”, as well as some types of animals as squirrels, frogs, toads, snakes, birds, and various kinds of animals. Scientific studies about this region continue to be done in order that the success and sustainability of conservation can be going well.

Based on the study of ecology, it shows that ecosystems in conservation area are sufficient to support the process and achieving the objective of learning about the basic concepts of ecosystems and animal conservation. Conservation areas in the campus environment are accessible by several schools in the urban area of Bengkulu and the nearby districts. Facilities and infrastructure is very supportive to the sustainability of learning, and supported by several education experts of UNIB. Conservation area as an educational vehicle is developed to serve as a source of learning for primary and secondary school students.

B. Learning Model Design

Based on analysis of the needs and conditions of learning resources, the outline inexen learning model design described as follows in Figure 2.
Learning scenarios carried out in three stages: (I) **Introduction Phase**, consists of several stages of learning, gain the student early knowledge, inventory of environmental problems associated with the object of observation in this case the ecosystem of turtle conservation area. Exploration preparation includes preparing the equipment, explaining the procedures and motivating the students to work carefully by concerning safety in working, conducting observations accurately and maintaining safety in working, (II) **Explanation Phase**, this stage is the longest stage according to time implementation. The initial step is conducting general orientation on conditions of observation location. The next step is observing the physical or chemical conditions, the diversity of animals and plants in turtle conservation area ecosystems. Taking note of results observations and analyzing the data. The final step is formulating conclusions based on observation data, (III) **Explanation Phase**, containing of verification and clarification of observation data during the exploration stage. The next step is discussions and discovery of the environment and environmental conservation concepts. Following-up is to apply the concepts to daily life to build student’s environmental awareness.

The stages of learning associated with various activities organized in the surrounding natural environment are expected to improve student performance. Learning model design provides the opportunities for the students to learn more through exploration activities at turtle conservation area ecosystem in environment of campus UNIB. The learning helps students to apply their knowledge, so it will connect the gap between theory and facts that occurred in the neighborhood

Learning model design based on natural environment conceptually would encourage the learning environment ("Teaching Green"), which is the teacher who has the ability to develop learning that creates good relationship between students and the environment, and to encourage the environmental awareness. Environmentally learning concept will produce "Green Teacher", a teacher who has an understanding of the environment and has a positive attitude towards the environment. "Green Teacher" are teachers who are able to develop sustainable environmental education and participate in environmental activities and its preservation as a form of performance in shaping the environmentally-based school "Green Scholl" [7].

**C. Student Performance**

Based on small-scale trial results on the students of SMAN 8 Bengkulu City, it shows that the learning model make good paradigms and positive tendency to participate in the environment, in particular turtle conservation as natural resources in Sumatra.

Based on small scale trials results, it shows that the perspective view of a high school student on the environment in general is good. Exploration activities conducted increase the student’s knowledge of the surrounding natural environment. Knowledge that had been gained adding more comprehensive understanding, so that the paradigm of the students on the environment becomes better.

The trial results of inexen learning model that conducted at a turtle conservation area shows a tendency of student participation in conservation programs in general is good. The result of the student’s learning in environment education at turtle conservation area can be seen in Figure 3.
Good paradigms of students have a perception that the existence of eco-system and biodiversity conservation should be maintained. The student’s perspective towards the environment is in line with the tendency to participate in the activities of turtle conservation program. The tendency to participate includes the readiness to protect the turtle from extinction and campaigning to protect the environment as a turtle habitat from damage caused by human action. The tendency to participate in the conservation of turtle is a manifestation of the tendency to participate in conservation extensively.

Learning model developed involves the students to learn actively in constructing knowledge through problem solving and inquiry approach [8]. Learning with contextual problem solving can encourage student’s interest towards the subject matter. Through problem solving students will construct their own knowledge during the learning process and gain an understanding of concepts through interactions between internal and external factor or environmental [9]. The learning is not only emphasizes the mastery of concepts, but also shaping the mindset and attitudes of the students to be more concerned about the environment, and have ability to apply the principles of environmental sustainability. In this lesson students are directed to understand the environment by introducing environmental conditions, observing environmental phenomena, and appropriately environmental problems based on exploration results.

Inquiry approach on exploration activities encourage students to become active both physically and mentally in learning. Students are invited to actively think to recognize the problem, investigate to find the answers to the problems until making the conclusions [10]. Thus in inquiry learning students are actively involved in the process of finding answers to issues or questions. Discovery-Inquiry learning cycle includes three elements that must be passed, namely Exploration, invention or concept development, and discovery application [11]. Learning by discovery can improve intellectual ability, increasing the intrinsic and extrinsic motivation, and also can encourage students to learn more actively [12]. The emergence of intrinsic and extrinsic motivation will lead to increased passion or enthusiasm and awareness of students,

The developed learning model also describes the phenomena or facts that are found in the environment around students and many found in daily life by students. Learning that presents a phenomenon that is close to daily life, will encourage students to learn contextually. Contextual learning can always connect or apply the subject matter with the practical realities that found in daily life in the surrounding environment of students. With contextual learning, students will find the relationship between abstract ideas with practical matters (applicative) in a real context, and internalize the concept through the discovery process [13].

Contextual learning assumes that one’s mind will seek for the meaning in accordance with the real environmental situation and provide benefits to the environment. Combining the subject matter to the student’s daily life experiences will produce basics knowledge in depth [14]. Student will be able to use their knowledge to solve new problems that never been encountered. Through contextual approach, it is expected
to build knowledge of student that can be applied in daily life based on their learning experience. Contextual learning is a learning concept that linked the subject to be examined with the real situation, so that student will be able to apply their knowledge in daily life.

Shortly, Inexen learning model that developed portrait to student-centered learning. Implementation of student-centered learning in primary and secondary education can encourage creativity and motivate students to learn independently. High motivation will encourage curiosity about an object (concept) so that it will increase students’s comprehension. Referring to the results of research, Inexen learning model has motivated students to learn actively to construct understanding by exploring the facts and ecological phenomena at the ecosystem Sumatran turtle conservation area in the campus environment at UNIB. The understanding obtained forms a positive paradigm of the environment and tendency to participate in environmental conservation. Inexen learning model that developed is expected to emerge the friendly behavior of students toward the environment.

IV. CONCLUSION

Ex-Situ Sumatran turtle conversation area at campus UNIB very adequate to be used as a learning resource to support the process and achieving the goal of learning about the basic concepts of the environment and its preservation. Inexen learning model design in ex-situ conservation area of Sumatran turtle designed by three stages: Introduction, Exploration, and Explanation. Each stage consists of several steps that constitute a unity and follow-up of each stage.

Based on small-scale trial results, it showed that Inexen learning model can emerge the good paradigm and tendency to participate on students of SMAN 8 of Bengkulu city in the environment and its preservation program.

ACKNOWLEDGEMENT

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REFERENCES

FORMING QUALITY OF HUMAN RESOURCE IN KOMPAS “CARING WASTE TO SAVE CITY’ THROUGH SCIENCE EDUCATION

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Abstract—Qualified human resource produced by qualified education becomes the strength in caring living environment. This can be seen from several aspects of human resource: 1) character; 2) knowledge of technology; and 3) The product of living environment recycling. Kompas, the daily News, issuing the article ‘caring the waste to save the city’ says that 1.500–1.600 tons waste in Bandung city produced by 2.4 million citizens per day. This phenomenon shows the lack of human resource toward the living environment. The education of Natural Science has a potency to play a strategic role to provide human resource. This research has goal to describe the forming of qualified human resource in the phenomenon of “Kompas’ article “caring the waste to save the city” through the education of Natural Science. Kind of research being used is the result of literature review with the qualitative-descriptive approach. The technique in collecting data is done by editing, organizing and finding the research result, the result obtained. The data analysis in this research is characteristically deep discussing toward the content of written information or mass media. The result of the research shows the formation of qualified human resource covers character aspects, that is awareness in keeping environment and the life style which potential to the bad environment. Knowledge aspect about technology, it is the development of recycling waste technology also the aspect of recycling waste result which is separated and recycled in order to be able to be used again.

Keywords: Human resource, Natural-Science Education, Living Environment

I. INTRODUCTION

Human resources reflects the quality of the effort given person in a certain time to produce goods and services. Through the mind and physical potency of every human being in every activity. The mind is the basic capital from birth while the physical potency gained from learning. Human resources have an important role in nation building, so as to improve the quality them with education. As technology advances, quality improvement and quality of human resources into something problem that needs to be dealt with carefully and thoroughly.

The quality of human resources is still low seen on the Kompas.com article “The difficulty of cleaning times in Penjaringan’s river” [1]. Many people do not abiding the rules and do not listen the employers rules not to throw waste into the large river. For many years there are many silt at the bottom of the river. In addition, problems Indonesian capital is “Waste in the Jakarta at Bantargebang up to 7,000 tons every day,” which initially was estimated to 2000 tons every day [2]. It was supported that the production of plastic waste in Indonesia is ranked second domestic waste producer of 5.4 million tons every year. Plastic waste is increasing from day to day, so that human resources need to cultivate the environment, especially difficulty plastic waste elaborated [3]. That is accordance by Regulation No. 18/ 2008 about Waste Recycling, that the growing population and changing consumption become increased the volume, type and characteristics of the waste that increasingly diverse [4].

Qualified human resources are human resources who are able to create not only a comparative value, but also the competitive value, generative and innovative. Besides that, human resources have environment insight needed because it will affect the activities of human resources. Human with good environment insight
will think about the balance of the ecosystem, so there is no damage to nature. Meaning of human quality, accord to Regulation No. 20/2003 about National Education System, educated human who faith and piety to God Almighty, noble, healthy, knowledgeable, skilled, creative, independent, and become citizens of a democratic and responsible. The role of human resources can provide a positive and negative impact on the environment. So, government of Bandung collaboration with community concerned with waste recycling and some of the people are forming organizations concerned about the environment. It can to reduce waste production.

Kompas article "Caring the waste to save the city" that 11 years ago there were often twisted nickname is "Bandung Lautan Sampah" [5]. This is onus for the Government of Bandung because it requires substantial funds to manage the waste produced by the population of Bandung city. Estimated funds to reach 70-80 billion every year for cost of transporting the garbage trucks, use of land to waste. Besides that, some people at village choose self-contained in waste recycling. That program among other a calendar of garbage, composting, and a double-edged fork.

One of the way to improve the quality of human resources is improve the quality of education, especially science education, because it was realized that technological development begins with the development of science. Education is a media that was instrumental to creating quality human and potentially in the broad mean. Science is learning the concept of nature and have a relationship associated with human life. Science position as process implies ways of thinking and acting to confront or respond the problems in the environment. Problems arising and very worrying is the damage of environment.

Science is closely related with problems of nature and the environment. Science education as one of media to provide an understanding about natural preserve. According with the purpose of science education one of which is increase awareness to conserve and preserve the environment.

The problems of this research, are:

a. What is the essential of the quality of Human Resources?
b. What is human resources in environmental recycling?
c. How is forming the quality of human resources through science education in the Kompas article "caring the waste to save the city"?

This research purpose to describe the forming the quality of human resources in the Kompas article "Caring the Waste to Save the City" through science education. This research is useful in education as an educational insight to the actors, as well as innovation in education to create quality human resources by the aspect of character, knowledge of technology and awareness of environmental sustainability, from an early age.

II. RESEARCH METHOD

This research is literature review results with qualitative descriptive approach. This type of research is literature / research library is the kind of research with a series of activities related to literature data collection methods, reading and recording and processing of materials research [6]. Researchers used literature review type to describe the forming the quality of human resources in the Kompas article "Caring the Waste to Save the City" through science education. The data used among:

a. Regulation No. 18 / 2008 about waste recycling,
b. Local Regulation of Bandung city No. 09 / 2011 about Waste Recycling
c. Kompas article of the phenomenon of waste in the Bandung

The collecting data technique used literature review to find and collect the article or journal libraries that have compatibility with the object of this research. The data is collected and processed by step among:

a. Editing, checking of the data obtained of completeness, clarity of meaning and coherence of meaning
b. Organizing, preparation of data within the framework determined
c. The discovery of the other research results, further analysis the results of the data preparation by using rules, theories and methods that have been determined to be concluded in accordance the answers of the problem [7].
Analysis of the data used in this study conducted inductively namely how to analyze data starting from the facts or concrete events that have been collected to be concluded. Data analysis used in this research conducted inductively namely how to analyze data starting from the facts or concrete events that have been collected to be concluded.

III. ESSENTIAL THE QUALITY OF HUMAN RESOURCES

Human resources consist of three syllables, namely source, potency and human. Of the three syllables if defined one by one has the means that: the source is out, or origin [8]. Potency is the ability to do something or the ability to act [9]. While humans are intelligence creature. If three syllables are combined into human resources it has the meaning of human potential can be developed for production processes. Production is an activity that do to increase object value or create new objects that have been more useful in complete the needs. Improve the potency of object by changing the quality and shape is the production of goods. As activities by environment concern organization “Kami Kawasan Bersih (Kakasih) RW 09 Cigereleng village, Regol district, Bandung city. Waste calendar program on Mondays and Thursdays separating organic waste into fuel biodigester, it capacity is 15 kg into liquid fertilizer and gas for the stove. The ability to act is doing to developed accordance, that human is a intelligence creature. Intellect has the mean of the ability to see how to understand the environment [10].

Citizen activities at the Regol District of Bandung can be a role model in citizens to live in a society and state that understand environment conditions. It supported the meaning of quality according to the Dictionary of Indonesian Language, which is the form of good behavior human as a citizen to live in a society or state who can be a role model in the society and state.

Human resources is one of factor very important and can’t be separated from an organization, whether institutional or company. These factors are all the human potential of a mind, power, skills and emotion [11]. Besides that, human resources is also defined as the integrated capabilities of the intellect and physical potency of the individual, whose quality determined by heredity and environment [12]. Human resources have an important role in the phenomena that occur in the environment, because of all the potential in humans will impact on the character or behavior. The impact can be positive or negative in accordance with the potential of being applied in the form of behavior. "There are still some people in Bandung not wise to managing the waste and throw it into the river" Ridwan Kamal narrative on daily Kompas [13]. The important of human resources to have an environment insight, thus forming a balance between ecosystems. As unresolved problems in Bandung is awareness of people in Bandung still low so that the impact of waste production has increased from 7500 m³ every day to 8418 m³ every day.

The characteristics of high quality human are: 1) Humans are faithful and piety to God almighty one; 2) Righteous sublime; 3) personality; 4) Discipline; 5) Work hard; 6) Tough; 7) Responsible; 8) Independent; 9) Smart and skilled; 10) physical and mental health; 11) Love motherland; 12) high national spirit; 13) Having a sense of social solidarity; 14) innovative and creative [14]. Improving the quality of Human Resources is the key to national and regional development success. They can be realized because human beings as subjects and objects in the national development. Then development of human resources is really capable to have productivity, skill, creativity, discipline and professional. Besides that, also utilize, develop and master of science and innovative technologies to spur national development. The quality of human resources also have an important role in improving regional competitiveness and development investment in the region [15].

Improving the quality of human resources is a long-term human investment, because individual take the path of education does not automatically make their quality personal [16]. Education geared to improving the quality of human resources to support existing dignity people, noble and based norms. However, the quality of human resources not maximal. This is due to various terms of education, social welfare, employment and so on.

"The quality of human resources in West Bandung should continue to increase over the current development. Only education, the quality of our human resources could be improved. That's why I always welcome to any effort from anyone to make improvements in the education in this KBB, "said Deputy Regent
West Bandung, Drs. H. Yayat T. Soemitra. There are four principal policy to improving human resources, exactly: 1) improving the quality of life such as physical, spiritual and struggle; 2) improving the quality of human resources productive and equitable dissemination efforts; 3) improving the quality of human resources capable to utilize, develop and master the science and technology in environment insight; and 4) the development of institutions that support quality improvement [17].

IV. HUMAN RESOURCES IN ENVIRONMENTAL DEVELOPMENT
(Waste Recycling by human resources in Bandung)

Based on the Final Report JICA In 2010, the composition of waste in Bandung, are 0.2% metal, 57% organic, 7.4% of fabric, 10.6% paper, 0.1% B3, 18.5% plastic / rubber, and 6.2% other. That is a big problem in Bandung, the human population more and more also improve quantity of waste.

The Regulation No. 18/ 2008 about waste recycling, the center government and Bandung local government should be do good waste recycling so as to reach the vision of their city. But in fact, Bandung has not been able to good managing the waste recycling evidenced by increasing volume of produce waste everyday and many of waste don’t transported to transitory dumper. The local regulation of Bandung No. 09/ 2011 specifies that waste source is origin pile of waste. The data in Table 1 shows the volume of waste pile in Bandung continues to increase but the volume of waste transported decreases.

<table>
<thead>
<tr>
<th>No</th>
<th>Year</th>
<th>Volume of waste pile (m$^3$)</th>
<th>Volume of waste transported (m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2002</td>
<td>2,459,435,091</td>
<td>911,900</td>
</tr>
<tr>
<td>2</td>
<td>2003</td>
<td>2,484,797,788</td>
<td>1,053,957</td>
</tr>
<tr>
<td>3</td>
<td>2004</td>
<td>2,507,719,861</td>
<td>1,165,652</td>
</tr>
<tr>
<td>4</td>
<td>2005</td>
<td>2,533,214,483</td>
<td>814,333</td>
</tr>
<tr>
<td>5</td>
<td>2006</td>
<td>2,533,805,807</td>
<td>815,950</td>
</tr>
<tr>
<td>6</td>
<td>2007</td>
<td>2,583,126,335</td>
<td>911,900</td>
</tr>
</tbody>
</table>

In 2007, based on data from the Department of Irrigation, when filtering the waste in front of PLN Cikapundung, waste piled up to 50 m$^3$ every day. In the regulations and guidelines about waste recycling that apply in Indonesia, should the amount of waste has been reduced through waste reduction activities which have become the main provisions in waste recycling in Indonesia. The Regulation No. 18/ 2008 describes the waste recycling is divided into two main activities, they are waste reduction and waste handling. Waste reduction are restrictions on waste pile, waste recycle, and reuse waste activities. Handling waste activities such as (1) sorting of waste with organizing and segregation based on the type, amount, and or the characteristics of the waste, (2) collecting by taking and removal from waste sources into a transitory dumper or integrated waste treatment facility, (3) transporting (4) processing to change the characteristics, composition, and the amount of waste and (5) of final waste processing or residues of previous processing into the environment media safely. Each main activities of waste recycling has standard or provisions in implementation, which has been set in national regulations and standards.

High-tech waste processing will be used Bandung government is incinerator. At the plenary session submitted that waste recycling is based on friendly environment technology through waste processing to produce electricity. The argument of ‘Gerinda Damai’ fraction stated that before create the rules about tipping fee of waste recycling, Bandung government should set up a legal framework that a Regional Cooperation Regulation, Local Regulation of Waste Recycling and Spatial Planning Local Regulation.

Waste in Bandung is waste from several sectors. Table 2 shows the waste in Bandung is mostly from the settlement with the percentage reached 66% of the average total volume of waste every day.
TABLE 2. THE AVERAGE WASTE PILE IN BANDUNG BASED WASTE SOURCE IN 2007

<table>
<thead>
<tr>
<th>No</th>
<th>Source of waste</th>
<th>Average waste pile (m³)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Settlement</td>
<td>4,591.98</td>
<td>66.02</td>
</tr>
<tr>
<td>2</td>
<td>Market</td>
<td>618.5</td>
<td>8.25</td>
</tr>
<tr>
<td>3</td>
<td>Shops and restaurants</td>
<td>302.8</td>
<td>4.04</td>
</tr>
<tr>
<td>4</td>
<td>street sweeping</td>
<td>452.3</td>
<td>6.03</td>
</tr>
<tr>
<td>5</td>
<td>Industrial area</td>
<td>798.5</td>
<td>10.65</td>
</tr>
<tr>
<td>6</td>
<td>Public facilities</td>
<td>363.6</td>
<td>4.85</td>
</tr>
<tr>
<td>7</td>
<td>Canal and others</td>
<td>12.9</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Waste recycling in Bandung still using simple processing, that is collecting and dumped into last dumper. Sorting implemented in transitory dumpster, not at the household level, and even not by the janitor but by scavengers. Further processing at last dumper with incinerators, composting and recycling. While in Regulation No. 18/2008 that the duty of human “every person in the waste recycling of household and waste household shall reduce and handle waste with environmental insight. That is if obedient correctly by the people in Bandung, will not be burdensome task of scavengers or the janitor. So that waste pile is not piling up in last dumper.

The problem in Bandung about waste caused by several factors, namely: 1) Bandung public awareness is still low; 2) the ability of the Bandung hygiene Company service area is limited, just only serve waste recycling about 65%; 3) organic waste are not separated by people, causing waste recycling becomes difficult and inefficient; 4) last dumper is limited; and 5) law enforcement is inconsistent, so there are no sanctions for people who violate.

V. FORMING THE QUALITY OF HUMAN RESOURCES THROUGH SCIENCE EDUCATION

Various phenomena of life in all dimensions, whether social, cultural, economic, or political happening around us show that in fact what we have will ultimately be meaningless if we are not able to use it. This stems from the low quality of human resources. High-low quality of human resources, among others, characterized by an element of creativity and productivity are realized with work result or a good performance by individuals or groups.

The importance of creativity, among other things: 1) Creativity is essential for growth and personal success, and it is vital for the development of Indonesia; so obligation of parents, teachers, and the community was crucial. 2) Quality develop of human resource capable to positioning Indonesia to a leading position, compatible with other countries, both in the development of economic, political, and socio-cultural, in essence requires our commitment to two things: a) look for and development of excellent talents excel in other field, and b) the buildup and development of creativity which basically belongs to each person, but it needs to be identified and stimulated from an early age. 3) The companies recognize enormous significance of the new ideas. Study literature shows that there are different definitions about creativity [18]. Many experts opine that creativity as a form of thought, while some circles consider that is an attempt to produce a product. In general, Creativity as being imaginative and inventive, bringing into existence, making, originating [19]. Creativity as 'the ability to generate, to approach problems in any field from fresh perspectives' [20], while Schiffer defines creativity as "the ability to take existing objects and combine them in different ways for new purposes [21]. The creativity is not only related to new ideas, but how new ideas can solve the problem effectively (useful/helpful) and has a value of ethical (right, not normatively problematic). Creativity is not only wildly imaginative thinking, but rather to think the possibility of solving the problems precisely [22].

That was concluded that creativity is the ability to think about new ideas to use to solve the problems encountered about the environment. Creativity is important for the forming the quality of human resources, which are not only thinking of new ideas, but think about how new ideas can solve the problem effectively.

Kompas.com (8/21/16) article titled "Caring Waste to Save the City" preaching to readers that the quality of human resources has an important role in the development of the region or country. As reported that the amount of waste generated in Bandung have to spend substantial funds for waste recycling. The desire to burn
waste with incinerator failed to use because high cost and rejection by some environmental activists. Rejection of environmental activists to the incinerator can be based on such things in the surgical incinerator that ideal operation of incinerator is difficult to maintain, so the actual incinerator operators frequently (regularly) violated the standard; 1) Modern incinerators in Scotland estimates the emission limit of 172 times In 2009 and 2010 Holcim incinerators in Argentina produce dioxins 52% higher in 2009 and in 2010 even 203% much; 3) incinerators in Massachusetts USA fined for high dioxin emissions in 2008; 4) In Canada Waste To Energy (WTE) facilities with plasma technology had to be closed because of NOx emissions and high methane; 5) incinerator in a French city has successfully closed the local incinerators because has produced dioxin 13,000 times higher and especially after the increase of cancer cases.

Even of rejection, there are still some people who independently and creatively to sorting the waste since two years ago with waste calendar program. Such activity can reduce the production of waste, up to 50% of the production of waste every day. Interestingly, the organic waste is sorted on Mondays and Thursdays chopped and soaked and processed into fuel biodigester that capacity of 15 kg of liquid fertilizer and gas for the stove. Biodigester is airtight, biogas technology is not new. But in Indonesia, its application is limited on cattle manure. This technology uses an anaerobic system which closed system. Organic materials are incorporated into the biodigester. Biomethagreen will be overhauled by specific bacteria producing methane through the mechanism of an overhaul so as to produce bio gas. Bio-gas produced will be used as fuel for cooking and electrical energy is very safe and beneficial.

Efforts to build the quality of human resources is inseparable from the quality of education, because through the process of education has implications for aspects: First, Instilling a love of science and technology. Second, create an atmosphere in the learning process can generate and cultivate creativity, innovation and learning aptitude. Third, Cultivate willpower (fighting spirit), professionalism and insight excellence. Fourth, Cultivate an attitude of life-saving, precise, orderly, diligent and disciplined, and fifth cultivate moral and noble character as a manifestation of faith and devotion to God Almighty.

National education should be designed to be able to expert a generation or human resources which has skill in the era of globalization and openness of information flow and advances outstanding communication tool. The program to improve the quality of human resources through education will benefit to organization of productivity, morale, efficiency, effectiveness, and stability of the organization in anticipation of the environment, both inside and outside the organization that is always changing in era globalization. Function and orientation of education to improving the quality of human resources in policy of Depdiknas explain that three main strategic of national education development, namely: (1) equal access, (2) improving the relevance and quality of education, and (3) increase quality of education recycling [24]. For implementing the three basic strategies of educational development mentioned above, should be seen parts of the national education system in relation to the orientation of each and described in the plans and priorities of education development.

The quality of human resources is related to the quality of education of Sciences. Science education is one aspect of education is used as a tool to reach educational goals. Learn science is an ideal way to reach the competencies (skills, nurture attitudes, and develop mastery of concepts related to everyday experience). Science is the study of natural phenomena that includes living beings and inanimate beings or life science and the science of the physical world. Science knowledge acquired and developed based on a series of studies conducted by scientist made in the search for answers to the question "what?", "Why?", And "how?" Of the phenomena of nature and it application in technology and life. Science education emphasizes providing direct experience to develop human competencies able to explore and understand the nature scientifically. Science education is directed to find out and do something that can help students to gain a deeper understanding of the nature around. Therefore, the approach applied in presenting science learning is combining the experience and understanding.

Science and technology not be separated with a skill, because the skill is also a participation of human resources qualified. So that people will be able to anticipate changes in situation, thus the human resources to be able to implement, develop and understand of science and technology through its skills. The qualification
of human resources qualified has a variety of complex characteristics, which not be obtained spontaneously but can be obtained through the cultivation and education.

VI. CONCLUSION

Human resources is also defined as the integrated capabilities of the intellect and physical potency of the individual, whose quality determined by heredity and environment. Improving the quality of human resources is a long-term human investment. Education geared to improving the quality of human resources to support existing dignity people, noble and based norms.

High-low quality of human resources, among others, characterized by an element of creativity and productivity are realized with work result or a good performance by individuals or groups. Creativity is the ability to think about new ideas to use to solve the problems encountered about the environment. Creativity is important for the forming the quality of human resources, which are not only thinking of new ideas, but think about how new ideas can solve the problem effectively. Science education is directed to find out and do something that can help students to gain a deeper understanding of the nature around. Therefore, the approach applied in presenting science learning is combining the experience and understanding. Research result support The Regulation No. 18/2008 about waste recycling chapter IV part two about the responsibility of every people in reducing the waste

REFERENCES

POTENTIAL OF STEM-BASED PHYSICS LEARNING IN IMPROVING STUDENTS CREATIVE THINKING SKILLS

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Abstract—This paper discuss about potential in implementation of STEM-Based Physics Learning in order to improve students creative thinking skill. Creativity is one of 21st-century skills that needed by student to face the global job’s competition. Education as the basis for the development of the younger generation should prepare students to face the job competition in the 21st century. Creativity require students to think divergent and complex. Education which oriented in convergent thinking will be difficult to improve students’ creative thinking skill. Therefore, learning that emphasizes on convergent thinking shall be replaced to improve students creativity thinking skill. STEM education is learning approach that integrated Science, Technology, Engineering, and Mathematics. Multidisciplinary integration in STEM learning to require student to connect content from various discipline so student can be stimulated to generate creative ideas. STEM learning approach that adjusted to the stages of the development of students'creative thinking skill and characteristics of physics as a science will help teachers to teach physics effectively.

Keywords: STEM-Based Learning, Creative Thinking Skill, Physics Education

I. INTRODUCTION

The dynamics of the problems arising in this modern society requires people to be able to adapt quickly. Partnership for 21st Century Skills as an international institution said that creativity and innovation is an important skill to have for modern society [1]. The statement was strengthened by the results of research that creativity is the most important skill in the 21st century and that creative thinking skills are essential for success in academic and social success in life [2][3][4][5][6]. Therefore, creativity is needed for young people to face the future that uncertain and community life that have complex problems.

Education is an inseparable part of the process of preparation qualified human resources, strong and skilled. Good education will be obtained the workforce candidate with quality, productive, and competitive. Therefore, education should be applied a system of learning that prepares students to acquire the creative thinking skills. In Indonesia, the government has made several efforts related to the paradigm shift in the competence of the 21st century learning, include adjustments to the curriculum that emphasizes student activity oriented towards problem solving. Apart from that presented explicitly in the core competencies that creativity is a competence that must be implanted in every learning in the classroom. Regarding the method and its implementation is not described specifically, so the teacher are free to choose the types of approaches, methods and learning strategies appropriate to the characteristics of disciplines and students. Teachers need to understand the characteristics of creative thinking skills and disciplines well to be able to achieve the learning objectives.

Creative thinking skills cannot simply be taught to students, requires the involvement of students actively in learning through experimental activities, discussions and presentations so as to increase their confidence to find answers to the problems they face [7]. The learning activities that are not student’s center will make the lack of student activity in learning activities. Contextual learning system and put forward the concept of self-
discovery will facilitate creative thinking skills development as part of the soft skills of students. This is consistent with the nature of learning physics as one of the Natural Sciences.

Creative thinking skills is one of the soft skills, which are more complex. These skills have properties that expressive, productive, inventive, innovative, and emerge native. The meaning of creativity rather refers to mental processes related to the completion of problems, ideas, concepts, artistic forms, theories or unique products [8]. Creative thinking is divergent thinking patterns, so it takes a learning approach and assessment systems appropriate to be able to familiarize student’s divergent thinking. Contextual learning system and put forward the concept of self-discovery will facilitate the development of creative thinking skills as part of the 21st century skills [9]. This is consistent with the essence of learning physics as one of the Natural Sciences which emphasizes the mastery of the collected knowledge (facts, concepts, or principles) and the process of the invention, even more than that physics is a creative activity that in many ways resembles other creative activities of the human mind [10]. Concepts in physics acquired through activities that involve process skills. Therefore, to foster scientific creativity in the learning of physics requires a learning approach that facilitates students to think complex and divergent in solving scientific problems.

II. DISCUSSION

An understanding of the dimensions of creativity will assist educators in developing and accessing the creativity of learners [10]. Learning for creativity means creativity as a result of the lesson, not the creative learning in terms of teacher creativity. The creativity of teachers in this case is the ability of teachers using imaginative approaches to make it more interesting, exciting, and effective, be open, student-oriented, be exploratory and use group-based learning strategies.

A. Creativity in physics education

Physics as part of natural science is a science which is based on the scientific method [11]. The views of teachers as educators to physics is important, because teachers have to plan, implement and evaluate the science lesson well.

The Subject of learning for each discipline has a specific characteristic and philosophical foundation. An educator must understand the characteristics and philosophy of the disciplines that will be taught in teaching and learning. Reference disciplines for science education illustrated in Figure 1. Three essences of Science stated by Collette and Chiappetta as a body of knowledge, the way of thinking and a way of Investigating [12].

![FIGURE 1. REFERENCE DISCIPLINES FOR SCIENCE EDUCATION][9]

The essence of physics is as a body of knowledge, physics as a way of thinking, and physics as a way of Investigating [13][14]. Physics is the science that is developed based on the creativity of scientists [15], so in studying the physical sciences would be very well if done with creative learning. Creative thinking pattern cannot be separated from the three basic perspectives namely, creativity as the attitude of a person (person), as a product of creative thinking and creative thinking as a product [16]. Structural model of scientific creativity by HU & Adey and Piaw basically nothing out of the essence of learning physics itself, because of the nature of learning physics associated with a
physical point of view as a process, physics as an attitude and physics as a product. Scientific creativity is a kind of intellectual properties or the ability to produce specific products that is original and have more social or personal, are designed with a specific purpose in mind, using the information provided [17]. Three-dimensional structure of Scientific Creativity Model (SSCM) according to Hu & Adey can be illustrated in Figure 2.

![FIGURE 2. CREATIVITY AND MOTIVATION [19]](image)

Personal creativity is seen not only in one side only, but of the process of how a person / students to think of an idea, imagine an implementation plan, implement creative ideas through the stages of fluency, flexibility and originality to ultimately produce a creative science. In this case more creativity in solving problems in dedicated scientific phenomena. In contrast to the general creativity as dictated by Guilford and Torrance that creativity as psychological aspect of a general nature, not related to discipline or intellectual abilities (IQ).

Cognitive and affective factors involved at every level of creative learning. In connection with the cognitive and affective factors of creativity, Hennessey and Amabile proposed the "principle of intrinsic motivation creativity", which states that intrinsic motivation is conducive to creativity and creativity damaging extrinsic motivation [18]. They also found that intrinsic motivation is influenced by things that are situational. Thus, situational events in the environment of the learners (e.g., schools) can affect one's motivation on a task (e.g., problem solving). The relationship between motivation, knowledge and creativity can be broadly described in Figure 3 [19]. Learning that highlight problems in situational circumstances that would have an influence conducive to developing creative thinking skills. Learning should be prepared based on situational issues and more emphasis on knowledge which is based procedures and stimulate intrinsic motivation rather than extrinsic motivation. This will help stimulate the emergence of creative ideas in self-learners.

B. STEM Education

STEM education is defined as an approach to teaching and learning that integrates content and skills of science, technology, engineering, and mathematics [3]. Standard STEM guide describes the combination of behavior students, integrated with STEM content, which is expected skilled students master the science, technology, and mathematic engineering. This behavior is the involvement in the investigation, logical reasoning, collaboration and investigation. More Maryland defining the purpose of STEM education is to prepare students to pursue post-secondary studies and prepare students as workforce ready to compete in the 21st century [11].

STEM (Science, Technology, Engineering, and Mathematics) education approach tries to connect the four areas of science, technology, engineering, and mathematics as one that holistically [20]. STEM education as stated by Bybee can be used by government, educators, business people, community and corporate leaders to communicate the importance of education and preparation for a students to be ready when he was in college and the world of work [20]. According to research performed by Gonzalez & Kuenzi, STEM approach effectively implemented in formal education/class system and no formal/outside the classroom. STEM approach not only be done in primary and secondary education levels, but also can be carried out until the level of even a post-doctoral study [21].

Implementation the STEM education approach in the field of education has the aim to prepare students to be competitive and ready to work the fields practiced. STEM approach has the main principle is related to
communication, materials, ability to solve problems (problem solving), integration, technology and career [22]. Six key principles are summarized in science as material, technology as a product of science, engineering as the ability to apply science and math components as a liaison between the components. Four components that include Science, Technology, Engineering, and Mathematics are expected to be mastered by students so that they can properly career.

In addition to developing content knowledge in science, technology, engineering / design and mathematics, the integration of STEM education also seeks to foster soft skills such as scientific inquiry and problem solving skills. By improving problem solving skills with the support of scientific behavior, to the integration of STEM education seeks to build a society that recognized the importance of STEM literacy. STEM Literacy refers to an individual's ability to apply the understanding of how competition works in the world RII domain that requires four interrelated. Table 1 below defines literacy STEM according to each of the four fields of study are interrelated.

<table>
<thead>
<tr>
<th>TABLE 1. STEM LITERACY DEFINITION (SOURCE: NATIONAL GOVERNOR’S ASSOCIATION CENTER FOR BEST PRACTICES)</th>
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<tr>
<td>Science Literacy</td>
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<tr>
<td>Technology Literacy</td>
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<td>Engineering Literacy</td>
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<td>Mathematical literacy</td>
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C. STEM Education for Scientific Creative Thinking Skills.

The integration among disciplines in STEM approach allows students to gain mastery of the competencies required to complete the task [23]. Training students in this way is considered beneficial because it is a multidisciplinary world that relies heavily on the concept of STEM, which the participants should be used to solve real world problems [24]. Two important approaches to instruction integrative of STEM education is multidisciplinary and interdisciplinary integration.

Multidisciplinary integration requires learners to connect content from a variety of disciplines taught in different classes at different times. Interdisciplinary integration could begin with real world problems. Combining cross-curricular content with critical thinking, problem-solving skills, and knowledge to reach a conclusion. The integration of multidisciplinary ask learners to connect the content of certain subjects, but the integration of interdisciplinary focus attention on the problem students and combine content and skills from various fields.

The issues raised in STEM-based learning should be specially prepared. The problems that were brought in STEM learning content should contain variances, processes or products [25]. Variance of the content in question is the diversity in the information retrieval, the variance of the process means that students are given a wide choice to showcase ideas and product variances which means the option to view what has been learned of students. Contextual learning system and put forward the concept of self-discovery will facilitate the development of creativity [10]. In cultivating the creative thinking, students should be encouraged to answer questions relating to the following matters: Make a combination of several parts to form a new thing; (2) Using the random characteristics of an object resulting in a change of an existing design into a new design; (3) Elimination of a part of something in order to obtain something new; (4) Thinking about alternative uses of something in order to obtain new uses; (5) Develop ideas contrary to ideas that are commonly used by people in order to obtain new ideas; (6) Determine the usefulness of an extreme form of a body that was found a new use for the object [4].
There are seven basic principles in the approach to STEM education broadly depicted in Figure 3. Through learn and apply rigorous content within science, technology, engineering, and mathematics disciplines to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems. In step of integrate STEM content students will integrate content from science, technology, engineering, and mathematics disciplines as appropriate to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems. In step of interpret and communicate information from STEM students will interpret and communicate information from science, technology, engineering, and mathematics to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems. In step of engage in inquiry students will engage in inquiry to investigate global issues, challenges, and real world problems. In step of collaborate as a STEM team students will collaborate as a STEM team to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems. In step of apply technology strategically students will apply technology appropriately to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.

### III. CONCLUSIONS AND SUGGESTION

Creativity as one of the competencies of the 21st century skills should be developed in science education. The creativity of science is the thinking skills that emphasizes divergent thinking patterns, complex and problem solving that is based on scientific methods. STEM learning approach is a multidisciplinary approach that facilitates students to develop creativity through learning physics. STEM learning approach bringing learners to study physics contextually, and dynamically. Physics is a science that is based on natural phenomena that occur around the community. Appointment of a problem in the study of physics learning should take real-world problems are contextual. Real-world problems offer a complex issue so that students can practice finding a research problem and limits the issues that can be studied during the learning process in the classroom. In analyzing the problem scientifically, students will certainly understand that it takes the right step and systematically to conduct experiments. To arrange a systematic step, students practice developing procedural knowledge. Such knowledge can bring creative ideas to the category of scientific process, scientific attitude and scientific products. STEM learning approach in accordance with the characteristics of the learning physics in physics as a process, attitude and products. Scientific process in question is the emergence of imaginative ideas in self-learners, learners can imagine how the impact of the treatment given and the reasons why something can happen. Learners will be trained to be sensitive to the problems and trying to learn from mistakes they did in the experiment. Scientific attitude that may arise in learning is fluency in proposing the idea, responding to the problems during the process of discussion and planning procedures for implementing the trial is complete and systematic, Flexibility to look at issues based on multiple viewpoints and allow it to come up with ideas that are unique and original to finish the problems they face. Scientific
product in question is the process and result of modifications made by learners to the content so that it can complete the problem faced. The result of such modifications would be the technical product during the learning process which is based on the construction of students understanding of the physics concepts they know.

Components of these three things (the scientific process, scientific attitude and scientific products) are the traits of people who are able to think creatively, because during the learning process the teacher can observe the evolution of each of the characteristics of the creative thinking. Learning with instructional systems make students as active learners and independent, it will support teachers to become facilitators intact. The time that a teacher will be widened to make an assessment for student’s active role in resolving the problems of either group or individual.

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REFERENCES


INNOVATION OF TEACHING AND LEARNING SYSTEM INTEGRATED IN REPRODUCTION SYSTEM MATERIAL USING “AMONG SYSTEM” METHOD

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Abstract—Promiscuity and teenage sexual abuse are the reflection of moral decreasing in Indonesian students. Those issues are triggered because teenagers misuse the technology, information and society still considers sexuality as a taboo subject. On most of school in Indonesia, comprehension and subjects about sexuality is limited only on structure and function reproduction organ. In fact, sex education is related with teenage moral quality. It is our responsibility to increase teenage moral quality. This paper which is written by using literature study approach propose an idea that is called as among method employing technique Tut Wuri Handayani to integrate sex education in school, family, and society as the trinity of education. The method can be applied for teacher especially for senior high school teacher during learning process of reproduction system on Biology. This method that is adapted from Ki Hajar Dewatara’s concept synchronizes knowledge which is constructed by students from many resources and then compiled into a science as basic guidance to undergo life in good manner. Through this method, the student will develop their knowledge over and over again since they do practical science not just recital the concept. The technique of Tut Wuri Handayani is implemented on trinity of education which are giving, guiding, and supervising reproduction education and teenage sexual behavior related with norm applied on society. The application of this method can be a new way for teachers and parents to communicate and supervise the development of knowledge, behavior, and character of their children that are related with reproduction education and understanding.

Keywords: Teaching Learning, Innovation, “Among” Method

I. INTRODUCTION

Promiscuity and teenager sexual abuse is a reflection of moral decrease of Indonesian students. One of the causes is technology advance misuse and lack of awareness about the importance of reproduction education or to be specific is sex education. Family and society still consider this topic as a taboo issue to be discussed with their children. As a result they reluctant to ask to their parent and prefer to find the information by themselves from various sources. In school environment, they only obtain information about structure and function of reproduction organ. Whereas they also need understanding related about teenager moral quality that is included on reproduction education. It is our responsible to teach them about morality and also if they ask anything about reproduction that is not explained on the handbook. On one hand, students need more detailed information about reproduction organ. On the other hand, there are many teachers that are reluctant and shy if any student teenager ask about reproduction organ information outside from the handbook. They need open-mindedness from their teacher, family and society to educate them about this issue. If not, they will find other sources of information that are not guaranteed as valid sources such as peer or internet media.
Student will construct their own understanding obtained from various sources without any guidance from other people who understand well about this issue. Their own construction will lead to misconception. Their misconception drive them to try new things that they consider as a right thing to do whereas it may cause harm to other parties. This is the place where family, society, school, and teacher must act together and continually. The first time when teacher begin to teach topic about reproduction, they should be open-minded and wise to elaborate student in the learning process. Education process of the student is not only about teaching them so they understand about the structure and function of reproduction organ but also to seed moral values so that education process can be conducted as its function. Education is an attempt to develop various human potential from student, where the potential includes creation, feeling, and intention so that the potential can be realized and useful as provisions for their life [1][2].

The common mistake from teacher is that they assume that they know all things and refuse to learn from their student. As a result, teacher will less understand what student know and want. In addition, one of the administrative assessment teacher’s duties is to give exercise to student without providing sufficient guidance and clarification. Teachers tend to force students to consume knowledge without giving any guidance how to elaborate the knowledge to be utilitarian science for their life. No wonder if student process their knowledge acquired from less meaningful knowledge or even from knowledge that is diverged from culture, norms, and values on society.

Current education system applied on Indonesia is a adoption from western system. The system is not compatible with condition, culture, and infrastructure in Indonesia. As a result the quality of education in Indonesia is affected because of it [3]. However, Indonesia has its own education system which is a legacy from prominent figure called Ki Hajar Dewantara. The system has applied on Taman Siswa that is called as Among system. Among system is the learning method and education based on care, dedication, and love. If this system can be applied well, it would be a signature education system and advantages for Indonesia in education field because its main source is Indonesian local wisdom [1], [3], [4].

Reproduction is part of biology material for XI grader on second semester. Teacher still consider that reproduction material is only a common knowledge that must be consumed by student without any awareness that inside the material exist structure and function where there is science that must be comprehended by student well. When student construct science from knowledge that they obtained, they need guidance from teacher. Among system is one of the system which is appropriate method to solve the problem. Teacher’s duty is as facilitator on science shaping from knowledge obtained by student from various resources. Among system allow a creation of well established condition in education world. The situation principals are generosity, hospitality, love, empathy, and reward for every member component, teacher and student.

This essay’s main purpose is to argue the idea of among method using technique Tut Wurihandayai to be integrated with reproduction education in school, family, and society as a tri-center education. The creation of well established condition through Among system could help teacher and student to establish open-minded relationship, so that moral and ethic seeding during comprehending science from reproduction material can be well understand for student. Thus, the true teacher’s duty as student accompanion to remind and guide them to right path can be achieved.

II. RESEARCH METHOD

This paper which is written by using literature study approach propose an idea that is called as among method employing technique Tut Wuri Handayani to integrate sex education in school, family, and society as the trinity of education. The method can be applied for teacher especially for senior high school teacher during learning process of reproduction system on Biology. This method that is adapted from Ki Hajar Dewatara’s concept synchronizes knowledge which is constructed by students from many resources and then compiled into a science as basic guidance to undergo life in good manner. Through this method, the student will develop their knowledge over and over again since they do practical science not just recital the concept.
III. RESULT AND DISCUSSION

A. Family Role on Reproduction Education

Family has a main task on education field which is creating a place and condition that well established for family education process that can form smart and moralistic generation as an initial provision for them to undergo their life [6]. Selo Soemarjan also agree with it that family is core group because family and society is naturalistic education place. The importance of family role in education field is argued by Ki Hajar Dewantara and M. Syahran Jailani that family is part of the components from three core education. Parents must realize that education task is not focused only on school. Family has more urgent task to educate children to be a generation with good moral [1] [5].

Reproduction is an important material for a child. Compared with other material in Biology, reproduction material include vales, norms, and knowledge related with moral and culture of generation. Until now, there is no synchronization between family, teacher, and society how they comprehend reproduction material. Teacher only focus on functionality and structure, whereas family and society more concern about moral and ethics of reproduction. The shift of focus point on reproduction in family, society, and school give negative impact to children understanding. As a result, they comprehend those issue as separated component.

Reproduction education should be provided by parents to their children since they were young [7]. Nurohmah divides several stages on providing education about reproduction health by family since young until teenager where every explanation about reproduction material but be accompanied by important key admonition. The admonition must be adjusted with children’s mind capability [8]. For example, on children 0–5 years old parent introduce the name of reproduction organ and explain the different between male and female gender. After that, parent give key advice where reproduction organ must not be exposed and only certain people allowed to see or even to touch them. During teenager period, key advice emphasizes ethics, moral, and negative impact of free sex.

School is not the one and only who has responsible to give education related with reproduction. Family and society also must provide basics of knowledge about reproduction, moral, ethics and culture. If a child understand well about basics of reproduction from his family, he may also be a good source of reproduction knowledge for his peer. As a result, education function in society become inseparable part besides family and school. Education in good family affect children’s understanding and behavior.

Family accompaniment is important part for achieving science related with reproduction so that children behavior would not fall into free sex. The transfer process of knowledge and science about sext must be guided with key advice continually provided by family. It is a basic component to educate children. This kind of education method is important because it is character shaping-process of next generation. Thus, synergy would be established between family and school.

B. Teacher’ Role in Understanding Reproduction Education and Sexual Behavior on Senior High School Student on Biology Subject.

Reproduction education for children should be started for their family. In fact, children do not obtain sufficient understanding and knowledge about reproduction from their parent. There are several reason why it still happens. First, family still consider reproduction is as a sensitive and taboo issue to be discussed with their children. In addition, parent do not have ability and capability to deliver reproduction education to their children.

School is the best place for children to obtain sufficient basic understanding of reproduction education. Also, school must realizes its specific role to deliver comprehension of reproduction education that is adjusted with the student's level development. It is very important for student that during their crucial age, the must already know at least basic of reproduction education so that they would not find information from other unreliable resources. Integrity in the school curriculum can be used as media to deliver reproduction education and sexual behavior for student.
Gabriella Devi Benedicta is a researcher from Pusat Kajian dan Seksualitas Universitas Indonesia. She stated that reproduction education and teenager sexual behavior must be included in national curriculum and pointed as an independent subject and not integrated with other subjects. Material of reproduction and teenage sexual education would be included as local subject (muatan lokal) on school. This idea is based on the findings of high amount of unwanted pregnancy and abortion on teenager that is caused by low understanding between teenager about reproduction health and sexuality. However, up until now this idea has not been supported with specific policy from Kementrian Pendidikan dan Kebudayaan [9].

Kulon Progo is one of districts in Yogyakarta that consider this issue seriously. Major of Kulon Progo, HastoWardoyo, instructed to all headmaster of Junior School and Senior School in district Kulon Progo to include reproduction education and sexuality to specific curriculum because student really need knowledge about it. This instruction had been applied since 2014 second semester in all Junior School and High School in Kulon Progo district. The application of reproduction education and sexuality must be integrated on specific content on Physical Education subject and supported with module [10].

On the level High Senior School specifically, reproduction education and sexuality is not sufficient if it is only integrated to subject Physical and Sport education. The range of reproduction education material and sexuality is very broad and details in high school level. Clear and detailed description cannot be acquired from perspective Physical and Sport education only. Thus, reproduction education must be included in biology subject as well.

Technically, teacher of biology subject can integrate reproduction education and sexuality on biology learning process even though the material on syllabus is limited on explanation of reproduction system from biology perspective. The deep level comprehension of this material must be adjusted to be compatible with student’s comprehension level. In their level, they need to know reproduction education related with sex organs system and its function in detail, pregnancy process and labor in detail, explanation about safe sex, teenager sex behavior, the risk of sexual disease, moral and principle about say no for pre-marriage sex and establish self confident and acceptance. Teacher must understand that when they deliver reproduction education, they are actually give understanding to student about the importance of reproduction education and sexuality as a defense for them to keep them safe and give awareness of their reproduction health. Thus, teacher must own sufficient knowledge and comprehension and have a willingness to learn more about reproduction education and sexuality.

C. The Importance of Teacher’s Role in Shaping Student’s Moral related with Reproduction and Seksual Education

The integration of reproduction education and sexuality inside school curriculum for High School student is an attempt to increase student’s comprehension about those issue and importance of those issue for their live. Understanding level of sex education and behavior on realm of teenager in Yogyakarta Special District is very various. The higher average is 74.9% and the lowest averages is 26.3% [11].

Knowledge provision about reproduction and sexual education is not enough to defend student from harm of free sex that its trend is increasing recently. Thus, student also need moral education. Indonesian culture values must be implemented for them so that they know that free sex is not part of Indonesian culture. They must know the society norms about free sex and the consequence if they break it. In addition, they must know that they have responsibility to god if they participate on free sex.

D. System Among Advantage and Method Variation on Learning Process

Among system is a concept by Ki Hajar Dewantara that had been applied on Taman Siswa education system. This system does not employ basis of “regering, tuchtenorde” but emphasize concept of “orde en vrede” (orderly, peace, and peaceful) [12]. This system foundation is Indonesian values of culture so that it is a suitable method for education system in Indonesia. System Among is a learning method and education based on local wisdom asih, asah dan asuh (care and dedication based on love) [13].
By using Among system for delivering reproduction material on education system in school will encourage to embed positive values in teenage association. Basis of Among system is hospitality and its principles are nature destiny and independent. The application of this method would make student to realize the importance to study without any pressed and frightened feeling from punishment. Teacher provide guidance and support student to grow and develop their destiny. Thus, during delivering the material, teacher not only fulfill their duty to complete curriculum but also give what student need.

There is a certain technique in Among system where teacher omit the obstacles that block student's development and growth and tighten the relationship between student, nature and society [13]. Thus, Among system consider the diversity background of every student. Though the learning process is conducted in classical way, the system would answer specifically every student’s need. Because every student has different background, the reproduction education must be differentiated. Some student will consider this topic as taboo and sensitive issue but the others would be openly accept to learn this issue as a scientific issue. Their perspectives are different because of reproduction education understanding that they obtained from their family and society.

Reproduction education material in Biology subject aims to embed values of character development for every individual. Those values are self identity, self confidence, self esteem, ability to choose live path and understanding nature effect [14]. Among system application is not using force and pressure but it does not allow student to free fall without any control. This application allow student to be independent integrate material about reproduction system they obtained with prior knowledge they obtained and values delivered by teacher. It would be an important factor for them to manage their emotion and shape their personality.

Among system consists of hing dynamic and prospective without leaving its special characteristic. The application of the system would be developed dynamically with controlled modification but still consider behavior, shape, content, and cadence. The behavior must be persistent. Only shape, content and cadence are allowed to change to be adjusted with current necessities and developmental epoch. Thus, by employing Among system, reproduction, character, and mental education can be combined well.

School has responsibility to direct misconception from student about reproduction education that they had obtained beforehand. It will help student as young generation to develop as individual with healthy physic and has good moral to prevent them fall into wrong association. In addition, Among system drives student to have toleration and adaption ability toward diversity and alteration in society.

E. Among System Role to Prevent Abused Sex Behaviour on Students

Students in high school are adolescence. Adolescence word comes from Latin that means develop to adult [15]. Adult in this case means physic, social, and psychological. Teenager is transition between children to adult period where unstable emotion can be easily triggered as a cause from mentally and physically development. Reproduction system material delivered in school must include biology field with religion, family, and social perspective. Those perspectives give clear view that free sex broke law and norm from religion and society.

Distorted sex behavior on teenager may appear because of high curiosity feeling on them. In addition, they can easily find information from various resources that easily can be accessed. Internal drive from hormone and strong stimulus are the impulse factor to do sex. They may try to do it without giving any concern with norms or rule because their psychology is not stable. Thus, string rules and norms are great defense to prevent distorted sex behavior [16].

Sex education for teenager is a guidance about sexuality on teenager about gender role. They will be though about how to behave as boys or girls and how to establish relation or contact with opposite gender. If they know about common knowledge of sex education, they can prevent themselves from sexuality abuse and neglect to try something that are not allowed to do. Thus, teenager really need to obtain reproduction education properly with proper method as well [17].
By using among system, teacher role in school is as parent and student as children. Through this system, interaction between student and teacher would respect each other so that student do not feel afraid with teacher since teacher would not dominate but instead guide them [18]. This system could be the best system in Indonesian education system [19].

In this paper, Among system would be explained using technique of Tut Wuri Handayani. Among system’s name is take from Javanese language which is mongataumomongmeans take care of children. Teacher would be considered as guardian or caretaker for children who educate with love. Tut Wuri means following from behing with full of care and responsible based on sincere feeling. Tut Wuri neglect feelings of authoritativ, possessive, protective, and permissive because those feelings should not exist for caretaker. As Handayani means to give freedom, change and attention, and guidance for children so that they may do based on their own initiative and experience and can develop their personality based on their destiny[20].

Among system role with tut wuri handayani technique is to solve sexual abuse by integrated reproduction education in school, family and social as three core of education. This technique is implemented by tree core of education that give, guide, and care the education process and student’s behavior. This method allow teacher and parents to communicate and observe student’s development of reproduction education understanding, behavior, and characters.

The application of this system can be done by choosing or combining teaching method proposed by Ki Hajar Dewantara such as :

(a) Giving examples (voorbeeld);
(b) Accustomed to certain behaviour (pakulinan, gewoontevorming);
(c) Learning (leering, wulang-wuruk);
(d) Order, Force, and Punishment (regeeringentucht);
(e) Behaviour(zelfbeheersching, zelfdiscipline);
(f) Mentally and Physically Experience (nglakoni, ngroso,beleving) [12].

The application of Among system is chosen so that student could be part of society who are autonomous and responsible [21]. The aim of the system is to reeducate them to comprehend knowledge and then they will be guided to be part of society driven by creation, empathy, and intention feeling. As a result, the system can form student to be religious person and free mentally and physically, have good moral, smart and versatile.

IV. CONCLUSION
Among System Method with tut wuri handayani technique can be applied on reproduction system material on high school to integrate reproduction education in school, family, and society as three core of education. Teacher as caretaker in school deliver material and teach developmental values to student in open way and take care them by considering every student’s background and need. This system can vanished the boundary between teacher and student in establishing science with norms so that student would not fall into free sex and sexual abuse.

REFERENCES


DEVELOPMENT INTEGRATED SCIENCE OF CONNECTED MODEL TO IMPROVE SCIENCE PROCESS SKILL AND CURIOSITY

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Abstract—Learning science in junior developed as integrative science subjects rather than as educational disciplines. The goal of the Curriculum 2013 is that after the process of learning science, students better appreciate and practice the teachings of his religion, more honest, disciplined, caring, confident and able to cooperate with others. Besides, it is expected that students understand the knowledge based on curiosity about science, technology and culture associated with the phenomena and events that looked the eye, teachers are expected to be more active, creative and innovative to make students active and curious about the topic studied. Integrated learning in science can be packaged with THEME or TOPIC about a discourse that is discussed from various viewpoints or scientific disciplines are easily understood and recognized learners. Integrated learning will provide a meaningful experience for students, because the integrated learning learners will understand the concepts learned through direct experience and connect with other concepts already understood that in accordance with the needs of learners. Connected models allow materials that have relevance can be integrated into a learning activity so that the material can be easily controlled and not fragmented. With the model connected, it is possible to be able to pour the ideas, ideas, and skills which could be among the themes, content, chapter, and each skill can be integrated into one unified whole understanding. This paper describes an alternative to using a model of integrated science connectedness. With integrated learning science connected models is expected to increase students' science process skills and curiosity on specific themes.

Keywords: Integrated Science, Connected Model, Science Process Skills, Curiosity

I. INTRODUCTION

At this year's curriculum was revised, there are six things that revised:
1. Using active learning methods
   Teachers act as facilitators of learning makes students enjoys teaching and learning activities. Thus creating an active learning, creative, innovative, and fun.
2. Improving Core Competence relationship (KI) and the Basic Competency (KD).
3. Simplification aspects of the assessment of students by teachers. Religious and social assessment of students is done by teachers Citizenship Education (PPKN) and teachers of the religious and moral education.
4. The process of student thinking is not restricted. Not only students SMA/equivalent, the child now SD /MI may think until the stage of creation, within its capabilities.
5. Application of the theory of 5M remain in place:
   a. remember
   b. Understand
   c. Apply
   d. Analyzing
   e. Create
6. Structure of subjects and study time at school is not changed.
In connection with the efforts of national education standards, the government through the minister of education and culture has published a number of new regulations, including permendikbud No.20, 21, 22, and 23, 2016 on competency standards, content standards, process standards and assessment standards, with the entry into force of the revised curriculum and permendikbud, teachers in Indonesia are required to respond with implementing the curriculum into the classroom.

II. DISCUSSION

This study was designed with a "research and development". This approach refers to the opinion of Borg and Gall [2], which states that research model development is a process used to develop and validate educational products, such as teaching materials, textbooks, teaching methods, and others who do in a cycle of research and development. The steps of research development also refers to measures proposed by Borg and Gall [2] which includes: (1) study the collection of information; (2) planning; (3) developing the initial model; (4) pre-trials; (5) a revision of the earlier draft; (6) The main product testing; (7) revision of the primary products; (8) operational trials; (9) the revision of operational products; (10) dissemination and retribution.

A. Integrated Science

In essence the IPA includes four elements: product, process, application, and attitudes. Products in the form of facts, principles, theories, and laws. IPA is a process in problem-solving procedures through a scientific method that includes the activities of observation, hypothesis formulation, experimental design, trial or investigation, testing hypotheses through experimentation, evaluation, measurement, and conclusion. IPA applications on an application of the method or scientific work and concept of science in everyday life. Meanwhile, the attitude referred to in IPA were realized with curiosity about objects, natural phenomena, living beings, as well as the causal relationship that raises a new problem however can be solved through the correct procedures. Therefore, science is open ended because of the ever-evolving follow the pattern of changes in the dynamics of society [4].

Curriculum 2013 is designed to strengthen student’s competencies in terms of knowledge, skills, and attitudes intact. The process of learning achievements through a number of subjects that are arranged as a union of mutual support achievement of these outcomes. If the SD/ MI, all subjects are combined into one and presented in the form of themes. At the SMP / MTs of learning has begun to be broken into subjects, but this separation is still not done completely for the students of SMP/ MTs. Material of disciplines of Physics, Chemistry, Biology and Earth and Space Sciences still needs to be presented as a whole in Science (Natural Sciences). It is intended to give students insight intact for SMP/ MTs on the basic principles that govern the universe and all its contents [10].

The curriculum in 2013 to adopt the view that knowledge can not be moved away from the teacher to the learner. Learners are subjects that have the ability to actively search for, cultivate, construct, and use knowledge. This leads to learning must be in respect of providing opportunities for learners to construct knowledge in cognitive processes. In order to truly understand and can apply knowledge, learners should be encouraged to work to solve problems, find everything for themselves, and strive to realize their ideas. Teachers provide facilities to the process, by developing a learning environment that allows learners to discover, implement their own ideas, be aware of and consciously using their own strategies for learning. Teachers develop learning opportunities for learners to pursue originally done with the help of the teacher, but more and more independent. Understanding of learning shifts from "notified" to "actively seek out".

According to the Ministry of Education [14], the purpose of learning science, namely: a. Improving the efficiency and effectiveness of learning; b. Increase interest and motivation; c. Some basic competence can be achieved at once [18]. Integrated learning is learning that begins with a subject or theme associated with the subject to another, certain concepts associated with another concept, which is spontaneous or planned, both in the field of study or more, and with a variety of learning experiences children to make learning more meaningful. Integrated learning is a new trend in addressing the development of science in the 21st century and can give new perspectives for teachers and students to understand the conceptual relationship, new
models, and the structure of knowledge between disciplines [13]. Integrated learning makes learning more relevant, effective, efficient, and provide variety in teaching style [3].

Curriculum 2013 developed two learning processes that direct the learning process and the learning process indirectly. Direct learning is a process of education in which students develop the knowledge, thinking skills and psychomotor skills through direct interaction with learning resources designed syllabus and lesson plan (RPP) in the form of learning activities. In the direct instruction of students learning activities to observe, ask, gather information, associates or analyze, and communicate what is already found in his analysis activities. The learning process directly produces knowledge and skills directly, called instructional effect. Incorporation of integrated science teaching materials may use a variety of models. There are several models of integration used in the development of integrated science curriculum.

**B. Connected Model**

Adopted 10 models of curriculum integration according to Fogarty [7] into an integrated learning which can lead teachers how to integrate the concepts, skills, topics, and themes, there is one model of connectedness. Integrated learning model of connectedness (connected model) by Fogarty [7] is a "model focuses on making explicit connections within each subject area, connecting one topic to the next, connecting one concept to another, connecting a skill to related skill, connecting one day's work to the next, or even one term's ideas to the next". The definition indicates that the focus of the model connected is on linkages in the entire field, the relationship between topics, the relationship between concepts, linkages between skills, associate task today with the next, even ideas that are taught in one semester with ideas that are taught in next semester in one field of study.

The primary key is the presence of a connected model of a conscious effort to connect the field of study into one discipline. This concept shows the details of one discipline focused on the actual parts are interconnected, so that there will be a series of material. This material will be the next material prerequisites, the material supporting the next material, or material one associated with other materials so that what is learned to make learning meaningful. Linkages between concepts, topic, or theme occurs only on one subject.

The connected model of the integrated curriculum is the view through an opera glass, providing a close-up of the details, subtleties, and interconnections within one discipline. While the disciplines remain separate, this model focuses on making explicit connections within each subject area connecting one topic, one skill, one concept to the next; connecting one day’s work, or even one semester’s ideas, to the next. The key to this model is the deliberate effort to relate ideas within the discipline, rather than assuming that students will automatically understand the connections [7].
Connected Model emphasizes the need for integration of inter field of study in itself. In the Learning model connected, meaning "connected" does not mean linking several disciplines that have similar characteristics. Each discipline remain in their respective positions. Meaning of "connected" is intended to connect the material into one discipline. Scope of science subjects in junior high emphasis on observations of natural phenomena and their application in everyday life, issues related to the natural phenomenon Competency productive with the expansion in the abstract concept that covers the following aspects: 1) Living Beings and Process of Life; 2) objects / substances / materials and nature; 3) Energy and its amendment; 4) Earth and the Universe. In general, these aspects are in the field of the study of physics, earth space, biology, and chemistry [10]. In other words Natural Sciences is the integration of the study of physics, earth space, biological, and chemical.

Characteristics of learning using a model of connectedness that is learning Basic Competency ( KD ), the concepts in the KD-KD be attached to the concept of the other. The advantages of this model is that it can see the problem not only from one field of study. The main concepts are interconnected, leading to repetition, reconceptualization, and assimilation of ideas in a discipline. Syntax -integrated learning can be supple and flexible, can be applied on various types of models of learning and teaching methods and the use of appropriate media. Meanwhile, according to [18], measures integrated learning models Connection (connected) is as follows:

a. Planning phase
   1) Determine Competency
   2) Determine Determining Indicators Learning Objectives
b. Steps taken by the teacher
   1) Introduce the concept of student support that must be mastered. (Material prerequisites)
   2) Delivering the concepts to be mastered students
   3) Delivering process skills that can be developed.
   4) Delivering the tools and materials to be used / needed.
   5) Outline the key questions.
c. Implementation Phase, covering
   1) The management class by dividing the class into groups.
   2) Activity process.
   3) The data recording.
   4) Discussion in the classical
d. Evaluation phase, comprising:
   1) Evaluation of Processes, such as:
      a) The accuracy of the observations
      b) Accuracy in drafting tool and materials
      c) The accuracy of the students when analyzing the data.
   2) Product Evaluation
      Student mastery of concepts / materials in accordance with specific learning objectives that have been set.
   3) Evaluate the Psychomotor
      The ability of student mastery of the use of measuring instruments.

Connected models allow materials that have relevance can be integrated into a learning activity so that the material can be easily controlled and not fragmented. With the model connected, it is possible to be able to pour the ideas, and skills which could be among the themes, content, chapter, and each skill can be integrated into one unified whole understanding. Benefits of thematic learning by Daryanto [21] as follows:
1. By combining some basic competencies and indicators as well as the course content will be saving, because of the overlap of material can be reduced;
2. Students are able to see meaningful relationships because the content/learning materials to act more as a means or a tool, not an end;
3. Lessons to be whole so that the students will gain an understanding of the processes and materials that are not fragmented;
4. With the integration between subjects then the control concept will be better and increased.

Besides being able to increase students' cognitive abilities, the development of models of connected have been optimizing also aspects of process skills and attitudes, as well as a number of studies such as the results of research Pursitasari [12], which proves that learning science using Thematic can improve critical thinking skills and improve the character of the students; Arif research results proved that the development of teaching materials unified model of the Connected IPA can improve science process skills and student achievement SMP; the analysis of research Setiyawati concluded that the learning activities connected with the integrated model types can develop the scientific competence of students [15]. Based on these results we can say that developing a learning device using the integrated science connected model can be an alternative option for teachers in Indonesia which is implementing the curriculum in 2013. Wilujeng recommends that science teachers continue to improve its ability to design and develop integrated science capability in terms of both competence and the competence of pedagogical content [20]. Teachers are required to improve the ability of interdisciplinary science learning through other approaches that are relevant in accordance with the standard of science learning in SMP/MTs.

C. Science Process Skill
Skills whole process is directed scientific skills (both cognitive and psychomotor) that can be used to find a concept or principle or theory, to develop a concept that has been there before, or to perform denial of an invention. Learning science that integrates the dimensions of the process should be able to give the opportunity to construct their own knowledge gained through a series of processes. Process skills that can be trained to when learning science including observing, classifying, take measurements, make inferences, predict, making the relationship of space and time, interpret, create an operational definition, control variables, make hypotheses, conduct experiments, and communicate [4].

Science process skills are central to the acquisition of scientific knowledge which is useful in solving problems in society [8], the indispensable tools of scientists, helping them from their conceptual framework, thereby facilitating learning of new content associated with novel science problems [14]. Science process skills are the building blocks of critical thinking and inquiry in science that can be gained through precise science educational activities [16], claimed to enable an individual to improve their own life visions and give a scientific view/ literacy as a standard of their understanding about the nature of science [6].

Science as a practical subject provides students with an opportunity to interact with science process skills that can be used to solve problems in everyday life and contribute to national development. Science process skills are activities, which students carry out in scientific investigations to enable the acquisition of scientific knowledge and skills. The importance of teaching science process skills is to allow students to describe objects and events, ask questions, construct explanations, test those explanations against current scientific knowledge and communicate their ideas to others [9].

American Association for the Advancement of Science (AAAS) identified thirteen science processes. These are best thought of as a set of intellectual skills that are associated with acquiring reliable information about nature. Each process is defined. In addition, comment about the inherent nature of each of the skills is provided. The first eight processes are called "basic processes” and are appropriate for children in the primary grades. The last five are called integrated processes and are more appropriate for children at grades four and above. In the present study observation, inference, generalization, generalization and prediction were the process skills selected for testing its development due to the implementation of multimedia teaching [14].

The American Association for the Advancement of science–AAAS, in their programme, Science A Process Approach (SAPA) perceives it as a corresponding de-emphasis on specific science “content”, and more emphasis on science “processes”. SAPA holds that science is what scientists do. The science process skills are the intellectual skills needed for scientific investigation attained by students as a result of learning
science. As defined by SAPA, the science process skills are a set of broadly transferable abilities, appropriate to many science disciplines and reflective of the behaviour of scientists.

According to the Curriculum Development Center in Wilujeng states that the science process skills is the basis of solving problems in science and the scientific method [20]. Skills-science process skills can be divided into two parts, namely the basic skills and integrated science process skill. Six basic skills for the IPA process (K-12) include 1) observation (observing), which uses the five senses to find information about objects and other identifying characteristics; 2) classification (classifying), the process of classifying and sorting objects; 3) measurement (measuring), comparing the unknown quantity with a known quantity, such as a standard measurement units and non-standard; 4) communication (communicating), that use multimedia, writing, creating graphics or activities for sharing the invention; 5) inference (inferring), namely the formation of ideas to explain the observations; 6) prediction (predicting), assuming development of the expected results. Five integrated science process skills include 1) formulating hypotheses (formulating a hypothesis), which makes a prediction that is based on research evidences and previous investigations; 2) variables (variables), the name and control the independent variables (independent), bound (dependent) and control (control); 3) operational definition (operational definitions), which develop specific terms to describe what is happening in the investigation based on-observable characteristics; 4) experiments (experimenting), which is doing an investigation; 5) data interpretation (interpreting data), which analyzes the results of an investigation.

Skills processes involving sensing devices can be made to pay more attention in the learning process or become focused and interested in following the lesson, as expressed by Wachanga [19] is "The process-skill of observation involves the use of one senses to perceive objects and events; Reviews their properties and behavior. It requires that the students pay close attention to some aspects of what is being observed". The extracted process skills to students in learning science will be able to equip the students in the construction of its own concept of IPA. Therefore, learning science should be able to provide ample opportunity for students to perform self-discovery and construct knowledge as optimal as possible.

D. Curiosity

Curiosity Before any scientist starts on a project, he must have been curiosity about that relationship or phenomenon. So he becomes eager to find out about that phenomenon. The urge to find out is what is called curiosity, Examples, if you wake up one morning to find a lot of insects among the flowers planted around your home, you would want to investigate the cause that is curiosity.

American Association for the Advancement of Science reveals four aspects of scientific attitude that is needed at the primary level of honesty, curiosity, openness /open minded, and distrust (Skepticism). Other voices split into: (a) curiosity, (b) detachment of the data / facts, (c) the attitude of critical thinking, (d) the attitude of invention and creativity, (e) the attitude of open-minded and cooperation, (f) attitude perseverance, and (g) the attitude sensitive to the surrounding environment [5]. Indicators curiosity in learning activities for junior-high level [13] is as follows:

<table>
<thead>
<tr>
<th>Table 3. Indicators Curiosity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Curiosity</strong></td>
</tr>
<tr>
<td>Attitudes and actions which always attempt to learn more depth and extends from something Lesson learned, visits and heard.</td>
</tr>
<tr>
<td>Asked the teacher about a new natural phenomenon occurs</td>
</tr>
<tr>
<td>Asked the teacher about something that is heard from the television or radio</td>
</tr>
<tr>
<td>Asked the teacher about some events that are read from the print media</td>
</tr>
<tr>
<td>Ask about anything related to the subject matter but outside covered in class</td>
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</tbody>
</table>

III. CONCLUSION AND SUGGESTION

Learning knowledge addition to developing the science of cognitive aspects must also develop science process skills and curiosity of students, because the science is not just a collection of science, but also processes, attitudes and values. through an integrated learning model of connectedness is expected to make
science learning more meaningful and give students the nature of science and its application in everyday life. Teachers as agents of change in the front line of education is expected to be active, creative and innovative in developing integrated science teaching device. Thus, science process skills and curiosity that has been owned by the students can be increased.

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REFERENCES

DEVELOPING ANDROID-BASED CHEMISTRY INSTRUCTIONAL GAME TO IMPROVE THE SELF EFFICACY AND COGNITIVE ACHIEVEMENT OF HIGH SCHOOL STUDENTS

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Abstract—The aims of this research are: (1) to reveal the characteristic of android-based chemistry instructional games on chemical equilibrium for high school students; (2) to reveal the quality of the developed android-based chemistry instructional games; (3) to determine the differences in the improvement of self efficacy and cognitive learning outcome of students between learning using android-based chemistry instructional games and students between learning without android-based chemistry instructional games. This study is research and development (R&D). The development of instructional media be carried out by adapting Borg & Gall and Dick & Carey models modified into four phases: preliminary study, curriculum study, the product development of instructional media, and product evaluation. The product assessment was conducted by one media expert, one material experts, five peer reviewers and five chemistry teachers. The product testing was performed to the 11th grade students of High School, consisting of five students of SMAN 1 Piyungan Bantul for one-to-one trial, 15 students of SMAN 2 Yogyakarta for small group trial, and 25 students of SMAN 1 Cangkringan for field trial. The data collecting technique was done by using media evaluation questionnaires, self efficacy questionnaire and test. The results of this research show that: (1) the android-based chemistry instructional media has characteristic such as relevant, flexible, interesting and clear visualisation; (2) that the developed instructional games has a good quality based on the the assessment from chemistry expert, media exper, peer reviewer, chemistry teacher, and high students; and (3) that there is a significant difference in the improvement of self efficacy and cognitive learning a outcome of the student who are taught by using the developed instructional games and those who are taught not by using instructional games.

Keywords: Instructional Games, Self Efficacy, Chemical Equilibrium, Android

I. INTRODUCTION

Natural Sciences (IPA) education in Indonesia still needs a special attention. The attention supposed here is a concern on the achievement of education quality which is still inadequate. This can be seen from the result of National Exam (UN) for SMA/MA (high school) of 2014/2015 in D.I Yogyakarta that the average score for chemistry subject test was 61.88. That score was lower than the average score for physic (66.32) and biology (67.33).

To understand chemical concepts in chemistry learning is very essential. In fact, students often have difficulties in understanding chemical concepts as in [1]. From a field survey conducted to 50 students of SMAN 1 Cangkringan, it was concluded that chemical equilibrium was considered a subject matter difficult to reach KKM (Minimum Completion Criteria).

To improve students’ achievement, it is necessary to increase their self-efficacy. Reference [2] stated that self-efficacy may encourage the involvement of learning activities that can affect the level of achievement and motivation. The opinion stressed that self-efficacy is a factor supporting the learning achievement of learners.
Self-efficacy has a major effect on the individual's behaviors, one of which is motivation. Individuals with high self-efficacy also exert greater effort.

Learners' achievement cannot be separated from the role of teachers in learning process. In order to improve the effectiveness and efficiency of learning, it should be developed various models of creative and innovative learning. They are carried out in order to make learning process not to seem less attractive, monotonous and tedious which will inhibit the transfer of knowledge. Therefore, the role of media in learning process is important because it will make learning process more variative and interesting as in [3].

Advances in information technology is currently growing so rapidly that the technologies are widely utilized in various fields, including in the field of education, particularly the teaching and learning activities as instructional media. With instructional media, it is expected to give a new nuance to learners in order not to feel bored with the lessons given. Media is an integral part of learning process for the realization of education in general and teaching purposes at schools in particular as in [4]. Selection of effective instructional media expectedly will help much realize the learning purposes at schools. The use of audio-visual media in teaching and learning can improve interest and be an improvisation in learning process as in [5].

Along with the development in this modern age, various advanced communication tools, smartphones, are offered with the aim to support our needs, including meeting educational needs. Android-based smartphones supported with an instructional media application can be used as learning facilities for students as in [6]. This is in line with reference [7] who stated that the prominent advantage of android-based instructional media is the adaptability to be used anywhere and anytime without being confined in space and time. The advantage is supported with the android device which is small, lightweight and easily carried to anywhere. In addition, the android-based instructional media is expected to increase the utilization of mobile device or tablet as an instructional media for learners.

Smartphone development is indicated by the emergence of various operating systems on it, such as Android, I-phone, Blackberry, Windows Phone, and others. The growth of mobile devices in Indonesia reached 70.74% during July 2014 - July 2016 for android operating system, which also showed that android-based device was most widely used in Indonesia as in [8].

Based on the explanation before, the researchers conducted research and development on android-based chemistry instructional media on chemical equilibrium integrated in the method of Student Team-Achievement Divisions (STAD). Reference [9] explained that one type of the simplest cooperative learning is STAD. In this type, learners are given opportunities to discuss their observations and ideas in order to understand physical symptoms. In addition, the STAD encourages peer tutors among students in a group, more intelligent students help their less intelligent peers so that all group members can master the material studied. The result of the development of android-based chemistry instructional media is expected to help chemistry teachers during learning activities and is also expected to improve self-efficacy and cognitive learning outcomes significantly of SMA (high school) students. In addition, the developed media is expected to facilitate learners to access learning materials anywhere and anytime. The learning focus of this research is chemistry learning on chemical equilibrium for the 11th grade students of high school in the first semester. It is because the material is fairly difficult to understand as it requires precision, good-analysis and an ability to forecast the shift directions of chemical equilibrium. The study also focused on one of the factors that affect learners' achievement namely confidence or self-efficacy.

II. RESEARCH METHOD

This study is research and development which is an adaptation and combination of Borg & Gall as in [10] and Dick & Carey as in [11] models. The combination of both development procedures is as follows.

1. Preliminary analysis (literature study and field surveys);
2. Analyzing curriculum (competency standart, basic competencies, learning indicators, making evaluation and assessment);
3. Developing the instructional media product (creating media design, collecting materials, and manufacturing media products); and
4. Evaluating the product (validation by material experts, validation by media expert, assessment from peer reviewer, assessment from chemistry teachers, individual trial, small group trial, and field trial).
5. Dissemination and socialization

The study was conducted at SMA Negeri 1 Cangkringan, Sleman, Yogyakarta during December 2015. The subjects in this study consisted of 2 material experts (in the field of chemistry and chemistry learning), 1 instructional media expert, chemistry teachers from five different schools, 5 peer reviewers, 5 students for individual trial of SMAN 1 Piyungan, 15 students for small group trial of SMAN 2 Yogyakarta, and 2 classes for the experimental class and control class, each of which consists of 25 students of SMAN 1 Cangkringan.

The media product was validated by the media expert and material experts while media assessment was conducted by the chemistry teachers and peer reviewers. The instrument of media assessment had been previously validated by an instrument expert. The results of the assessment and the comments were used as the base for improving the media and then used in the field trial, the experimental class.

Self-efficacy was measured using questionnaires previously validated by an instrument expert while cognitive learning outcomes were measured using the instrument of pretest and posttest outcomes. The self-efficacy questionnaire instrument was administered before and after learning after the tests.

Data were classified into two, namely quantitative and qualitative data. Qualitative data consisting of the comments and suggestions put forward by the media expert, material experts, chemical teachers, peer reviewers, and students were used as the base for improving the instructional media product. Quantitative data consisting of scores determining the effectiveness of media products on students' self-efficacy were analyzed by comparing the pretest data to the posttest data and the experimental class to the control class.

Quality media assessments obtained from the material experts, media expert, peer reviewers, chemistry teachers, and students were still in the form qualitative data. Then, the data were converted into quantitative data with a scale of 1-5, and afterward the data were analyzed and calculated for all aspects. The average scores were compared to Media Quality Conversion as in [12] as shown in Table 1.

<table>
<thead>
<tr>
<th>No</th>
<th>Score Range</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>$\bar{x} + 1.8 , \sigma_x$</td>
<td>Very Good</td>
</tr>
<tr>
<td>2.</td>
<td>$\bar{x} + 0.6 , \sigma_x \leq \bar{x} + 1.8 , \sigma_x$</td>
<td>Good</td>
</tr>
<tr>
<td>3.</td>
<td>$\bar{x} - 0.6 , \sigma_x \leq \bar{x} \leq \bar{x} + 0.6 , \sigma_x$</td>
<td>Fair</td>
</tr>
<tr>
<td>4.</td>
<td>$\bar{x} - 1.8 , \sigma_x \leq \bar{x} - 0.6 , \sigma_x$</td>
<td>Less</td>
</tr>
<tr>
<td>5.</td>
<td>$\bar{x} \leq \bar{x} - 1.8 , \sigma_x$</td>
<td>Much Less</td>
</tr>
</tbody>
</table>

### III. RESULT AND DISCUSSION

**Media Product Manufacturing**

This research was conducted through 5 stages, i.e. preliminary studies, curriculum analysis, product development, evaluation, and dissemination. The result obtained in the preliminary study stage was that the learning process at SMAN 1 Cangkringan still led to teacher center. The instructional media used was only a textbook and Student Worksheet (LKS) with lecturing method. It was needed an innovation of interesting instructional media in order that the learning process would be able to achieve its objectives. Developing an instructional game can be an alternative instructional media that can improve self-efficacy and cognitive learning outcomes of students.

Reference [13] said that digital games can improve learners' cognition when used as instructional media. In addition to instructional media, learners' self-efficacy also influences their learning outcomes at school. Reference [14] said that learners' self-efficacy can predict their learning outcomes. The students with high self-efficacy have high learning spirit.

To create media of instructional game was started by creating flowchart and storyboard first. The flowchart creation was intended that the resulted media would have an easily-used navigation flow in the
operation. Those can be seen in Figure 1. Meanwhile, the storyboard creation aimed to make a number of suitable and attractive frames.

![Flowchart of Media](image)

**FIGURE 1. FLOWCHART OF MEDIA**

Here some examples of the storyboard illustration of chemistry instructional game. Those can be seen in Table 2.

<table>
<thead>
<tr>
<th>SCENE</th>
<th>VISUAL</th>
<th>CONTENT</th>
<th>SOUND</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main menu</td>
<td>1, 2</td>
<td>1: Application Setting Reset 2: exit button 3: Game name 4: the info button score 5: Game button 6: Competence button 7: Materials button 8: Instruction button 9: info button</td>
<td>On the main menu, there are 8 buttons: game button is to get into the game page, material button is to get into the material page, info button is to get into the info page. Instruction button to get into the instructionl page, competence page to enter into the competence page.</td>
<td></td>
</tr>
<tr>
<td>Game menu</td>
<td>1, 2, 3, 4</td>
<td>1: game level 5 button 2: game level 4 button 3: game level 3 button 4: game level 2 button 5: game level 1 button 6: life indicator button 7: back button</td>
<td>On game menu, there are seven buttons: back button is to return to the main menu, game level 1 button is to get into the game level 1, game level 2 button is to get into the game level 2, game level 3 button is to get into the game level 3, game level 4 button is to get into the game level 4, level 5 game button is to get into the game level 5, and the life indicator shows the number of lives that user owned</td>
<td></td>
</tr>
</tbody>
</table>

The development of android-based chemistry instructional game used Adobe Flash Professional CS6 software with action script 3.0 and can be operated on android devices with minimal operating system of version 4.0. The instructional game is only displayed in Bahasa Indonesia. In general, the menu listed in the android-based chemistry instructional game includes: (1) Kompetensi, SKKD (Competency Standard and Basic Competences), indicators and learning objectives; (2) Materi, containing a summary of chemical
equilibrium matter; (3) Petunjuk, containing procedures for the media operation; (4) Informasi, containing information on the chemistry instructional game and its developer profiles; (5) Game, containing a game with five-tier stages and difficulties. The instructional game also comes with score menu to know the rank obtained by learners after completing the game. Here are some displays of the chemistry instructional game show in Figure 2.

![Screenshot Displays of: (A) Log In; (B) Main Menu; (C) Animation](image)

Log in menu is in the beginning of the instructional game display. This menu is intended to enter students' name which will appear on score menu to know the rank.

Main menu displays menus that exist in the developed instructional game, namely: competence, material, instruction, information, game and score.

Animation contains video animation of chemical equilibrium material to help learners understand more the chemical equilibrium concept. This video animation is not a video recording but with frame by frame.

Game level displays level 1-5 in the form of small planets that have to be passed. Level 1 is the lowermost planet with the easiest game. Level 5 is the topmost planet with the most difficult game.

Level 5 contains 20 evaluation questions as a collection of the questions from level 1-4. At level 5 there are timer to see learners' speed to do the exercises that were provided. Learners can randomly do the exercises

Score shows students' names and scores after finishing the game of level 5. The displayed scores are 5 of the highest scores. So, learners can repeat the game at level 5 as much as 5 times.
Validating the Product

Product evaluation was done to assess or validate the developed instructional media products. The product evaluation results of instructional game were the data of assessment results from the material experts, media expert, peer reviewers, and chemistry teachers of high schools still in the form of scores, and then converted to define the quality criteria.

The material experts for the assessment of chemistry instructional game were chemistry lecturers at FMIPA. The media expert for the assessment of chemistry instructional game was an instructional media lecturer already competent in the field of instructional media. The assessment of android-based chemistry instructional game by peer reviewers and chemistry teachers was carried out at different times and places. The peer reviewers came from UNY (Yogyakarta State University) consisting of five graduate students who were conducting research on media development. Meanwhile, the chemistry teachers came from different SMA/MA (High School), namely SMA Tiga Maret Yogyakarta, SMK 1 Purwosari, SMAN 1 Kasihan Bantul, SMAN 6 Yogyakarta, and MA Al-Iman Yogyakarta.

The assessment of instructional media game was divided into two aspects: the material and media aspects. Details of the assessment can be seen in Table 2 for the material aspects and Table 3 for the media aspects.

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Number of people</th>
<th>Number of item</th>
<th>Average score</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material expert</td>
<td>2</td>
<td>15</td>
<td>66</td>
<td>Very good</td>
</tr>
<tr>
<td>Peer reviewer</td>
<td>5</td>
<td>14</td>
<td>64.6</td>
<td>Very good</td>
</tr>
<tr>
<td>Teachers</td>
<td>5</td>
<td>14</td>
<td>67</td>
<td>Very good</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>197.6</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td></td>
<td>65.87</td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td></td>
<td></td>
<td>Very Good</td>
<td></td>
</tr>
</tbody>
</table>

From the assessment results of material aspects by the material experts, peer reviewers and chemistry teachers, the average result score amounted to 65.87. This score was included into very good category, which showed that the android-based instructional game has fulfilled the indicators of learning and material aspects very well so that it was feasible to be used as an instructional media.

From the results of the assessment for media aspect by the media expert, peer reviewers and chemistry teachers, the average score amounted to 73. This score was in very good category, which showed that the android-based instructional game has fulfilled the indicators of audio-visual and software engineering aspect very well so that it was worth to feasible be used as an instructional media.
Evaluating the Product

Product trial of the android-based instructional game consisted of three stages, namely individual trial, small group trial and field trial. All subjects in the trial stages were high school students of in the class XI IPA (Natural Sciences) who also assessed the media using media assessment tools for learners. The students assessed its learning and material aspects as well as its operational and display aspects.

Individual trial was done on 5 students of SMAN 1 Piyungan with varied academic abilities. The small group trial employed 15 students of SMAN 2 Yogyakarta with varied academic abilities. The field trial was conducted by involving 25 students of SMAN 1 Cangkringan during learning process in the classroom. The media assessment results by students can be seen in Table 4.

The assessment results by students in individual trial, small group trial and field trial were that the media got average score amounted to 63.75, and was included into very good category. The score indicated that the android-based instructional game has met the indicators of learning and material aspect as well as the indicators of display and operational aspects very well. Therefore, it was possible to be used as an instructional media.

Based on the field trial result, it was concluded that the android-base chemistry instructional game products can improve the self-efficacy and learning outcomes of students. That was in line with reference [9] explaining that android-based instructional media can improve learners' self-efficacy and self-confidence which will be followed by the increase of students' learning achievement.

<table>
<thead>
<tr>
<th>Aspects</th>
<th>Individual</th>
<th>Small Group</th>
<th>Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning and Materials</td>
<td>20.8</td>
<td>21.47</td>
<td>22.20</td>
</tr>
<tr>
<td>Media Display and Operation</td>
<td>41.2</td>
<td>41.87</td>
<td>43.72</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>63.33</td>
<td>64.294</td>
</tr>
<tr>
<td>Average</td>
<td>63.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Very good</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IV. CONCLUSION

The android-based chemistry instructional game on chemical equilibrium has passed stages of validation, evaluation and product revision before being used as an instructional media.

The results showed that (1) the android-based chemistry instructional game has characteristics: the materials presented in the instructional media are relevant, the media product is flexible, the media visualization is interesting and detailed; (2) the android-based chemistry instructional game has good quality criteria based on the assessments by material experts, media expert, peer reviewers, chemistry teachers, and high school students. So, it deserves to be used as an instructional media; (3) there is a significant difference in the improvement of self efficacy and cognitive learning outcome of the students between those who were taught by using the developed instructional game and who learnt through conventional learning in the class XI of SMAN 1 Cangkringan, Sleman, Yogyakarta.

ACKNOWLEDGMENT

This research was partially supported by DIKTI Postgraduate Research Grant. This research was conducted by collaborations with SMAN 1 Cangkringan, SMAN 1 Piyungan and SMAN 2 Yogyakarta. This
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REFERENCE

THE OPTIMIZATION THREE CENTER OF EDUCATION FOR ESTABLISHING AND DEVELOPING CHARACTER OF STUDENTS IN LEARNING SCIENCE

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Abstract—There are a lot of cases that occurred in Indonesia in recent weeks, one of which is forest fires that occurred in the area Pelalawan, Riau. Forest fires is done intentionally by the public as an effort to open new land for agriculture, plantation and so on. The activity that are very inhospitable to the environment is a form of the lack of concern in environment of the local residents. This situation needs effective solution, one of them is by changing people's behavior toward nature through education. The young generations ought to have a better knowledge in environmental conversation. Therefore, the purposes of this research are: 1) provide insight on the importance of building good character in students, 2) provide an understanding at all levels of society that they have a strategic role in shaping the character of students. Method of this paper is study literature. The purpose of education which is not only from one way but also from others shows a sustainable development in environmental education. This can also be done to optimize Three Education Center (Tri Pusat Pendidikan). Three education center is a theory introduced by Ki Hajar Dewantara involving families, schools and peoples. The process of students’s progress and improvement should be a priority in our education system because it has great influence on the students’s character. Learning science for students can be a good alternative for their development of cognitive, affective and psychomotor ability. In conclusion, in order to gain a better education of students’s character, optimization of Three Education Center is highly suggested.

Keyword: Three Center of Education, Character of Students, Learning Science

I. INTRODUCTION

In this era many Phenomenon on society about behaviour non-educatif more increasing and very worrying. Behaviours are in the form of burning forest occurring in areas Pelalawan, Riau. The community and deliberately burn a forest with the purpose of open new land that will be used to agricultural, plantations and forth. Activities that very unfriendly that environment is a manifestation of lack of characters (cares about environment) within the local community. Other cases are in the Rinjani mountain, many tourists visited for enjoying the beauty of Rinjani mountain but when they back home, they leave the waste heaped. The condition is deeply uneasiness and disturbing so impact on the environment, social, economic, attitudes and care of the society to the environment. Others cases are the relegation moral in society Indonesia such as: murder, rape, brawl, burning woods etc.

Morality planting can be through education received from birth. This is in line with government’s programs that included values character in education as based on Pancasila and the constitution of the Republic Indonesia Undang-undang 1945 who rooted in religious values, national culture Indonesia and
responsive to demands the change of era. Hopefully with process in character education can build and develop the positive character of within students.

The weak character of students in school are evident in various aspects, one of them the attitude of students after making lab worked in the laboratory, when some student not cleaning and attempted to replace tools and material worn, in addition it can be visible of students attitude who often late for class, not perform tasks, and transgress the bounds of set by school. Therefore need planting and developing character within students as early as possible.

Character word comes from the Greek language from the word “charassein”, which means painting or drawing. Based on the meaning of character interpreted as a sign or special features, so creating the view that the character is pattern of behavior is both individual [1]. The term character in Indonesia joined and interchangeable with the term ethics, confirmed, value and pertaining to the power of moral, racial “positive” not neutral [2]. Investigating the values character done since 1000 last year Thomas Linkona stated Moral education is not a new idea. It is, in fact, as old as education itself. Down through history, in countries all over the world, education has had two great goals: to help young people become smart and to help them become good people [3]. Character education is a necessary goal of schools, as implied by legislation and standards for at both the national and local education and government levels [4].

As for values referred in education nation character according to set out in [2]: 1) Religious; the attitudes and behavior submissive in implementing religion which will be done, tolerant with the implementation of the other religious worship, and getting along with other community, 2) Honest; the behavior that was based on trying to make himself as he who is trustworthy in word, the action and work, 3) Toleration; attitudes and action of appreciate differences of religion, tribe, ethnic, opinion, attitude, and actions, others different of him, 4) Discipline; the action of indicating orderly behavior and obedient with provisions and regulations, 5) Hard work; the behavior that showing effort conscientious in overcome the barriers learning and duty, as well as secured their diligently duties, 6) Creative; reflecting and doing something to produce method or new result of something that had been owned, 7) Self-supporting; the attitudes and behavior that not easily dependent in resolving duties, 8) Democratic; manner reflect, good attitude, and action who feel same rights and obligations himself with others, 9) Curiosity; attitude and action have who always want to know more about something he learn, seen, and heard, 10) The spirit of nationality; mode of thinking, action, and who have a conception to puts the national interest and countries up our self and group, 11) Love of country; style of thinking, good attitude and do something for showing the loyalty, concern, as high appreciation for languages, physical environment, social, culture, economic, and political, 12) Appreciate achievement; attitudes and action of encouraged him to do something important for society, and admitted, and respect when some people get success, 13) Friendly/ communication; showing action interest and happy when his speaking, interacting and collaborating with others, 14) Peace-loving; attitude, words and actions that leads people another feels happy and securely upon the presence of himself, 15) Love reading; habitual for spending time for reading various an give virtue for themselves, 16) Caring with environment; attitude and actions are always tried to prevent damage the natural environment and developing efforts to repair damage natural those which have occurred, 17) Socially responsible, attitudes and action of have always wanted to provided assistance in others and people who needed, 18) Responsibility; the attitudes and behavior someone to carry out their duties and obligations, that she should be do with ourselves, the community, natural environment (social, and culture) the state, and One God.

Characters within students needs can build early in around family, the family is a first give an education to students, next in around schools and society students can develop and can be actualize in students environment. This is line with the theory put forward by Ki Hajar Dewantoro about important centers in education known with the term tri center education (tri pusat pendidikan) are family, school and community.

The family is the first place for students undergo every stage of development themself, until they will be able to prepare to come in and undergo the adult stage. Father and mother have main task of each in educating by the presence of good collaboration between them will form generation quality. Education by father and mother can be like communication and action. Comunication and action of the good exemplified by father and
Education family according by Mansur involves the provision of values positive for sprouting children as foundation education next step [5]. Another way Hasan Annalawi making restrictions of what education family as the worked by parents as the person who given responsibility to give values, attitude, role model for example and pure [5].

Family have function according by Adullah as education a noble mind, social, citizenship, habits formation and children intellectual education [5]. Mollehnhaur in Abdullah dividing three functions family in education of children [5]: a) Function quantitative, is prepared for the formation of basic behavior, it means family not only supply children physical basis, like; clothes, food and drink, and good place for living. But also, the family are required to provide and facilitate the availability of the good rudiments, in the form of behavior, ethics, manners and the formation of children character have good manners and have a certain character (berakhlak) either as the creation of human essential, b) Functions selective, is filter children experience and it is not same as position community because learning environment. It is means education family has function for playing as a function control supervision of kids will be any information that received c) Function pedagogis, pass on values and norms. That it is means education in family serves give inheritance values pertaining to aspects personality children. The last task of education in family reflected of attitudes, behavior and personality children in daily life displayed.

School is formal education. Formal education according to written on is the education a structured level consisting of basic education secondary education, and higher education [6]. Schools can increase pattern thinking a child, and becoming the place for children to study whole range of the sciences.

According to Sukmadinata “The area of the school getting important place for developing of learning that students played” [7]. While according to Sabdulloh in [7] that: school is educational environment that is deliberately planned and executed with strict rules such as must be a series of steps and sustainable, so called formal education and school is a special institution, a vehicle, a place to carry out education, in which there is learning process to achieve educational objectives on certain. In line with the opinions [7] The state of schools can be influence the success rate of learning. The quality of teachers, a method of teaching, curriculum conformity with children capability, condition of facilities or paraphernalia at school, the implementation school governance, and so on, all of them influence success for students.

The vicinity of the school into second place after family in forming child character. In school children can interact with friends who same age and friends who having age is older or younger. According to [7] function the vicinity of the school there are seven: a) Developing intelligence mind and to providing knowledge, b) Developing personal students thoroughly, conveying knowledge and implementing education intelligence, c) Specialization increasing differentiation in duty of societies and social institutions, schools also as social institutions specialty in the field of education and teaching, d) For existence of schools as social institutions specializing in the education sector and teaching so implementing education and teaching of the community becomes more efficient, e) The school help of the individual development of being a creature social, those who adapted properly in the community, f) Conservation and transmission of cultural when was been in a family, the lives of children always depend on parents, so when he entered in school he got a to train stand alone and responsibility before preparation to the community. Based on opinion on top the conclusion, function of school is helping developing good character in kids.

Teachers have many role: 1) Teachers need to involved in learning process, discussion, and take initiative as the efforts for building character education, 2) Teachers responsibility to become a role model having moral values and took the opportunity to affect her students, 3) Teachers need to give the understanding that character of students grow from cooperation and participate in making decision, 4) Teachers need reflection the problems moral of routine question to ensure that her students undergo developing characters, 5) Educator need to explain or making classification for students constantly about various values the good and the bad. Based on the discussion so it obviously that teachers have strategic role in building students.
character. A teacher is role model for her students (digugu dan ditiru), it is for imitating caprice her ways, so teacher should be come a good example for her students in school or outside school [3].

Horton and Hunt said the society is people relatively by stand alone, living together in a long time, inhabit a certain, having a same culture, and do most of their activities in there group [8]. Education experienced in society beginning when childhood for some time after out of the care of family and outside of education in school. Then, in the community having influence broader. When the circle will be likely for children to grow up into good personally, and vice versa. But there is no guarantee will be onward like that, so that needs to be reconsidered how pattern foster obtained child around family, as it would be the foundation in the formation of his character.

Learning is the process of interaction students with teachers and source of learning at a learning environment [6]. Science is one part of education by using science as the tools to get the purpose educational and education sciences to especially. Developing good character reflected in science as a gesture, that is attitudes, which is reflecting in scientist to get a product science by the way observation, experimentation and problem solving.

The foundation science has two dimensions, there are science become products and science become proces. Product science of the fact, concepts, principles, theory and law of theory. Sciences proces are skills and attitudes who needed and developed knowledge. Science become products and science as the process was not, 2-dimensional interwoven as one unit. In learning science planting good character within students who maybe done by means optimum the essence of science in learning science itself which was held in school.

Reference [9] the nature of learning science covers four things: the product (content), the process, attitudes and technology. Productis in science learning formed fact, law, principle, and whose theories had already been received by the truth. The process is process or method of to obtain knowledge by means of scientific work. Attitude is in learning contained development scientific attitude. Technology closely related to life and used in daily life.

II. METHODS

This research using methods of literature review. According to the literature review is an objective [10], through summary and critical analysis about the relevant available research or non-research literature on topic being studied. Metasynthesize is the technique used in this research that is the non-statistical technique used to integrate, evaluate and interpret the findings of multiple qualitative research studies [11].

III. RESULT AND DISCUSSION

As explained in the introductory that characters from Yunani language, “charassein” which means that carve pattern that does not at an ever-increasing. When people are born in the world, people have experienced to growth and development, it is influenced by the environment. During the stage so formed a character where such characters into a distinctive features of a person who distinction between each other. This is appropriate with expressed by [12] that good character in somebody would be reflect that a good person and it is make different and special to each other.

According to [3] there are several reason people needed the character education, which are: 1) Many young generation hurt each other because lower awareness to moral values, 2) Put a value moral for young generation is one of the most important functions of civilization, 3) The role of schools as educator the character becomes increasingly important when many children have a little teaching moral from they parents, the community, or religious, 4) There are still moral values are universally was received by as attention, trust, respect, and responsibilities, 5) Democracy needs special moral education because democracy is regulations for and by the community, 6) There is nothing as education free value. School teach education free value. School teach values every day through design or without design, 7) Commitment to character education important when we want and continue to be a good teacher, 8) Effective character education make schools more civilized, care with community, and referring to performance academic that rises.
Based on the reasons so forming students with good character is the task between parents, school and community. So it is needs good collaboration from them that hopefully can be achieved.

Developing good character (good attitude) is one of the essence of learning science is contained in the process of science, namely scientific attitude that by scientist as; logically, not manipulating data, plagiarism, objective, honest, have high motivation and etc. Scientific attitude in the learning science is included in building and the developing attitude what they have by children starts from birth the first time they found of education in the family.

The learning process can experienced by students everywhere and all the time, it can be around family, school and also public. This is in line with the theory introduced by Ki Hajar Dewantoro about education centers, there are strategic functions in children learning, there are family, schools and society. In learning process comprehensive, educational environment specifically the very influential on the establishment of personal children. Family often called as “the first school” that meaning is in neighborhood children first learned about education attitude. Planting a attitude against children in family environment divided into two forms, namely run traits that raise worthy and away from all the properties of reprehensible. Planting a noble mind on child in family environment will give the impact of very significant to the attitudes and unmanlyer children. The form of planting a noble mind of parents to children the most effective Is to give the example both directly [13].

Family is the smallest social unit who were in the community consisting of father, mother, and children. A bond that is in family is very closely so as familial ties can severely affect the formation of the nature and character of children. it can finally contribute to the establishment of the nature of children through education that is in the family. Bonding contributions in family for child education is by familial can train children for able ways to take care of yourself also parents attitude with children can make affect developing child. Children directly can learn from parents about undergoing and dealing life. So an education in around family is very determine the nature of or the character of a child in the future. Parents take hold high authority in family, so that should be parents really understand and gived a good example to children. One of example is giving a specific time for children when he must learn and when he should be playing, because child gets trained to always appreciate time and being personal who disciplines.

School is bigger social environment than families that the child can do actualization himself. In school, unlike family, because children meet and interact with a lot of friends, same age, under age or above age. The influence exerted by their peers is very high in forming identity and child character. If in the family child got good education from his parents, he was has been formed especially attitude about care and aware of their surroundings, because school is the place actual of that did he ever got in family environment. He will not be easy to influence of their peers, but he can have an influence positive on other friends who are not yet or less having awareness of to the environment. Because influence of their peers in education gives the impact on the establishment child character. Schools become a formal educational institutions must seek to the establishment of the good characters within child. Learning can be defined of a relatively permanent influence on behavior, knowledge, and thinking skills that comes about through experience [14]. So that learning experience found from through at the school and learning science especially can be used and developed in society. The community in the sense of friends and society.

Communities is the biggest social environment. In the society there are many kinds of thoughts, behavior and many kind of attitude. Societies are place for actualize what has been obtained in family environment and the vicinity of the school. Everything that has been obtained in family environment and schools will develop and felt by the community. In society the good characters can be developed one of them is by active in organizations social, started sorting and choose friend in associate and implement any theory in can be school in society, and others.

Character needs to implanted as early as possible to anticipate the problem in the future that increasingly complex as behave cheat, undisciplined and others. Character formed through a ongoing process. Optimizing this role of the family, schools and well-off communities form the good character within students belong character in learning science. In learning science students are required to have a sense of responsibility,
discipline etc. Character education teaching habits of thought and do something can help people to live and work together as family, friends, neighbors, the community, and people.

**IV. CONCLUSION**

Beginning developed character from around family next actualized and developed in school and seriously practical in the community. In learning science developing character, it looks of the nature of learning science which refer with the scientific to get facts and concept. With optimize tri education center so good character of students in learning science can increase.

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**REFERENCES**


COMPARISON OF PSYCHOMOTOR LEARNING OUTCOMES USING THE VIDEO AND DEMONSTRATION IN THE PRACTICUM ACTIVITIES

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Abstract—Learning outcome of junior high school student in the psychomotor domain is still low cause by the practice guidance is not yet effective. The video which contains steps of practicum activities are expected able to streamline the implementation of practicum physics. This research aimed to compare of learning outcomes psychomotor physics students use the video and demonstration in the practicum activities in class VIII SMPN 31 Padang. Population a quasi-experimental with randomized control group posttest design which expanded are class VIII in SMP N 31 Padang. Sampling was done by cluster random sampling technique. The research instrument is the observation sheet with scoring rubric. Data were analyzed by using a statistical test equality of two on average. The results showed that the working hypothesis which says there are differences in psychomotor learning outcomes physics students use a video with a demonstration of practicum activities in class VIII in SMP 31 acceptable on the real level of 0.05. Average psychomotor learning outcomes experimental class 1 at 84.35 and 77.43 for the experimental class 2 and statistical test results obtained \( t = 5.0355 \) that means a significant difference between the experimental class 1 and experimental class 2.

Keywords: Video, Practicum Activities, Psychomotor Learning Outcomes

I. INTRODUCTION

National education aims to develop students’ potential in order that created man of faith and piety to God Almighty, have noble moral, healthy, learned, accomplished, creative, independent, and become citizens of a democratic and responsible [1]. Students in the educational process should be able to learn and change his personality, these changes can be seen in the form of improved behaviour towards the better, such as increased skills, knowledge, attitudes, habits, understanding, skill, intellect and others [2].

Learning is a process of interaction between students and teachers. Learning is the assistance provided so that teachers can occur the process acquire science and knowledge, mastery of skills and behaviour, as well as the formation of attitudes and belief in students thus achieved a positive behavior change on students [3].

BSNP (Badan Standar Nasional Pendidikan) has issued a policy regarding the curriculum applied by educational units namely KTSP (Kurikulum Tingkat Satuan Pendidikan) which are based on the guidelines has been made BSNP. Curriculum unit level education at the level of primary and secondary education developed by the school Committee and the school based on the standards of competence of graduates and standard content as well as guidelines for preparing the curriculum created by BSNP [4]. KTSP-based learning defined by BSNP is an activity the activities of teaching and learning to achieve the learning objectives, a process of implementation of the ideas, concepts, and policy learning activities in a given KTSP, so students master a set of specific competencies, which are a result of interaction with the environment[5].

Implement education units in accordance with the standard rules KTSP process which has been established by the national standards bodies of education (BSNP) in Permentiknas No.41 Year 2007 explained that the implementation of learning activities is the implementation of the RPP. Implementation of learning activities include introduction, core activities and activities cover [1].

• Introduction
The preliminary activities of the early activity is a step in a process of teaching and learning aimed at resurrecting the motivation and focus the attention of siwa to participate actively in the process of teaching and learning.

- **Core**
  The core activity is a learning process to reach KD. The learning activities are conducted in an interactive, inspiring, fun, challenging, motivating students to be active, and independently according to their talents, interests and physical and psychological development of students. This activity is carried out systematically and systemically through the process of exploration, elaboration and confirmation.

- **Closing**
  Closing an activity undertaken to end the teaching and learning activities that can be done in the form of a summary or conclusion, assessment and reflection, feedback and follow-up.

Government Regulation No. 19 Year 2005 on National Education Standards chapters 6 Section (1) states that the curriculum for the type of general education, vocational, and specialized in primary and secondary education consists of [4]:

- a groups of religious education subjects and noble character
- a group of subjects of citizenship and personality
- a group of subjects in science and technology
- a group of subjects aesthetics
- a groups of physical subjects, sports and health.

Natural Sciences (IPA) is part of the science subjects are expecting learners are able to achieve an ability and skills to be able to interact with nature. Science teaching and learning process is done should be to enable all the potential and ability of the students, as well as to involve students in each learning activity.

Physics is one branch of science that in studying the subject of physics is carried out through a process including exploration skills (to obtain information, facts), activities of experimentation and problem-solving activities (done to strengthen the understanding of concepts and principles). Each teaching-learning activities aimed at achieving the basic competencies that can be translated into indicators with intensity varying competence achievement [4].

Problems often occur in the process of learning science at school today is teachers do not carry out a thorough study. Teachers are more concerned with aspects of cognitive and less attention to the affective and psychomotor aspects. This is not in accordance with the regulations of the Minister of National Education (game) Number 20 Year 2007 explained that one of the principles in the assessment is comprehensive and sustainable, then in Government Regulation No. 19 Year 2005 section 25 (4) of the National Education Standards explains that “competence education graduates include attitude, science knowledge and skills”. This means learning and assessment must study covers all aspects of cognitive (knowledge), affective (attitude) and psychomotor (skills). Likewise, learning science in physics, is expected to develop the potential of students in all aspects so that students can acquire knowledge, skills and good behavior in the future with self supporting. Physics Education should not only be theoretical but with the experimental process has not done well. Implementation of laboratory experiments have not been effective. This is due to the lack of clear information about the steps in the lab activities and demonstrations given guidance.

Practicum is an activity in laboratory instrumental in the success of the learning process of science Physics. Students with practicum can learn science through direct observation of phenomena and processes of science to practice scientific thinking skills, inculcate and develop a scientific attitude, locate and resolve problems through scientific methods and etc [6]. Students through practicum will be easier to understand the material and gain experience of practicum activities undertaken so that students can foster scientific attitudes and skills of practicum work undertaken.

The execution of laboratory experiments should be implemented as possible so that the learning affective and efficient. Practicum implementation can work well if the information regarding the practicum implementation given by the teacher should be clear and understood by students. Implementation of
hazardous or expensive lab should be done by way of demonstration or show such a way that all students can attend practicum well [7].

The objective of the demonstration is to help students observe a phenomenon, or focus student attention on the observation targets [8]. Accidents in the laboratory often occur due to lack of knowledge of students about the techniques or methods they need to do in the practicum [8]. For the clear information through demonstration of practicum activities can also minimize the danger that occurs when the practicum implementation.

Demonstration method is a method of learning which is implemented in the form by disclosing and demonstrate to students about a process, a situation or a particular object, either a reality or just a clone [9]. Teachers in the demonstration methods serve to explain and demonstrate the learning material directly to students and the students pay attention to the teacher carefully. Demonstration method has strengths and weaknesses, the advantages of the methods demonstration namely: (1) attention and students' thoughts can be focused on a given subject, (2) the error that occurred in the lecture can be resolved through direct observation and a concrete example, (3) provide motivation strong on the students to study harder, (4) students can participate actively and gain a direct experience. While the shortcomings of the demonstration, namely: (1) If the appliance is too small or less precise placement, the demonstration can not be seen clearly by all students, (2) if the time is not enough, the demonstration will run with blocked or running in a hurry [2]. Teachers in the learning process should be clear to every student so that a practicum implementation is not effective and not all students get a thorough explanation.

The disadvantage in the demonstration that contains material or practicum tools that are too small and lack of proper placement can be addressed using learning media is video. The look and sound of video that can be set up so that all students can see and hear a demonstration clearly. Video can streamline the practicum implementation time because the display settings and a demonstration can be set in the video outside of school hours.

Learning media by their nature can be divided into three groups: (1) the audio media (auditory) media that can only be heard, or media that have only sound elements, such as radio and voice recording, (2) a visual media is a media that can only be seen, does not have a voice, an example of this media is slide film, photograph, transparency, painting or drawing, and printed material such as graphics media. (3) media-based audio-visual media that has elements of sound and also has elements of the image can be seen, such as a video display, different types of movies, slide shows with sound, and so on. The ability of this media is considered superior, because it has two elements, namely audio and visual media [10].

Video is an example of audio-visual media which is a set of components or media capable of displaying images at the same sound at the same time [11]. Video as an audio-visual media to show motion and equipped with sound, through video messages are presented factual (events/important events and news) and fictional (like a story), can be informative, educational and instructional. Video in learning can be used to teach the subject matter. Video learning can also contain demonstration lab activities that will be delivered to the students so that students can accomplish their practicum and effective manner so as to change attitudes and develop skills acquired from lab activities [11].

Video practicum is a video media that contain information and demonstrations on practicum implementation steps are presented clearly so that students can carry out practicum work well. Video practicum can expedite the process of practicum implementation of Physics science at school, so that students acquire the knowledge, understanding, and acquire the skills and hone motor skills so that students can be independent in life and be able to continue their education to a higher level.

The results of student learning is something that is obtained by the students after learning activities are used to determine the success rate of students in mastering the subject matter. Student learning outcomes can be seen based on the assessment. Assessment may be the teacher against student learning outcomes to see the level of student competence achievement, as well as materials used to prepare a report learning outcome, and used to improve the learning process [12]. The assessment process is carried out comprehensively ie covering
all aspects of competencies that include cognitive abilities, psychomotor, and affective [12]. Teachers generally do not carry out a thorough assessment and covers all three aspects, only the teacher assesses students' cognitive learning outcomes and ignoring the results of psychomotor and affective student learning. This is reflected in the midterm exam and national exam.

Psychomotor learning outcomes are the result of learning related to the students' skills. psychomotor learning outcomes can be seen in the form of skills (skills) and an ability to act or behavior of individuals [13]. Skills or abilities of students psychomotor is a continuation of the results obtained by students learning cognitive (understanding something) and affective (ie aspect that is seen in the tendency to behave) [13].

Assessment of learning outcomes in psychomotor include: (1) the skills and abilities of students using the tools and attitude to work, (2) the skills and abilities of students in analyzing a job and arrange the order of a job, (3) the speed and accuracy of the students in doing the task, (4) the skills and abilities of students in reading and picture or symbol, (5) compatibility forms do with the expected or appropriate a predetermined size [12].

II. RESEARCH METHOD

Type of research is Quasi Experiment Research (quasi-experimental) design with posttest Randomized Control Group Design expanded. This study requires two experimental classes. Students in the experimental class 1 is given treatment by delivering video lab practicum and guidance during the learning, whereas the experimental class 2 uses demonstration lab activities that teachers and guidance practicum. This type of research Randomized Control Group Design expanded posttest can be illustrated in Table 1.

<table>
<thead>
<tr>
<th>Group</th>
<th>Pretest</th>
<th>Treatment</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment 1</td>
<td>-</td>
<td>X₁</td>
<td>T₂</td>
</tr>
<tr>
<td>Experiment 2</td>
<td>-</td>
<td>X₂</td>
<td>T₂</td>
</tr>
</tbody>
</table>

Explanation :
X = The treatments were given to both experimental class
T = Tests conducted on the second end of the experimental class

The study population was all class VIII SMP N 31 Padang. The sample in this study consisted of two classes of experimental class 1 is VIII2 consisting of 28 students and experimental class 2 is class VIII4 comprising 28 students. Technique to get these two classes of samples used cluster random sampling technique.

The variables in this study consisted of three, namely, the independent variable is the use of video practicum given the experimental class 1 and demonstration of practicum activities in the experimental class 2, the dependent variable is the student learning outcomes, namely the psychomotor, the control variables are teachers, curriculum, allocation time, the subject matter and the matter tested are the same.

The research instrument used is the observation sheet through the scoring rubric. Observation sheet is a sheet that is used for the observation of any object or appearance aspects skills that need to be observed [12]. Data retrieval is done when students take science subjects Physics lab for six sessions with six kinds of practicum. Grading scale used is a range of scores from 1 to 5 criteria: if the score 5 if the means do skill aspect is very precise, if a score of 4 if the means do skill aspect right, if the score 3 when ways of doing aspects of skill rather precise, if the score 2 if the way improper conduct skill aspect, a score of 1 if it did skill aspect is not very precise.

The first thing that must be considered in the scoring is there or not differences in weight or value of any aspect of the existing skills assessed in the rating scale or checklist in the observation sheet [14]. Then to interpret the results obtained can be compared to a reference or existing criteria.
Every single aspect of the skills have different weights, the final score is the number of students who achieved the score of each item that has the specified weight. Score each item on the score obtained is divided by the number of possible answers, and then multiply it by the weight of each item. The weight of each items is the weight of these groups are divided on the number of items. The score for each item a predetermined weight is determined weight score before grains divided by the number of answer choices and multiplied by the weight of each item [12].

\[
S = \frac{\text{score acquisition}}{\text{maximunscore}} \times \text{weight}
\]  

Data analysis aims to test whether the hypothesis tested in the study is accepted or rejected. Analysis of the data used is the similarity of two averages. The results of normality and homogeneity test was done it turned out samples come from a normally distributed population and homogeneity. Therefore, to test the equality of two average by using the t test. t test formula as follows:

\[
t = \frac{\bar{X}_1 - \bar{X}_2}{S \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}
\]

\[
S^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1 + n_2 - 2}
\]

III. RESULT AND DISCUSSION

Psychomotor student learning outcomes data obtained when students take a practicum matter physics science lessons for six sessions through observation sheet. Student practicum conducted in accordance with the curriculum and basic competence in materials science subjects Physics class VIII. Data score psychomotor learning outcomes of students used is the average value of the results of learning obtained by students each doing practicum work.

Data score of the learning outcomes calculation statistical test, the obtained average value (\( \bar{X} \)) standard deviation (S), and the variance (\( S^2 \)) experimental class and control class. The results obtained are presented in Table 2.

<table>
<thead>
<tr>
<th>Class</th>
<th>N</th>
<th>( \bar{X} )</th>
<th>S</th>
<th>( S^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment 1</td>
<td>28</td>
<td>84.35</td>
<td>4.365</td>
<td>19.053</td>
</tr>
<tr>
<td>Experiment 2</td>
<td>28</td>
<td>77.43</td>
<td>5.827</td>
<td>33.957</td>
</tr>
</tbody>
</table>

Table 2 shows the average value (\( \bar{X} \)) experimental class 1 at 84.3, while the average value (\( \bar{X} \)) experimental class 2 at 77.4. This means that the average value of psychomotor learning outcomes Physical Science class students experiment 1 higher than the experimental class 2. To determine whether the difference in value between the two classes this sample means or not, it is necessary to do the statistical analysis in the form of the mean equality test two Average.

Based normality test experimental class 1 and class 2 experiments obtained \( L_0 \) and \( L_1 \) prices on the real level of 0.05 for \( n_1 = 28 \) and \( n_2 = 28 \), as shown in Table 3.
Table 3 shows that for the experimental class 1 L₀ obtained by 0.1145 and Lt amounted to 0.161, while the experimental class 2 L₀ obtained by 0.1365 and amounted to 0.161 Lₜ. Means the value of L₀ for the experimental class 1 and experiment 2 is smaller than the value of Lₜ (L₀<Lₜ). Means the end of the second grade test data are normally distributed samples. Homogeneity test is done the results obtained as shown in Table 4.

Table 4 shows that for the second grade sample with α = 0.05 seemed that of F is 1.782283 while for Fₜable is 1.88. This indicates Fₜ count smaller than Fₜable (Fₜ count<Fₜable). Means experimental class 1 and experimental 2 has a homogeneous variance.

Based on tests of normality and homogeneity tests were performed, the data obtained learning outcomes experimental class 1 and experimental class 2 are normally distributed and had homogeneous variances. For testing the hypothesis used t-test. t test results of samples of both classes can be seen in Table 5.

Table 5 shows that tₜ count = 5.0355 while tₜ table = 1.67 with a significance difference test criteria, if tₜ count<tₜ table means on the second sample is not a significant difference, if tₜ count> tₜ table means in both samples contained a significant difference on the real level of 0.05.

These data show a significant difference between the mean of the experimental class 1 and experimental class 2. This difference is because all of the control variables are teachers, curriculum, materials and time allocation has been implemented. Means the only independent variable, namely the use of video practicum given the experimental class 1 and demonstration of practicum activities in the experimental class 2 which led to a significant difference in psychomotor learning outcomes of students. Thus the hypothesis H₀ that says there are no differences in learning outcomes psychomotor Science Physics students use video with a demonstration of practicum activities in class VIII SMPN 31 Padang rejected, the opposite hypothesis Hₐ which says there are differences in psychomotor learning outcomes Science Physics students use video with a demonstration lab activities on class VIII SMPN 31 Padang accepted.

The results of the analysis of the data obtained showed psychomotor learning outcomes of students using a video lab activities higher than a demonstration of student learning outcomes using practicum activities. These results can be seen from the average value of the two classes of samples taken when students carry out practicum work for six sessions. The average value of the experimental class 1 is 84.35 and the average value of the experimental class 2 is 77.43.

Statistical testing for both classes were conducted by using statistical test formulated by [15] obtained psychomotor learning outcomes of students with the real level of 0.05 and dk = 54 obtained tₜ count of 5.0355 and tₜ table 1.67. Based on statistical tests that have been done, get tₜ count> tₜ table, meaning prices are in the
reception area $t_{out}$ significance. Means the average value of psychomotor learning outcomes of these two classes differ significantly and show psychomotor learning outcomes of students using video practicum higher than psychomotor learning outcomes of students using demonstration lab activities on the real level of 0.05.

Student learning outcomes are higher in the experimental class 1 because during the learning process students are given a free variable that video lab activities so that students obtain clear information on practicum implementation steps. Students can perform lab work properly and effectively. Students in the experimental class 2 during the learning process is given free variable that demonstration lab activities. During the learning process of students do not understand the steps practicum for students do not get a thorough explanation so that many students can not effectively carry out practicum work.

Video practicum is a video that shows the steps practicum. Students can watch the video by using the steps practicum with clear and able to carry out practicum work effectively and efficiently. Practicum implementation of effective and efficient able to train students so that students acquire psychomotor skills. Demonstrations by teachers are not able to present the material and measures practicum clearly. Students can not see small practicum tool and all the students did not get a good explanation of the practicum implementation so that the practicum implementation is not effective and efficient.

Based on these descriptions can be concluded that there are differences in learning outcomes psychomotor Science Physics students use video with a demonstration of practicum activities in class VIII SMPN 31 Padang. It is seen from the results of experimental class learning one of the experimental class 2, the result of learning psychomotor Science Physics students use video practicum higher than psychomotor learning outcomes Physical science students using demonstration lab activities.

**IV. CONCLUSION**

After performing data processing results of comparative studies of psychomotor learning outcomes Science Physics students use video with a demonstration in the practicum activities in class VIII SMPN 31 Padang, it can be deduced that there are differences in psychomotor learning outcomes Science Physics students use video with a demonstration in the practicum activities in class VIII SMPN 31 Padang. Psychomotor learning outcomes Science Physics students use video practicum higher than psychomotor learning outcomes Physical science students using demonstration lab activities. This is evident from the average value of the experimental class 1 at 84.35 and the average value of the experimental class 2 at 77.43.

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**REFERENCES**

IMPLEMENTATION OF MAPPING CONCEPT TO ENHANCE FOURTH GRADERS ON SCIENCE SUBJECT IN SDN KEBRAON IV/565 SURABAYA

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Abstract — The aim of this research is to enhance students' learning result on science subject in the fourth graders of IVB of SDN Kebraon IV/565 Surabaya. This enhancement effort can be performed through the learning strategic implementation of mapping concept. In making mapping concept students have to write down theme and then make sub themes and those sub themes are broken down into other sub themes. This research is a classroom action research, two cycles were performed. The subject of this research were twenty five IVB students in SDN Kebraon IV. The techniques of collecting data were done through observation and test. The instrument was observation activity sheet for teacher, students and also evaluation sheet test. The analysis data technique used was to figure out the students' average scores on science, the students' learning result completeness, the students and teachers' activity completeness. Based on this research findings on the Cycle I showed that the enhancement students' learning result on science subject was proved percentage of 56%. It increased in the Cycle II with the percentage of 73%. From this result can be concluded that the learning strategic implementation of mapping concept can enhance the students' learning result on science subject of the fourth graders of SDN Kebraon IV/565 Surabaya.

Keywords: Science, Mapping Concept, to Enhance

I. INTRODUCTION

In this society’s condition nowadays, education is not only oriented to the past and present, but also a process that anticipate and related to future. Education is supposed to have further vision and it should think what is going to be faced by students in the future. One of the basic problems in education is learning in formal education i.e. still low students’ preoccupation [1]. This is what the writer found on the students IVB in SDN Kebraon 4/565 Surabaya. According to previous research, the students of IVB class in that school were still struggling to memorize wide-ranging science materials; this is because the students were lazy to read their note. Their note was in long linear written form that covered the completely content material. Often the students made long linear conventional notes that and most of them made note by copying all the materials; hence it struck as boring and made students lazy to read. Here, the students were treated as an object of receiver and they should memorize the materials only. Whereas this matter is difficult to do because the students’ ability limitations in memorizing material, based on this understanding that the students get was less so that the achieved learning result was low.

The writer thought that the learning process was more to memorizing long notes, teachers did not make use appropriate learning strategic, and less proper feedback to get from teacher to the students so that they became passive objects. Science in its nature has process dimension, product and attitude shaping. All those dimensions are interrelated. To understand a concept, students are not told by teacher, but the teacher gives chance to students to get and find concept through their experience by developing basic skill and making conclusion. Hence, students can directly and actively involved in learning activity. Based on those, it is essential to apply appropriate strategic learning which its main aim is to teach students to get science knowledge vivid so that the level of students’ comprehension on the subject increase and their result gets higher. One of the appropriate applied strategic in learning science is mapping concept strategic. In science, mapping concept can help students to improve their cognitive skill i.e. to understand concepts or knowledge.
in science which in form of characteristics explanations of some objects, symptoms or occurrence or explanation about main characteristics to classify or categorize a group of objects or occurrence [1]. From the psychomotor aspect, students can also make mapping concept as material conclusion that is more efficient comparing to those of taking notes traditionally that covers all material’s content of the subject. Besides that, mapping concept makes abstract information to become concrete and very useful to enhance students’ memory of learning concepts, so that students do not easily forget what they have learned. The effort to enhance students’ learning result by learning strategic implementation of mapping concept in learning science emphasizes on the science dimension aspect as product. By applying learning strategic of mapping concept, it is hoped that students are going to get a help in understanding concepts in the subject. Through mapping concept students can transfer and write down their ideas they have in their minds. By making mapping concept, students have to write down. In making this mapping concept, students have to write down the theme and then make sub themes which from these sub theme is broken down into sub themes.

II. RESEARCH METHOD

This research was a Classroom Action Research (CAR) with descriptive qualitative and quantitative analysis. The subject of this research were IVB students of SDN Kebranon IV/55 Surabaya that consisted of 14 male students and 9 female students. The location of this research was SDN Kebranon IV/55 Surabaya which is located at St. Kebranon 2 No.65a. This research consisted of 4 elementary components which are also planning, acting, reflecting

![CAR Cycle Diagram]

This research consisted of 2 cycles where each cycle consisted of 2 times. Cycle I: planning, acting, observing and in reflecting where is teacher does the improvement toward performed activity. The gained data through observation are gathered and analyzed. When there is a possibility that any students face difficulties in understanding the given material because of teacher’s lack of creativity in explaining the material.
A. Data
- Qualitative Data: The data gained from students’ activity during teaching learning process. The data were taken when it was carried out and observed that is performed on learning process.
- Quantitative Data: The data was students’ learning result. This data is in form of numbers and taken from test result that was given by the teacher [3].

B. The Research Instrument
The researcher gained the gathering data by making use of some research instruments. Thus, from those instruments, the researchers could get the wanted data result. The prepared instruments were:
- Students and Teacher’s Activity Observation Sheet: The students and teacher’s activity observation sheet was used to observe students’ activity during learning process by making use of learning strategy of mapping concept. The observed teacher’s activity was the teacher’s activity while applying mapping concept in learning. The observed students’ activity was the students’ attitude during learning by applying learning strategy of mapping concept.
- Test sheet: The test sheet was learning assessment result during learning by making use of learning strategy of mapping concept [3].

C. The Data Collection Procedure
- Test: Test was used to get quantitative data that was gathered from test done by the students
- Observation: This research used systematic observation that used guidance as observation instrument. There were two observation, the first was aimed to observe the teacher’s activity during learning process and the second was aimed at students’ activity during learning process. From this observation could be derived that what were the obstacles that faced by the teacher in the learning process so that the teacher could find out a way to overcome those obstacles [3].

D. The Data Analysis Techniques
The data analysis techniques in this research used quantitative and qualitative data analysis techniques. To find out the success level or the students’ success percentage after teaching learning process each cycle by making use of evaluation in form of written test at the end of cycle. This analysis was counted using simple statistics:
- The writer summed all the students’ scores, and next they were divided by the students’ number existed in the classroom so that the test average was formulated:
  \[ X = \frac{\sum X}{N} \]  
  \( X \): mean  
  \( \sum X \): sum of all students’ score  
  \( N \): the number of students

The completeness of students’ learning is summed with the formula:
\[ P = \frac{F}{N} \times 100\% \]  
\( P \): the completeness gained  
\( n \): the number of students who did the completeness of learning  
\( N \): the number of students

The criteria of the learning completeness with mapping concept strategy are 86-100%: very complete, 75-85%: complete, 60-74%: fair complete, 50-59%: less complete, ≤ 50: not complete.

E. The Result of Observation
The observation data were the existing statements, which were shown in the observation behavior. That is the reason why the observation data was evaluated by analyzing and interpreting all that observation result. In other words, it was done by using qualitative analysis.

The formula to count the observation data:
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\[ P = \frac{\sum F}{N} \times 100\% \]  

(5)

P: percentage
F: the sum of score
N: the sum of maximal score from the taken components
The criteria of observation data from the teacher and student’s activity are 86-100%: very good, 76-85%: good, 60-75%: fair, 55-59%: less, ≤ 54: bad.

F. The indicator of a successful research

What this research examines was the enhancement of the students’ comprehension on science subject by making use of learning strategy of mapping concept. The indicator of research successfulness of the teacher and students’ aim of work covers:

- Students classically have completed the learning/the learning result increases. If the learning completeness reaches more than or equal to 70% while the mean of the classical learning all students reaches 65.
- The teacher’s activity in learning activity reaches success when the percentage is more than or equal to 70%.
- The students’ activity in learning activity reaches success when the percentage is more than or equal to 70%.

III. FINDING AND DISCUSSION

A. The result of Cycle 1

1) The teacher’s activity
   In the cycle 1 meeting teacher’s activity in learning as a whole got 64% percentage and this result had not reached the expected percentage i.e. 70% of all teacher’s activity on each aspect.

2) Students’ activity
   In the first meeting students’ activity in learning as a whole percentage reached 69%. This result had not yet reached the expected percentage i.e. 70% of all students’ activity on each aspect.

3) The learning result
   The learning completeness was counted from the students’ evaluation test result which was done in the end of the cycle. The result of the score is as follow:
   Mean Score :
   \[ X = \frac{\sum X}{N} \]
   \[ X = \frac{1530}{23} = 66,5 \]
   Learning Completeness Score :
   \[ P = \frac{\sum F}{N} \times 100\% \]
   \[ = \frac{13}{23} \times 100\% \]
   \[ = 56\% \]
   By seeing the data, the students’ learning completeness is 56%. This was not in accordance with the wanted learning completeness i.e. 70%. This was caused by the teacher had not maximally done the teaching learning activity by applying learning strategy of mapping concept.

   The reflection stage was carried out in the end of cycle 1. The researcher reflected again the learning that was done in the cycle 1 and the cause and also solution as an effort to improvement for the next cycle. Based on the observation result that was done in the cycle 1, the teacher’s activity percentage was 64%, while the students’ activity was 69%. This result did not fulfill the success of the research that is set up more than or equal to 70%. The students’ learning result was 55%. The result of this test had not yet reached of the successful research indicator that is set more than or equal to 70%.
Besides that, from the finished observation was done in the cycle 1 was found some obstacles in learning by using mapping concept. Some obstacles were:

1. Class management did by the teacher did not run very well. Based on the observation result, it was found out by the observer that during the teacher delivered the purpose of learning, students were calm and listened to the teacher. Yet, there still some students were talking to each other or making noise.
2. Before teaching learning activity, teacher was not strict enough because in doing mapping concept or evaluation, the students could not do it by themselves. Some of them still talking to one another or playing around.
3. During giving continuing training, the teacher was not discipline enough because in doing mapping concept or evaluation problems, students could not do it by themselves, some of them still asked or peeped their peers’ work.
4. The teacher’s time management was not managed well because it was over-scheduled.
5. The students’ enthusiasm was still low so that the teacher had to be able because the mapping concept was applied for the first time.
6. The students were still having problems in making mapping concept. This was because the mapping concept was still first time applied.
7. During the learning process, the teacher and students did not interact well. This was because the students were still shy and felt unconfident.
8. When the students presented reading the mapping concept result, the students lacked of not audacious enough and confident to step forward. Besides that when their peers presented, others did not really listen, pay attention and respond.
9. The mapping concept strategy applied by the teacher was not really maximal. The teacher still dominated in learning.

Based on this reflection, the researcher decided to continue the cycle II. This was done to fix the weaknesses in the cycle I. Besides that, the teacher and students’ activity did not reach the expected target i.e. 70%. The students test result did not fulfill the successful research target, i.e. the students who got score more than or equal to 65 had not yet reached 70%. Based on the reflection about the weakness of that cycle 1, then the improvement plan learning in the cycle II were as follows:

- In the cycle II for the class management, the teacher should deepen each student’s character so that it would be easy for the teacher to control the students not to make noise. Before whilst activity began, the teacher should hold learning contract with the students, which should be obeyed by the students.
- In doing the mapping concept the students had to be really calm and do it by themselves and if there was a difficulties one should ask to the teacher immediately without hesitation.
- In doing the taking the test the students had to do it by themselves and quiet.
- When the students were reading their mapping concept result, other students should really pay attention and listen and give response.

B. The Result of the Cycle II

1. The result of the cycle II can be explained in to these aspects:

   - The teacher’s activity
     In the first meeting of the cycle II the teacher’s activity in learning as a whole got the percentage of 94%. This gained percentage had already reached the expected percentage of 70% of all the teacher’s activity on each aspect.

   - The students’ activity
     In the second meeting the students’ activity, the percentage of successful learning as a whole got 97%. This result already reached the expected percentage i.e. 70% of all students’ activity on each aspect.

   - The learning result test
     The learning completeness was counted from the students’ evaluation test result, which was done in the end of each cycle. The gained score is as follow:

     Mean Score
The learning completeness of the students’ learning result is 73%. This fulfills the wanted learning completeness criteria i.e. 70%.

Based on the observation result about the students’ learning activity and learning activity by the teacher both the students’ evaluation test result in the cycle II. The researcher reflected again to see the weaknesses that happen and have to be improved in the next cycle. The final score of the teacher’s activity in the cycle I was 64% and this increased to 94% in cycle II. This shows that in the cycle II, the teacher’s activity increased as much as 30%. The students’ activity increased as much as 28%. In the cycle I the students’ learning activity as a whole was 69% that increased 28%. In the cycle I the students’ learning activity as a whole was 69% became 97%. This shows that the students and teacher’s activity has reached the successful learning research indicator which is more than or equal to 70%.

Besides the students and teacher’s activity, the students’ learning test result as a whole in the cycle I was 56% became 73%. This shows that the increasing is 18%. During the learning, it was held an observation to know the existed obstacles during the learning activity by applying mapping concept method. The obstacles found were:

1. The class management by the teacher has already run well. When the teacher delivered the learning purpose, the students were calm and they paid attention.
2. The teacher was strict in making learning contract, so that the learning process ran well.
3. When doing the training, the students could already work quietly and independently.
4. In the learning the students did not feel shy and unconfident anymore to ask or express their opinion, though it existed, it was from few students.
5. The students’ curiosity has already been present so that the teacher has to be able more to attract the students’ attention.
6. Some students still had difficulties in making mapping concept. Unlike in the cycle I, in this cycle the students confidently make mapping concept.
7. The teacher has already effectively in guiding the students in making mapping concept though not evenly and completely.
8. In the learning process, the teacher and students have already interacted so that the teacher enhances the communication with the students.
9. When the students present and read their mapping concept, the students have already brave enough and confident to step forward and besides that their classmates listen, pay attention and respond.

Based on the enhancement of the teacher’s activity, the students’ activity and their learning result and the result of assessment result of mapping concept product in the end of cycle II. Thus, the researcher decided not to continue to the next cycle.

C. The Discussion

This classroom action research was carried out by applying the learning strategy of mapping concept in science for the material, ecosystem. This research was held with two cycles which each cycle consisted of two meetings. Each cycle consists of four stages of activity: plan, act, observe and reflect. In this discussion is described about the enhancement of the students’ learning result in science on ecosystem material. The students’ learning result completeness in the cycle I is 56% while in the cycle II is 73%. Therefore, it can be
said that the learning strategy of mapping concept, the students’ learning result increased as much as 17%. The comparison of the classical completeness of the students’ learning result can be seen in the diagram as follow:

![Diagram](image_url)

FIGURE 2. THE COMPARISON PERCENTAGE OF LEARNING RESULT IN THE CYCLE I AND II

In the learning of the cycle I, the teacher’s activity in applying the learning strategy of mapping concept, the concept had not yet reached the success indicator. This is seen from the observation result to the teacher’s activity in the cycle I had not yet reached the success percentage i.e. 64% of the set percentage of 70%. After performing some improvements on the teacher’s work in the cycle II, the observation result of teacher’s activity in the cycle II reached the success of high percentage i.e. 94%. Hence, in the cycle II the success percentage of teacher’s activity enhanced successfully and increased from the cycle I. The comparison of the teacher’s activity in the cycle I and II described in the figure 3 as follow:

![Diagram](image_url)

FIGURE 3. THE PERCENTAGE COMPARISON OF THE TEACHER’S ACTIVITY IN THE CYCLE I AND II

Based on figure 3, it can be seen that the teacher’s activity percentage enhanced as much as 30%. In the cycle I the teacher’s activity got 64% percentage and in the cycle II increased to 94%. The teacher did not become the center in the learning because the teacher became the guidance and facilitator. Based on the observation activity result in the cycle II, the students’ activity got percentage of 97%. In the cycle II the students’ activity had already achieved the success indicator that is set of 70%. Hence, in the cycle II the enhancement percentage got was 28% of the observation result can be seen that the students’ activity had enhanced and it was successful. The comparison of the students’ classical engagement in the cycle I and II can be seen in the diagram below in Figure 4 :

![Diagram](image_url)

FIGURE 4. THE COMPARISON PERCENTAGE THE STUDENTS’ ACTIVITY IN THE CYCLE I AND II

Based on Figure 4 can be seen that the students’ activity percentage in the cycle I reached 69%. It increased in the cycle II from 28% to 97%. Besides that from the observation result that was performed, it can be found and concluded that some existed obstacles when the teacher taught by applying the learning strategy.
of mapping concept were: when giving motivation and demonstrated the steps in making mind mapping, there were still some students who were making noise and they did not pay attention to the teacher so that the teacher needs to have high innovation and creativity to make them interested. Besides that, there were still some students who had difficulties with what they were going to write even though they understood what was required. Still they had difficulties to write it down. The learning strategy implementation of mapping concept said to be effective when the students and teacher’s activity increased in learning so that the learning runs supportively and effectively. The students’ learning increasing result which is in accordance with the students’ creativity increasing that can be seen from the students’ mapping concept result product. The implementation of learning strategy of mapping concept said to be successful when the increasing of the students’ learning result, their creativity and the increasing of the students and teacher’s activity in learning by applying the learning strategy of mapping concept. Derived from all gained results during the teaching learning activity from the cycle I and the cycle II, it is obvious that the learning strategy implementation of mapping concept that was performed by the researcher can enhance the students’ learning result in science subject in IVB SDN Kebraon IV/565 Surabaya.

IV. CONCLUSION

Based on the data research analysis about the learning strategy implementation of mapping concept to enhance the students’ learning result in science subject for the Ecosystem material in class IV SDN Kebraon IV/565 Surabaya that:

- The students’ learning enhancement result in science subject for the Ecosystem material by applying the learning strategy of mapping concept can be seen in the students’ learning result has enhancement in accordance with the researcher’s target. The result test shows the more students who achieved completeness from the minimal standard score that has been set. This enhancement occurs classically.
- The students’ activity during the learning by applying learning strategy of mapping concept had gone through enhancement during 2 cycles. The striking activity was the students were more interested when the teacher delivered the steps in making mapping concept and also toward the delivered material. Besides during the training, the students were more enthusiastic.
- The teacher’s activity during the learning by applying the learning strategy of mapping concept had enhancement and had successfully delivered the teaching learning process in 2 cycles.
- The obstacles that faced during the teaching learning was when giving the motivation and steps demonstration in making mapping concept, there were still some students who were noisy and they did not pay attention to the teacher. Hence, the teacher need to have high high innovation and creativity to make the students interested. Other than that, there were some students who were still not able to find out the problem or main topic so that they could not find the concept in the reading material. When making mapping concept there were still some students facing difficulties of what they were going to write even though they understood the meaning but they hesitated to write it down. When taking the test, some students were still working together and they peeped their classmates’ work and even asked to their teacher.

REFERENCES

ENHANCING STUDENTS' ENVIRONMENTAL AWARENESS THROUGH SOCIO-SCIENTIFIC ISSUES BASED INSTRUCTION IN TEACHING AND LEARNING BIOLOGY

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Abstract—In recent years, the environmental issues become the big issues in our generation. As we know, environmental issues have many impacts to the living things especially for human life. Relating the environmental issues, we may concern not only one aspect but also many aspects such as social, moral, ethical, and so on. To improve environmental awareness of people we need a contribution of education to educate pupil in scientific process. So, in this case we should adopt an approach as the innovation of teaching and learning. SSI (Socio-Scientific Issues) based instruction is one of strategies in teaching and learning process. SSI based instruction provide a context for scientific content but also acknowledge the significance of social and cultural aspects of science in science education. Including SSI based instruction has been shown to increase interest in learning science involving socio-scientific issues and it can also provide a context for learning about the nature of science. This strategy can be used by teacher in teaching and learning biology to improve the pupil environmental awareness. In this paper, we will describe about the concept of SSI-based instruction and how to implement SSI-based instruction in teaching and learning biology.

Keywords: Socio-Scientific Based Instruction, Environmental Issues, Teaching and Learning Biology, Environmental Awareness of Pupil

I. INTRODUCTION

In recent years, the environmental issues become the big issues in our generation. As we know, environmental issues have many impacts to the living things especially for human life. Relating the environmental issues, we may concern not only one aspect but also many aspects such as social, moral, ethical, and so on. To improve environmental awareness of people we need a contribution of education to educate pupil in scientific process. So, in this case we should adopt a strategy as the innovation of teaching and learning.

SSI (Socio-Scientific Issues) based instruction is one of strategies in teaching and learning process. SSI based instruction provide a context for scientific content but also acknowledge the significance of social and cultural aspects of science in science education. Including SSI based instruction has been shown to increase interest in learning science involving socio-scientific issues and it can also provide a context for learning about the nature of science. This strategy can be used by teacher in teaching and learning biology to improve the pupil environmental awareness.

Socio-scientific issues are the topics in science that allow the student face the conflict or controversy in their society related the science and social aspect. This controversy may impact in social, ethical, cultural, political, and economic aspects of student. Issues such as global climate change, genetic engineering, alternative energy, stem cell research, sustainable development, food and energy resources, population control can be considered as socio-scientific issues [1]. These issues are included in environmental issues. Furthermore [2] state the environmental issues at global level such as water pollution, air pollution, depletion of natural resources, ground water pollution, toxic chemical and soil pollution, ozone layer depletion, global warming, loss of biodiversity, extinction of wildlife and loss of natural habitat, and nuclear wastes and
radiation issues. This kind of issues may be used in SSI-based instruction to enhance students’ environmental awareness. In this paper, we will describe about the concept of SSI-based instruction and how to implement SSI-based instruction in teaching and learning biology.

II. Method

This method based on a literature review of articles, journals, textbooks which related to Socio-Scientific Issues Based Instruction.

III. Content

A. What is Socio-Scientific Issues Based Instruction?

Socio-scientific issues differ from other issues in science in that they are open-ended, ill-structured, debatable problems subject to multiple perspectives and solutions [3]. Socio-scientific issues involve the products or the process of science and create a social debate or controversy. It may define the conceptual framework using the controversial issues to develop the emotion and character of student which discuss in moral and ethical aspects. On the other hand, it differs to STS (science, technology, and society) that only focus on the implication of science and technology to society but not explore the implication in moral and ethical aspect [3].

Socio-scientific issues (SSI) involve the deliberate use of scientific topics that require students to engage in dialogue, discussion, and debate. They are usually controversial in nature but have the added element of requiring a degree of moral reasoning or the evaluation of ethical concerns in the process of arriving at decisions regarding possible resolution of those issues. The intent is that such issues are personally meaningful and engaging to students, require the use of evidence-based reasoning, provide a context for understanding scientific information [4]. Socio-scientific issues are the topics in science that allow the student face the conflict or controversy in their society related the science and social aspect. This controversy may impact in social, ethical, cultural, politic, and economic aspects of student [1].

Socio-scientific issues based instruction is a strategy of learning and teaching using socio-scientific issues to engage student experience in classroom. Especially, SSI-based instruction can allow the students learn about the issues and challenged to explore the controversy around the issues. SSI-based instruction can improve the learning experiences of student and also construct their knowledge by allowing the student to practice the scientific principles and concepts in real-world problems or issues to overcome and respect the conflict in their society. SSI based instruction can be used for students to identify themselves as willing and able to engage in socio-scientific discourses [5]. Students should act as active contributors in society with competencies and willingness to employ scientific ideas and processes, understanding about science and knowledge to issues and problems that affect their lives.

Reference [5] show the framework for SSI-based instruction included some aspects, such as 1) design element, 2) learner experiences, 3) teacher attributes, and 4) classroom environment, and 5) peripheral influences. Design elements are related to features of curricular design for SSI-based instruction. Learner experiences are related to student’s opportunities to develop their skills in classroom using SSI-based instruction. Classroom environment consists of factors that play a role in successful of the implementation of SSI-based instruction. Furthermore, teacher attributes also have the role in successful of the implementation of SSI-based instruction. Teachers attribute may include perception of teacher, knowledge, behaviors, skills of teacher in delivering matter, and how teacher manage the classroom. In SSI-based instruction, teacher should decrease the effect of teacher-centered learning. Teacher should allow the student to explore their knowledge and develop their skills to overcome the problems. Peripheral influence is also important in SSI-based instruction such as family, society, culture, and so on. To understand the framework of SSI-based instruction we can see the following diagram (Figure 1).
To complete the framework that has been shown by [5], in reference [6] enhance the framework into a holistic concept by combining the teaching model of Dunkin and Biddle’s (1984) and learning cycle by Kolb (1984) such as the aspects of concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE). This conceptual model describes what kind of variables that can affect the SSI-based instruction and its effect on the outcome of student learning (Figure 2).

Based on the conceptual model in Figure 2, Shoulder and Myers explain some variables that influence to the learning outcome of student (as product variables) [6]. Those variables are presage variable, context variables, and process variables. Presage variables are similar to the teacher attribute. Context variables consist of pupil formative experiences and properties, school and community contexts, and classroom contexts. Pupil formative experience may be impact the learning process because every student has different formative experience. They bring their formative experiences to the classroom such as parents’ of view and experiences, socioeconomic status, and physical attributes. These conditions may impact to the learning process using SSI-based instruction. The influence of context variables is very important to the process variables. So, it also impacts the learning process using SSI-based instruction and the product variables. SSI-based instruction will impact on numerous student outcomes (product variables) in science education, including content knowledge, scientific reasoning ability, argumentation skills, and views of the nature of science [6].

**B. How to implement SSI-Based Instruction in teaching and learning biology?**

Socio-scientific based instruction is an approach that allow the student discuss about the controversial issues which related to the science and social aspect. Teaching with SSI-based instruction require time to student discuss about the topics. Indeed those topics should relate to socio-scientific issues. This following
model of SSI-based instruction which developed by some researchers can be used in learning and teaching biology (Table 1).

**Table 1. Model of SSI-based Instruction**

<table>
<thead>
<tr>
<th>No.</th>
<th>Model</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Instructional model for SSI-based education [13]</td>
<td>Problem analysis&lt;br&gt;  - Teacher offer the issues to student&lt;br&gt;  - Student looking for the issues related to the topics&lt;br&gt;  - Student analyze the issues and do the discussion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Classification of science&lt;br&gt;  - Teacher help the student to understand the concepts of science related to the issues&lt;br&gt;  - Teacher facilitating student in discussion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Refocus on socioscientific dilemma&lt;br&gt;  - Student refocus their attention on the issue and associated social problem or controversies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Role playing&lt;br&gt;  - Student assume the role to engage in the negotiation of SSI&lt;br&gt;  - Student debate the issues (pros and cons)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Meta-reflective activity&lt;br&gt;  - Students reflect their experience in SSI-based instruction&lt;br&gt;  - Student highlight the concept of science that related to social problem</td>
</tr>
<tr>
<td>2</td>
<td>Model for decision making using moral case issues [14]</td>
<td>Identify the moral issues&lt;br&gt;  - Identify relevant knowledge and unknown facts&lt;br&gt;  - Offer some solutions&lt;br&gt;  - Provide justification&lt;br&gt;  - Consider the alternative scenarios that argue for different conclusion&lt;br&gt;  - Identify and evaluate moral consequences&lt;br&gt;  - Offer alternative solution</td>
</tr>
<tr>
<td>3</td>
<td>Socioscientific Issues: Theory and Practice [15]</td>
<td>Sociomoral discourse:&lt;br&gt;  - Teacher offer the sociomoral discourse to motivate student&lt;br&gt;  - Student underlying the ideas to their past experience&lt;br&gt;  - Allow the student to negotiate, resolve conflicts, and enhance the quality of their own arguments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Argumentation and debate&lt;br&gt;  - Argumentation and debate use to engage students’ thinking and reasoning processes&lt;br&gt;  - Reflect their argument in their real life</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Discussion&lt;br&gt;  - Teacher should guide the discussion before attempting a debate may help both the teacher and the students to incorporate the behaviors that will ultimately make argumentation more productive.</td>
</tr>
</tbody>
</table>

**C. The Benefit of SSI-Based Instruction**

Socio-scientific issues based instruction is an active strategy learning, because it placing science content within social context. Socio-scientific issues use the scientific topics that require student to dialogue, debate and discussion. The example of scientific topics about the environment’s issues such as global warming, pollution, climate change, etc. Within using these issues, student will be active in classroom. They can learn about the environmental issues and challenged to explore the controversy around an issue which informed or covered by science. The benefit of socio-scientific issues based instruction are:

1. It is an ideal venue for the 5 E Learning process, according [7]
   - a. Engage<br> Students make connections between their learning experience at past and present.
   - b. Explore<br> Student must be active. Students are actively investigating trough inquiry-based instruction. They are asking questions, analyzing their data, and using their critical thinking skill set.
   - c. Explain
Students are communicating with others about what they have learned and trying to figure out where their learning fits in the scheme of things.

d. Extend
   Students are expanding on what they have learned, making connections to other concepts and applying the new information to their lives in new and different ways.

e. Evaluate
   Students demonstrate their true understanding of learning experiences by means of performance tasks.

2. It requires students to use higher order thinking skills to analyze and synthesize information to address the issue under discussion.

3. It allows students to more depth explore the context of science in environmental society.

4. Using a socio-scientific issues-based teaching approach helps improve students' understanding. It causes them to discuss issues in biology with one another, and getting students to talk about science helps them to learn.

5. Improve skills, such as decision making, negotiating, oral and written communication, self-awareness, and teamwork, which are cultivated as students work through socio-scientific issues with their peers.

6. Students need to be exposed to multiple perspectives and develop their own position if they are to become prepared to tackle the issues that they will face in the world outside of the formal school environment [8].

   According to socio-scientific issues based instruction, student must have to understand about how scientific issues and the decision that they make these issues have moral and ethical outcomes. Using the real-life example trough socio-scientific issues based instruction can make:

   a. Students easier to understand the material
   b. It allows the students to study a topic more in depth when they have to look at both sides of a moral issue
   c. Using issues in teaching and learning biology is very effective. Not only issues, but students search the current and up to date about the real-life issues

D. How to Enhance Students’ Environmental Awareness through SSI-Based Instruction?

   Environmental issues are urgent issues in the recent years. Issues such as global climate change, genetic engineering, alternative energy, stem cell research, sustainable development, food and energy resources, and population control can be considered as socio-scientific issues. These issues are included in environmental issues [1]. In addition, [2] state the environmental issues at global level such as water pollution, air pollution, depletion of natural resources, ground water pollution, toxic chemical and soil pollution, ozone layer depletion, global warming, loss of biodiversity, extinction of wildlife and loss of natural habitat, and nuclear wastes and radiation issues. Those become our concern to maintain our environmental. So, it is important for us to develop the environmental awareness.

   Reference [9] state the environmental awareness is a board concept that refers to a wide range of phenomena from awareness of environmental problems to support for environmental protection that reflect attitudes, related cognitions, behavioral intentions toward the environment. Alibeli and Johnson define the environmental awareness as the level of a person's ability to complete and demonstrate a willingness to contribute personally to find a solution [10]. Schaffrin explain the characteristics of people that have higher level of environmental awareness should (1) accept that the environmental issue is a serious problem; (2) agree to set environmental policy; (3) show a willingness to take personal action to reduce environmental damage [11]. To measure the level of people’s environmental awareness can be used NEP scale (New Ecological Paradigm Scale) developed by Dunlap, Van Liere and Jones [9].

   Teacher should have the strategy to choose what the environmental issues for student. Teacher can choose the environmental issues that relevant with biology material and the material will make the student enhance their environmental awareness. SSI-based instruction will allow the student discuss, debate, and offer the solutions about the environmental issues. So, this strategy is appropriate to develop their environmental awareness.

   For example, the investigation by Schweizer and Kelly that investigate how using debate as a pedagogical tool for addressing earth system science concepts can promote active student learning, present a realistic and
dynamic view of science, and provide a mechanism for integrating the scientific, political and social dimensions of global environmental change [12]. The investigation examines how students make use of observationally-based climatic data sets when debating the cause of global warming. The results indicate that students used observational data sets in a variety of ways, such as supporting their own argument; negating the argument of the opposing side; presenting challenges to the opposing side; and raising new scientific questions. This following figure will explain how SSI-based instruction enhance students’ environmental awareness (Figure 3).

**FIGURE 3.** HOW ENHANCE STUDENTS’ ENVIRONMENTAL AWARENESS THROUGH SSI-BASED INSTRUCTION

### IV. CONCLUSION AND RECOMMENDATION

**A. Conclusion**

Socio-scientific issues based instruction can be used for students to come to identify themselves as willing and able to engage in socio-scientific discourses. Students should act as active contributors to society with competencies and willingness to employ scientific ideas and processes, understanding about science and knowledge to issues that affect their lives. Environmental issue is one of issues that can used in SSI-based instruction. Teacher should have the strategy to choose what the environmental issues for student. Teacher can choose the environmental issues that relevant with biology material and the material will make the student enhance their environmental awareness. SSI-based instruction will allow the student discuss, debate, and offer the solutions about the environmental issues. So, this strategy is appropriate to develop their environmental awareness.

**B. Recommendation**

This paper will recommend to teacher, lecture, the government, and the education researcher in Indonesia. With using the socio-scientific issues student are trained to think critically about the environment’s issues. Students learn about the environmental issues and challenged to explore the controversy around an issue which covered by science and the decision that they make these issues have moral and ethical outcomes. We hope, this strategy can be implemented in each school level of Indonesia to create the better human resources for future.

**REFERENCES**


THE ROLE OF SCIENTIFIC INVESTIGATIONS IN LEARNING PHYSICS WITH MULTIPLE REPRESENTATION

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Abstract—The purpose of research is to investigate the role of scientific investigation in learning physics with multiple representation. The research was conducted by giving multiple representation tests to students, which in previous learning conduct scientific investigations and without scientific investigation. The results showed that students who perform scientific investigations have representation ability better than those not doing scientific investigation. Students are better able to create and connect between representation.

Keywords: Scientific Investigations, Multiple Representations, Physics Learning

I. INTRODUCTION

Multiple representation means representing the same concept of using multiple modes of representation. The ability to master the concepts of physics are very concerned with how to use the various languages of science in physics learning, such as verbal, visual, symbols and equations, gestures, role playing, presentations, and others that allows students to learn physics through development of mental ability to think with either [1].

Multiple representations have three main functions, namely as a complement, limiting interpretation, and construct knowledge [2]. Multiple representation as complementary in the process of thinking and cognitive students in getting the concepts more perfect. Multiple representations can be used to limit the possibilities of errors in the interpretation of a concept, principles and laws of physics. Multiple representations used to encourage students to build understanding of the situation in more depth.

Learning physics with multiple representations supporting the effectiveness learning process. Many research results which recommends learning physics with multiple representation. The diverse of format representation can give a fairly good chance to understand the concepts and communicate them, and how they work with the system and the process of a particular physics concept [3], and multiple representations role in solving physics problems [4]. Learning physics with multiple representations can give positive influence on cognitive abilities [5]. Multiple representations helps students to construct knowledge and problem-solving, and by Ainsworth that multiple representations are very relevant and necessary to build the capacity to develop the concept and the scientific method [2].

The scientists coordinate with multi features a representation that can be understood together. However, students of the difficulty in connecting multiple representations, their understanding is limited by the representation of individual features [6]. Results of other studies reveal that students use multiple representations inability to understand the concept of physics seem to have become a barrier or limit their understanding [7]. In addition, students can make representations but have trouble connecting between representation [8]. This shows the need to attempt to provide an intervention in learning physics with multiple representations.
Interventions that will be given is to apply scientific investigation in physics learning with multiple representations. Scientific investigation support students' understanding, experimentation, and the scientific method [9]. Scientific investigation is a holistic approach to learning science through practical work [10]. Practical work where students are not given a complete set of instructions but have the freedom to choose the procedure to be followed [11]. The investigative process consists of four phases, namely the planning and design phase, the implementation phase of action, reflection phase, and the phase of recording and reporting [12].

Multiple representation can developing the scientific method, but this study will investigate how the investigative role in learning physics with multiple representations. The aim is to equip students with the scientific performance, in order to understand the physics concept of a phenomenon, so as to build concepts representation of physics and connect between representation.

II. RESEARCH METHODS

The research was conducted by giving multiple representation tests to physics education students, which in previous learning conduct scientific investigations and without scientific investigation. The Subjects were 60 students, divided into experimental class (with scientific investigation) and control class (without scientific investigation). The selected subject matter is Ohm’s law and electrical circuits. The research design is Post-test Only Control Group with the following pattern on Table 1.

<table>
<thead>
<tr>
<th>Class</th>
<th>Treatment</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>F (Experiment)</td>
<td>X</td>
<td>T2</td>
</tr>
<tr>
<td>E (Control)</td>
<td>-</td>
<td>T2</td>
</tr>
</tbody>
</table>

(X) : the learning treatment with scientific investigation
T2 : post test

The Effect of treatments were analyzed with using statistical t-test. If there are significant difference between experimental class and control class, then the treatment is given effect significant. It means learning with scientific investigation affect the ability multiple representation of students.

Subsequently conducted interviews with two students have the highest ability in multiple representation of the experimental class and control class. Interviews were conducted to find out how they build a representation, as well as the influence of the scientific investigation of the representations constructed.

III. RESULT AND DISCUSSION

The test results showed that the ability of the representation of the experimental class has an average value is better than the control class. The data were then analyzed with a statistical t-test. Data and t-test results are summarized in Table 2.

<table>
<thead>
<tr>
<th>Class</th>
<th>The Representation Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Upper</td>
</tr>
<tr>
<td>F (Experiment)</td>
<td>85,71</td>
</tr>
<tr>
<td>E (Control)</td>
<td>71,43</td>
</tr>
</tbody>
</table>

The results of the analysis of the t-test are summarized in Table 3.1 shows the t-stat > t-table so it can be concluded that there are significant difference between experimental class and control class. It means treatment of scientific investigation affect the ability multiple representation of students.

Scores student representation for each subject matter and the kind of representation are summarized in Table 3.
TABLE 3. THE SCORE OF REPRESENTATION ABILITY

| Subject Matter      | Sources Representation | Representation Target (%) | | | |
|---------------------|-------------------------|---------------------------|---|---|---|---|---|---|
|                     |                         | Verbal | Image | Graph | Math | Eks | Con | Eks | Con | Eks | Con | Eks | Con |
| Ohm’s Law           | Verbal                  | - | - | 74,33 | 59,00 | - | - | 95,67 | 59,00 |
|                     | Verbal                  | - | - | - | - | 56,67 | 55,67 | 74,33 | 73,33 |
| Series Circuit      | Verbal                  | 60,00 | 60,00 | 63,33 | 61,00 | - | - | 74,33 | 67,67 |
| Parallel Circuit    | Math                    | 66,67 | 63,33 | 71,00 | 54,33 | - | - | - | - |

From the Table 3, can be compared the average score of representation ability experimental class and control class for the representation target. For the subject matter of Ohm's Law, the score average of each representation targets experimental class is better than the control class. Meanwhile, the subject matter series and parallel circuit mean score better in the experimental class except on verbal representations. Occurs on average similarity score representation verbal, which is 60.00 : 60.00 and 67.67 : 67.67.

From these results showed that the scientific investigation provides a good influence on the representation ability of the student. In scientific investigation, students perform experiments and the results are recorded and reported to involve multiple representations. So students build a representation based on the results of the investigation, so that students better understand the concept with multiple representations. This is consistent with the research results that scientific investigation supports the students' understanding [9].

To find out how to build student representation, conducted the interview. Interviews were conducted for representatives of students who have the upper representation ability in the experimental class and a control class, which then sequentially called F and E. The results of the interviews are summarized in Table 4.

TABLE 4. INTERVIEW RESULTS

<table>
<thead>
<tr>
<th>Subject material</th>
<th>Sources Representation</th>
<th>Representation Target</th>
<th>Student</th>
<th>F</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ohm’s law</td>
<td>verbal</td>
<td>Images, Math</td>
<td>Students understand the information, draw a circuit and write mathematical equations</td>
<td>Students understand the information, draw a circuit (incomplete) and write math equations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Graphs, Math</td>
<td>Students understand the information, create graph, create a mathematical equation from the graph (connected)</td>
<td>Students understand the information, make the graph (incomplete) and write the mathematical equations (graphs and equations are not connected)</td>
<td></td>
</tr>
<tr>
<td>Series circuit</td>
<td>-</td>
<td>Images, verbal, math</td>
<td>Students create a image of circuit, explain based on images, and write the mathematical equations</td>
<td>Students create a images of circuit, make explain not based on images, and write mathematical equations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>verbal</td>
<td>Pictures, mathematics</td>
<td>Students create images based on the information and make a mathematical equation (verbal-image-mathematical interconnected)</td>
<td>Students create images based on the information and write the mathematical equations (verbal-image-math is not interconnected)</td>
<td></td>
</tr>
<tr>
<td>Parallel circuit</td>
<td>-</td>
<td>Images, verbal, math</td>
<td>Students create a images of circuit, explain not based on images, and write the mathematical equations</td>
<td>Students create images based on the information and make explained (math-image- verbal images are not interconnected)</td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td></td>
<td>Pictures, Verbal</td>
<td>Students create images based on the information and make explained (math-image-verbal interconnected)</td>
<td>Students create images based on the information and make explained (math-verbal images are not interconnected)</td>
<td></td>
</tr>
</tbody>
</table>
Intervews showed how students F and E can build representations. Student (F) can build a representation are connected, however student (E) can build a representation but not interconnected and difficulity connecting between representation. This shows that the scientific investigation on learning physics with multiple representations provide a role in the process of making representations that are connected.

IV. CONCLUSION

Through this research can be concluded that students who perform scientific investigations have representation ability of physics concept better than those not doing scientific investigation, in physics learning with multiple representations. Students are better able to create and connect between representation.

REFERENCES

DEVELOPMENT LEARNING MATERIAL ON THEME SINDORO-SUMBING MOUNTAIN SLOPE CONSERVATION TO EXPLORE PROBLEM SOLVING SKILL

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Abstract- This research was aimed to develop learning material of integrated science with webbed type that integrates multi discipline knowledge in one theme to explore student problem solving skill. The title of this learning material is Conservation of Sindoro-Sumbing Mountain Slope which is integrated with local wisdom. Phenomenon in the learning material is found contextually in students’ daily life at the slope mountain of Sindoro Sumbing, Temanggung. This research is a development of learning material that uses Research and Development design, they are preliminary studying, planning, developing, and preliminary field testing. The limited testing was conducted at one school by involving 16 students from seven grade and wide scale was conducted by involving 61 students at the same grade. Data collections are observation, documentation, and questionnaire distribution was used by experts to judge the quality of learning material. Learning material should be implemented on study to knew the problem solving skill of student with instrument of problem solving skill. Validation of learning material is determined by the result of validation questionnaire, concept mastery level by using main idea in a paragraph. The result shows that learning material is deserve to use with very strong level category, 86.75%. Understanding of learning material are 81.12% with high level category. The implementation learning material on study can increase the problem solving skill of student with significant number (N-gain) 0.50 and that include on moderate categorized.

Keywords: Learning Material, Integrated, Problem Solving

1. INTRODUCTION

Science subject is a subject that discusses about science phenomenon that can be observed through various science field such as Physics, Chemistry, Biology and interspace science. In the curriculum development orientation of 2013, it is mentioned that science learning in Junior High School is applied in unity, and not just as single knowledge discipline. It means that science learning tools are arranged from various knowledge fields, thus the unity science learning approach is called as interdiscipliner approach [1]. Synthesis science is a unity among science fields, which are Physics, Interspace science, Chemistry and Biology that is presented fully. Material that is presented must have at least two fields, for instance Biology-Physics, Physics-Chemistry or Chemistry-Biology, the combination of those three fields Physics-Biology-Chemistry or all of the four science subjects based on the given theme [2]. The unity process of various knowledge discipline until it is completely united has many model. One of the process is by combining science using webbed model. This learning model combines multiple knowledge discipline or various subjects that is tied by a theme [3].

Nature phenomenon that is observed in integrate science learning is a learning source that can be used by students in attaining knowledge. The amount of science learning source has to be set accordingly with
students level development and the curriculum that is used, thus it will make the graduate students have ability suited with the standard of graduate competence. The learning source will be meaningful if it is interestingly designed and packaged, thus it will make easier for the students and the teachers to use it. One of the learning source organizing form is in the form of learning material.

Based on the observation result toward science teacher that is applying curriculum of 2013 in Temanggung regency, some of the teachers were facing difficulty in teaching science learning unitely. The knowledge background and the lack of experience become the major problem for the teacher in conducting integrate learning. This is suited with the problem in conducting integrate science learning mentioned by Kumala that: 1) Teachers have to have background knowledge in Physics, Biology, and Chemistry; 2) the books that are provided by government have not presented science unitely yet; and 3) The limitation of teachers ability in designing integrate science learning material [4]. Moreover, there are still many science learning material where the material's length and depth is not accordingly with students development level, thus it is not easy to be understood by the students [5].

One of the phenomenons that has been a focus of the century is an environmental damage phenomenon. Environmental damage is a consequence of civilization advancement and the improvement of human's need. Gunda states that the improvement of world population makes people require a lot of foods, which increasing the impact of the use of land that can damage the forest or the environment [6]. The destruction of forest is generally caused by a massive deforestation for the use of agricultural, plantation, transmigration, and wood processing industry. This of course will inflict a new phenomenon on the certain area that depends on the existence of forest, for the example the area on the mountain slope [7].

One of the mountain slope area damages is happen on the area of Sindoro and Sumbing mountain slope that are located in Temanggung and Wonosobo regency. Most of the area around Sindoro and Sumbing mountain's feet are planted by vegetables and tobacco plantation, Mulyani, Sindoro and Sumbing mountain's feet are planted by vegetables and tobacco plantation [8]. Those plantations are planted because the plantations are beneficial economically for the people who live in the slope area. The slope damage is remain continued because the plantation activity of those plantation have been done hereditary and it's difficult to be replaced by annual plantation that has economic value and suited to be developed. This causes to the increase of critical land in the area of Sindoro and Sumbing mountain slope.

Environment damage problem which occurs become people's responsibility in finding the solution to solve the problem. Students as part of life are expected to actively participate in solving the problem in their environment. This is suited with Akinoglu & Tandogan's opinion that what educators expect is to form each individuals into effective problem solvers of their life [9]. The Department of Education National Standard wants that the science learning is developed through the ability of analytical, inductive and deductive thinking in solving the problem related to the nature phenomenon, thus it is expected that students are able to improve the quality of themselves and the environment [10].

II. METHOD

The population that is used in this study is all of the seventh grade students of 2 Junior High School, Temanggung. The sample of the research development of learning material uses three classes from the existed population. The sample taking technique is purposeful sampling where the selected sample is based on certain considerations such as the school that has applied integrated science learning. Based on the school, two classes are selected to find out their understanding about learning material through a test, while one class is used to implement the learning material into the learning. The participants of this study is 16 students as research subjects for understanding test in small sample and 61 students as research subjects in large sample. Meanwhile, the feasibility test of learning material is conducted by 3 lecturers and 4 science teachers.

This research uses Research & Development (R&D) method from Borg & Gall. Research & Development is a research method that is used to produce a product and to test its effectiveness [11]. The research stage is limited to the fourth stage from ten stages of research and development method from Borg and Gall. The stages are preliminary studying, planning, developing, and preliminary field testing [12]. The product
effectiveness test is conducted by using weak experiment method. While, the design that is used is one group pretest-posttest design that uses only one group of experiment that is treated using pretest and posttest.

**III. RESULT AND DISCUSSION**

Research and development of integrated science learning material using preservation of Sindoro-Sumbing Mountain Slope theme is started with introduction study stage that is purposed to collect the datas that will be used in developing learning material. The learning material theme is chosen based on the situation of Temanggung regency by integrating the local wisdom of the native people. Next, various of local wisdoms that exist in the Sindoro-Sumbing mountain slope is integrated into the topic that exist in integrate science learning curriculum of seventh grade on the learning topic of environment destruction. The result of local wisdom integration and the problem in Sindoro-Sumbing mountain slope using science learning material of seventh grade can be seen on the Table 1.

<table>
<thead>
<tr>
<th>Main Material</th>
<th>Main Discussion</th>
<th>Problem and Local Wisdom</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ecosystem:</strong></td>
<td>• Ecosystem definition</td>
<td>• Biotic and abiotic components in Sindoro-Sumbing Mountain</td>
</tr>
<tr>
<td>• Admiring the regularity and complexity of God's creation about the aspects of physical and chemistry, ecosystem life, and human role in the environment as well as accomplish it according to their religious believes.</td>
<td>• The interaction between the component in the ecosystem</td>
<td>• The relation between biotic component with the environment in Sindoro-Sumbing Mountain Slope</td>
</tr>
<tr>
<td>• Increasing their believe by realizing the relation of regularity and complexity of nature in the universe toward the greatness of God who create it.</td>
<td>• The importance of ecosystem conservation for life</td>
<td></td>
</tr>
<tr>
<td>• Describing the interaction between living creature and its environment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Presenting the observation result of the interaction of living creature with the environment around them.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Physics and Chemistry Change</strong></td>
<td>• Physics and chemistry change</td>
<td>• Hydrology recycle process that happens in Sindoro-Sumbing Mountain slope.</td>
</tr>
<tr>
<td>• Understanding the essence characteristics, as well as the physics and chemistry change on the essence that can be taken advantages for daily activity (for instance the mixing-release)</td>
<td>• Element, Compound, and mixture</td>
<td>• Identifying kinds of water in various regions in Temanggung regency.</td>
</tr>
<tr>
<td>• Conducting investigation in deciding the liquid characteristics that exists in the environment using artificial or natural indicator</td>
<td>• Kinds of mixture</td>
<td>• The use of chemical manure and pesticide in the agriculture area in Sindoro-Sumbing mountain slope.</td>
</tr>
<tr>
<td>• Showing the wisdom and responsiblity on daily activity as a form of implementation attitude in selecting the use of chemical material to keep the health of self and the environment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Environment Pollution</strong></td>
<td>• The pollution of soil, water and air</td>
<td>• The activity of land conversion in Sindoro-Sumbing mountain slope to be the agricultural area for tobacco and vegetables by people around the mountain slope.</td>
</tr>
<tr>
<td>• Describing the pollution and the effects for living things.</td>
<td>• The cause and impact of global warming</td>
<td>• The burning area of conservation forest to provide area in Sindoro-Sumbing mountain slope.</td>
</tr>
<tr>
<td>• Describing the causes of global warming and the impacts for ecosystem.</td>
<td>• The efforts in maintaining the impact of pollution and global warming.</td>
<td>• The use of chemical material (manure) in agricultural activity in the mountain slope area.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The impact of Sindoro-Sumbing mountain slope damage toward the endemic animal of mountain slope area.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The impact of forest roasting causes to the air pollution.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The decreased of water volume in various fountains in Temanggung regency.</td>
</tr>
</tbody>
</table>
The concepts that have passed the selection stage are arranged into teaching material drafts by focusing on the cognitive and science structure that will be built by the students. The structuring of teaching material is purposed to help students built their thinking process related to the material that will be learnt, thus the students will be easier in understanding the teaching material completely. One of the ways that will ease the structuring of teaching material process is by drawing the map concept. Moreover, to give lead in teaching material writing, each main discussion is mapped in form of macro structure. It is purposed to keep the clarity of the relation between the texts and the accuracy of material structure that is presented.

Integrated science learning material that has a theme 'Sindoro-Sumbing Mountain Slope Conservation' that have been given assessment from experts and tested the understanding of the students, is then applied in the learning. The objective of the developed learning material is to see the effectiveness of the learning material use in igniting the ability of problem solving of seventh grade students. According to Subianto, environment learning should be designed and implemented through appropriate strategy, thus the students are able to face the real problem in their environment to support the formulation of knowledge, value, attitude, as well as skill in deciding and solving a problem [13]. Learning material is given to 32 seventh grade students in 2 Junior High School, Temanggung. The assessment is conducted by comparing the average of pretest score with the average of posttest score. Moreover, pretest is conducted before the students apply the learning by using integrate science learning material with Sindoro-Sumbing Mountain Slope Conservation Theme. Meanwhile, posttest is conducted after the learning appliance by using integrate science learning material with Sindoro-Sumbing Mountain Slope Conservation Theme. Pretest and Posttest are applied by giving certain problem that contain ability indicators of problem solving.

Learning material draft that has been developed is then tested the appropriateness of learning material which covers the properness of content, contextual aspect, presented material, graphic, and language use. Every aspects of learning material properness consists of several assessment components and refers to the instrument of learning material properness that is developed by BSNP. The examination of learning material properness is assested by seven experts that consists of three lecturers and four science teachers of Junior High School who have roles as material and learning technology experts. The validation by material experts is purposed to find out the accuracy rate of the existed material in the developed learning material. Meanwhile, the validation by learning technology experts is purposed to attain the data related to the graphic aspect, presentation, and language use in the learning material.

The assessment of learning material uses the criteria that is used by Achyani where the assessment is in form of qualitative score that is divided into four levels, which are very good (VG), good (G), not good (NG) and not very good (NVG). The scores are converted using numbers with VG=4, G=3, NG=2, and NVG=1 [14]. The score maximum that can be attained is 28 because each components of learning material is assested by seven experts. The attained score of each learning material properness component are compared using the maximum score and then categorized based on score interpretation criteria from Riduwan and Akdon [15].
Based on the assessment result by seven evaluator, the aspect of learning material properness attains the average percentage score 86.75% and can be categorized as Very Good. The overall assessment result can be seen on the Table 2.

<table>
<thead>
<tr>
<th>Properness Aspects</th>
<th>Percentage (%)</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content</td>
<td>86.24</td>
<td>Very Strong</td>
</tr>
<tr>
<td>Contextual</td>
<td>88.84</td>
<td>Very Strong</td>
</tr>
<tr>
<td>Material Presentation</td>
<td>86.16</td>
<td>Very Strong</td>
</tr>
<tr>
<td>Graphic</td>
<td>87.41</td>
<td>Very Strong</td>
</tr>
<tr>
<td>Language</td>
<td>85.12</td>
<td>Very Strong</td>
</tr>
<tr>
<td>Overall Average</td>
<td>86.75</td>
<td>Very Strong</td>
</tr>
</tbody>
</table>

From the Table 2, the aspect of learning material integrate gets the highest assessment result with percentage score 88.84%. Meanwhile, the language aspect obtains the lowest score with percentage score 85.12%

Based on the overall learning material properness test result, it can be seen that integrate science learning material with the conservation of Sindoro-Sumbing mountain slope theme is suitable to be implemented in the learning. The learning material can be used as a reference book to help teacher in conducting the learning process in the class. The integration of local wisdom as a study in the learning material become the characteristic of integrated science learning material with the conservation of Sindoro-Sumbing mountain slope theme. By choosing contextual phenomenon, the learning material is expected can trigger the students learning motivation and help them in relating the real phenomenon in their environment with the science.

Learning material that has fulfill the properness aspect is then tested to find out student's understanding (Seventh grade students of Junior High School) as the user of the developed learning material. The learning material understanding test is conducted on the small sample that consist of 16 students. The test can be categorized as limited test that is applied before it is tested on the larger sample. It is purposed to find out whether the text in the teaching material draft is ready to be tested on the large sample or not. Based on the attained score of the text understanding rate on learning material of limited test, the average score is 75.38% which can be included as high category [16]. Moreover, the whole paragraph that are tested is included as high category, thus there is no revision needed for each paragraph in the learning material. Meanwhile, the large sample test is applied on 61 students of seventh grade. The result of learning material understanding test on the large sample shows the whole text that are tested is included as high category with overall average percentage score 81.12%. According to Rankin and Culhane, the learning material understanding in high category shows that the learning material can be used by students independently without any guidance from teacher.

The implementation of learning material is conducted in three meetings and each meeting occurs for 3x40 minutes. On the first meeting, pretest and the introduction of learning material are applied to the students. Moreover, the students are given the book of Sindoro-Sumbing Mountain Slope Conservation Theme and assigned to solve independently the problem existed in the book. The use of the book independently is based on the test result of learning material understanding that is suited by using text understanding criteria from Rankin and Culhane. On the second meeting, students are accompanied by teacher in discussing the problem that is existed on the book to find out the answer from the given problem. Furthermore, on the last meeting, posttest is applied. The analysis result of pretest and posttest of student's ability in solving the problem and N-Gain on each indicators of problem solving ability are presented on the Table 3.
TABLE 3. THE ANALYSIS RESULT OF PRETEST, POSTTEST, AND N-GAIN ON EACH INDICATORS OF STUDENT'S PROBLEM SOLVING ABILITY

<table>
<thead>
<tr>
<th>Indicators of Problem Solving Ability</th>
<th>Pretest (%)</th>
<th>Posttest (%)</th>
<th>N-gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formulating Problem</td>
<td>40.63</td>
<td>73.96</td>
<td>0.56</td>
</tr>
<tr>
<td>Examining Problem</td>
<td>25.00</td>
<td>66.67</td>
<td>0.56</td>
</tr>
<tr>
<td>Formulating Hypothesis</td>
<td>33.33</td>
<td>65.63</td>
<td>0.48</td>
</tr>
<tr>
<td>Collecting and Categorizing Data</td>
<td>40.63</td>
<td>66.41</td>
<td>0.43</td>
</tr>
<tr>
<td>Proving Hypothesis</td>
<td>40.63</td>
<td>65.63</td>
<td>0.42</td>
</tr>
<tr>
<td>Deciding the Choices of Finishing</td>
<td>47.92</td>
<td>75</td>
<td>0.52</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>38.02</strong></td>
<td><strong>68.88</strong></td>
<td><strong>0.50</strong></td>
</tr>
</tbody>
</table>

From the table 1, it can be seen that the student's problem solving ability had improved (N-Gain) for 0.50 and can be categorized as medium improvement. To find out whether the collected data from the pretest and posttest result of problem solving ability is normally distributed, thus the normality test is applied on both of problem solving ability tests. Normality test is conducted by using Kolmogorov-Smirnov normality test by the help of IBM SPSS 22 application. The data is normally distributed if it fulfills Sig. > α criteria. The score result of normality test of pretest and posttest on the problem solving ability presented on the Table 4.

TABLE 4. RECAPITULATION OF STATISTIC ANALYSIS OF PRETEST AND POSTTEST DATA RESULT

<table>
<thead>
<tr>
<th>Problem Solving Ability Test</th>
<th>N</th>
<th>Sig</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>32</td>
<td>0.187</td>
<td>Normally distributed</td>
</tr>
<tr>
<td>Posttest</td>
<td>32</td>
<td>0.154</td>
<td>Normally distributed</td>
</tr>
</tbody>
</table>

Based on decision taking criteria for confidence level 95%, the total score is .Sig> 0.05 and can be concluded that the pretest and the posttest data are normally distributed.

In addition, the data result of the study is tested its homogenity to find out whether the sample that is used in the research comes from homogen sample or not. The used sample in this research can be assumed as homogen sample because it is only used by one class without differentiate the excelllent class with unseeded class.

After the improvement of problem solving ability is found, the next step is to test whether the improvement of problem solving ability that is reached by the students is significantly improved or not. The examination is conducted by using Sample T-One Test, which is by comparing the data before giving the treatment (pretest) with the data after giving the treatment (posttest). The treatment is the use of integrate science learning material with Sindoro-Sumbing Mountain Slope Conservation Theme. From the calculation, it is obtained 12.435 tvalue and 2.040 ttable Value. Tvalue is compared with ttable value and it is attained that t > ttable. Therefore, it can be concluded that there is significant difference between the collected pretest score with posttest score of student's problem solving ability.

Student’s problem solving ability can improve because the students are trained to solve the problem through various cases presented on the integrate science learning material with Sindoro-Sumbing Mountain Slope Conservation Theme. The given case is a problem that happens in the real life in the area of Sindoro-Sumbing Mountain Slope that is related with the material on science subject. According to Santoso, a learning that connects experience with real situation will result a knowledge that can be easily remembered and long lasted [17]. In addition, the given question on the case is related to the indicator of problem solving, which are (1) formulating problem; (2) examining problem; (3) formulating hypothesis; (4) collecting and categorizing data as material in proving the hypothesis; (5) proving hypothesis; (6) deciding the choices of finishing.

Eventhough, there is improvement, students problem solving ability based on the average of posttest value can be considered as low achievement, which is only 68.88%. The reason of the low achievement of the
student's problem solving ability is because the students are not get used with the problem solving question. Teacher in the school has not taught the ability of problem solving that is integrated in the learning or learning material yet. Whereas, the ability of problem solving is an ability that must be continually trained, thus the students are get used in solving problems in their life [18]. From the data analysis result of each indicators on problem solving ability, it is found that some students have not been able to relate the problem with the material on the science subject. It happens because the researcher cannot make sure that all the students that become research sample can independently read and learn all the material in the learning material well.

IV. Conclusion

The developed learning material is a tematic book of local wisdom based with the conservation of Sindoro-Sumbing mountain slope theme. The learning material is developed based on the development stage of Borg & Gall that covers preliminary studying, planning, developing, and preliminary field testing. The developed learning material has fulfill the properness aspect of learning material that covers properness, content, contextual, material, presentation and graphic aspects that are suited with BSNP standard. From the result of learning material properness test, the average percentage score of overall properness aspect is 86.75%, and can be categorized as a very strong properness category. Based on the result of the learning material text understanding test, it can be seen that the learning material can be used by students independently. Learning material that is developed contains problems that is useful for student's problem solving ability training, as well as the local wisdom. Each problems in the learning materials covers the indicator of problem solving ability. The implementation result of learning material on the science learning in the seventh class is proven can improve significantly student's problem solving ability with medium improvement category.

REFERENCES

AN INOVATION IN DEVELOPING BIOLOGY MODULE WITH LABORATORY WORK GUIDELINE AND WORKSHEET FOR HIGH SCHOOL STUDENTS (RESEARCH AND DEVELOPMENT)

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Abstract—Biology is a subject field which has several complicated materials and are often considered difficult for students. Data obtained through questionnaires reveal a fact that animal tissue is one of the difficult materials due to its complexity. Moreover, books with adequate exercises and guideline for laboratory work to support the material are difficult to find in school libraries, even in bookstores. That is why development in creating biology module equipped with laboratory work guidelines is strongly needed in order to strengthen and maintain students’ understanding. The purpose of this study is to find out whether a new developed biology module can help the students in understanding materials in Biology subject, especially on subject matter about animal tissue. The method used in this study was research and development method. The subjects were Biology teachers and XI grade students of Science Department in SMAN 89 Jakarta and SMAN 115 Jakarta. The researcher used questionnaires to analyze what the students’ need to understand the material. A new developed module equipped with laboratory work guidelines was created based on the needs. The module had passed feasibility test by materials, media, and language expert, as well before was given to the subjects of research. The module then given to the subjects along with an assessment instrument. The result shows the average percentage of 83.40 of the subjects found the module was interesting, has brief explanation, and the instructions are easy to follow and was really helpful for them in studying the material both at school and at home. Furthermore, in can strengthen and maintain students’ understanding.

Keywords: Learning Guidelines, Biology Module, Animal Tissue, Research and Development

I. INTRODUCTION

Biology learning, both in class and in laboratory, needs a study guidance which helps the students to understand the material given. One guidance commonly used by students, beside the textbook, is module. A module with specific work division which cover certain material will help students to independently master the material. “Learning module is equipped with guidance and supporting materials which cannot be found in textbook” [1].

We develop a biology module for grade XI students based on data analysis we obtained from an observation on students of XI IPA SMAN 89 and SMAN 15 Jkarta. The data clarified a fact that 36.36% of the students said biology materials for grade XI students are problematic. Furthermore, they think the textbook does not help them in understanding the materials well. The observation also provide data which reveal that 75% of the students do not reach the passing grade expected on the material concerning about animal tissue. Accordingly, we decided to develop a biology module for XI students of Science Department specifically in the material about animal tissue. .

Module is a perfect match for active learning and student-centered learning. With the teacher as a learning facilitator, students can independently study and comprehend the material using a module.
II. LITERATURE REVIEW

A module is a book which is written so that students are able to study independently without teacher’s guidance, it makes a module must include: 1) learning guidance, 2) targeted competences, 3) supporting information, 4) exercises, 5) worksheet, 6) evaluation [2]. A module is a teaching-learning activity with minimum teacher’s involvement which includes brief plans to achieve the learning target, adequate learning materials, equipment needed, and evaluation tool [3].

A module contains learning guidance and supporting information, those what make it superior compared to textbook [4]. Modules are systematically made, operational, and well aimed for students to improve learning effectiveness and efficiency [5]. According to Sudjana and Rivai “Students are allowed to adjust their learning speed with the accordance of their learning ability. The students may also check their learning progress and/or give a stress on comprehension of the material with 80% mastery [6].

Module, beside the textbook, is the main source of learning. That is why it can be classified as self-contained book. Developing a module requires the steps as the following:

1. Arranging the framework by determining the formula and the general instructional purpose.
2. Elaborating the general instructional purpose into specified instructional purposes and building up a set of problems to evaluate the specific instructional purposes.
3. Identifying subject materials suitable with the specific instructional purposes.
4. Putting the subject materials in a logical order.
5. Organizing the steps of learning activities.
6. Verifying the steps to make sure the purposes are achieved.
7. Identifying the equipment needed in the learning activities.
8. Drawing up the detailed programs, including developing guidance for teachers, worksheets, and answer sheets.

III. Method

The method used in this research is Research and Development method by delivering a product test and making it perfect afterwards [7]. This research is held in SMAN 89 and SMAN 115 Jakarta. The first stage is need assessment which was held in January 2011. The module development stage was held from May to July 2011. The proper test stage by experts from various fields such as material, linguistics, and media was held from August to September 2011. The module started being tested to teachers, small-group students, and large-group students in October until November 2011.

IV. RESULT AND DISCUSSION

Proper test by material, media, and language experts.

FIGURE 1. DATA OF TEST BY MATERIAL, MEDIA, AND LANGUAGE EXPERTS

According to the data obtained from proper test by material expert, it is described as the following:
a. Indicator of material construction reached the average percentage of 80% with good (B) interpretation from 12 questions.
b. Indicator of presentation reached the average percentage of 80% with good (B) interpretation from six questions.

According to the data obtained from proper test by media expert, it is described as the following:

a. Indicator of curriculum reached the average percentage of 100% with very good (SB) interpretation from three questions.
b. Indicator of presentation reached the average percentage of 80% with good (B) interpretation from six questions.
c. Indicator of layout reached the average percentage of 85% with very good (SB) interpretation from 24 questions.

According to the data obtained from proper test by linguistic expert, it is described as the following:

a. Indicator of grammatical presentation reached the average percentage of 81.25% with very good (SB) interpretation from 16 questions.
b. Indicator of layout reached the average percentage of 85% with very good (SB) interpretation from six questions.

c. Indicator of layout reached the average percentage of 85.93% with very good (SB) interpretation from 15 questions.

According to the data obtained from product test to three biology teachers of SMAN 89 and SMAN 115 Jakarta, it is described as the following:

a. Indicator of material construction reached the average percentage of 89.16% with very good (SB) interpretation from 12 questions.
b. Indicator of grammatical presentation reached the average percentage of 85.71% with very good (SB) interpretation from seven questions.
c. Indicator of layout reached the average percentage of 85.93% with very good (SB) interpretation from 15 questions.

According to the data obtained from product test to small-groups of 20 students, it is described as the following:

a. Indicator of material construction reached the average percentage of 81.56% with very good (SB) interpretation from ten questions.
b. Indicator of grammatical presentation reached the average percentage of 76.30% with good (B) interpretation from three questions.
c. Indicator of layout reached the average percentage of 79.53% with good (B) interpretation from 13 questions.

According to the data obtained from product test to large-groups of 60 students, it is described as the following:

a. Indicator of material construction reached the average percentage of 83.81% with very good (SB) interpretation from ten questions.
b. Indicator of grammatical presentation reached the average percentage of 80.01% with very good (SB) interpretation from three questions.
c. Indicator of layout reached the average percentage of 81.28% with very good (SB) interpretation from 24 questions.

Biology module development is completed through a sequence of stages, including need assessment to identify problems, module development stage started with building design to setting up product, validation stage by experts, and product tests by teachers and students. The whole stages in this research are appropriated with the development stages stated by Sugiono [7]. Results of the proper tests and product tests showed good (B) to very good (SB) interpretation. It means that the developed module is appropriate and suitable to be used in biology classes. The format used in the module also suitable with the standardized format from the National Education Standard Institution (BNSP) and Terbuka University (UT).

In general, the instruments given to experts (material, media, and linguistic), teachers, and students have three main indicators. They are material construction, grammatical presentation, and layout. From material expert, the module got good interpretation on the indicator of material construction and grammatical
presentation. The main indicator for the material expert is the material construction. It indicates that the module meets the standardized requirements by the Vocational and Secondary Education Directorate [3]. The purpose of the study is included, furthermore, the material is perfectly arranged. Images and illustrations are also well placed in the module in order to ease the students in understanding the subject matter.

From media expert, the module got very good (SB) interpretation on the indicator of curriculum, good interpretation on the indicator of grammatical presentation and very good (SB) on the indicator of layout. The main indicator for the media expert is the layout. The module follows the attraction aspect established by the Vocational and Secondary Education Directorate (2003) and the graphic aspect from BNSP [8].

From the linguistic expert, the module got very good (SB) interpretation on the indicator of grammatical presentation and good (B) interpretation on the indicator of layout. The main indicator for the linguistic expert is the grammatical presentation. The very good (SB) interpretation from the expert indicates that the module is very good from linguistic perspective. It also follows the linguistic features from the Vocational and Secondary Education Directorate [3] (2003) and the graphic aspect from BNSP [8].

In general, the proper test by the experts resulted one conclusion that the module is very good based on the indicators mentioned. It is similar with the result obtained from biology teachers. It got very good (SB) interpretation on all the indicators. It proves that the module has consistency in several aspects such as format, organization, and attractive layout. It also fulfilled the graphic and linguistic requirement established by BNSP [8].

Being tested to the small-group students, the module got very good (SB) interpretation on the indicator of grammatical presentation and layout. It shows that the module has consistency in several aspects such as format, organization, and attractive layout. It also fulfilled the graphic and linguistic requirement established by BNSP [8].

From the large-group students, the module got very good (SB) interpretation on all indicators. It indicates that the module has consistency in several aspects such as format, organization, and attractive layout. It also fulfilled the graphic and linguistic requirement established by BNSP [8]. All the indicators are made with the reference of the ones made by Hilmi [1]; BNSP [9]; and Dikmenjur [4].

Nonetheless, this research left some flaws, such as:
1. The cover of the module is relatively thick which makes it hard for students to carry.
2. The module follows the standardized format by BNSP which makes it thick and less practical since the students need a compact one.
3. The module was only tested in two different schools. It still needs to be tested in more schools such as schools with good reputation and international-curriculum-based schools.

V. Conclusion

This development research produced a biology module with animal tissue as the central theme through several stages such as need assessment, product development, proper test by material expert, proper test by media expert, proper test by linguistic expert, and product tests to teachers, small-group students, and large-group students. The result of proper tests and product tests showed good (B) to very good (SB) interpretation.

REFERENCES


THE META-ANALYSIS OF EFFECTIVENESS SCIENCE TECHNOLOGY SOCIETY (STS) APPROACH TOWARD THE LEARNING ACHIEVEMENT

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Abstract--The meta-analysis study was conducted in five experimental research findings regarding the effectiveness of the approach of learning Science Technology Society (STS) which is published in international journals. Aspects assessed were achievement, science process skills, understanding of the concept of science, scientific attitude, creativity and motivation. Informations and variables of the five experimental research findings were then grouped and tabulated. Based on the findings of experimental research, there were 28 substudy. The substudy found that here were three aspects that old time of research, the lessons (field studies), and achievement learning students. The effect of STS approach to the student achievement is known of effect size. That is measured using Glass formula. The result showed that the learning approach STS has a positive effect to the student learning. The biggest effects happened to review the science process skills. Seen from aspect time of research, learning approach STS has a big influence if applied in nine weeks. Other findings show that learning approach STS has an influence if it’s applied on science learning.

Keywords: Meta-analysis, STS Approach, Effect Size

I. INTRODUCTION

Learning science in Indonesia generally still using teacher-centered learning. Learning science tends to be limited to the transfer of knowledge from teacher to student. Learning science is happening today is not much to give students the chance to discover and solve their own problems that they find in the understanding of the material studied [1]. This is supported by the results of research by Organization for Economic Co-Operation and Development (OECD) through the Program for International Student Assessment (PISA) stated that Indonesia in the ability of science in 2012 was ranked 64th out of 65 countries [2].

The low scientific literacy sequence obtained due to the lack of trained thinking ability of students [1]. Therefore, learning science should be do with the STS approach. STS approach emphasizes the mastery of the process of science, creative thinking, and the formation of a scientific attitude, so it can train students to integrate understanding of science with technology, and social life through everyday experiences in the community [3]. Implementation SETS approach can be done by introducing the situation of STS in the form of phenomena, news, images, or movies. These activities can motivate and encourage students to identify problems and raises questions. Question students is the beginning of the discussions and the teacher in charge to facilitate the discussion. The results of discussions presented by students and teachers confirm the results of students' presentation. At the end of the lesson, the teacher with students formulate conclusions about the material that has been studied [4].

STS approach can improve student achievement with respect to the mastery of science concepts and processes, enhancing the ability to apply the concepts and processes of science in everyday life of students, and to increase students' curiosity about nature and the environment [5]. Therefore, the STS approach is
innovative learning, so as to improve student learning outcomes [6]. The learning result is the ability of the students after receiving a learning experience. The process of assessment of learning outcomes can provide information to teachers about student progress in achieving the goal of learning, so teachers can develop and foster more student activities. Student learning outcomes include cognitive, affective, and psychomotor [7].

STS approach give effect on student learning outcomes include cognitive, affective, and psychomotor. In the cognitive domain, STS approach requires students to think critically and act scientifically. In addition to the trial plan that emphasizes the development of the concept, enables students to think, assess, solve problems, and make decisions, so that students can make sense of the concept itself is constructed so that the students' understanding increases. In the affective domain characterized by improvement in the precision in analyzing, teamwork, discipline, responsibility, cooperation, and respect the opinions of others. As for the psychomotor skills shown by the increase in the manual that looks at students in physical activity, including: skilled to operate equipment used in lab activities, skillfully perform lab procedures, skilled in making the solution, and skilled cleaning tools [6].

Other studies suggest that the approach STS able to improve students' cognitive value with the average value of student scores 79 [8]. The STS approach is also able to complete the students' learning by 61.29% [9]. Effect of STS approach to the affective and psychomotor result the percentage of 80% and 78% [10].

Research on the STS approach to the cognitive, affective and psychomotor have been done. It is therefore necessary to study meta-analysis of the effect of STS on learning outcomes approach. Research of meta-analysis is a quantitative study by a combination of similar studies for the conclusion of the study. Conclusions derived from the magnitude of the effect of a treatment effect size was calculated through. In this study aims to determine the influence SETS approach towards learning outcomes of students' science based formula Glass [11].

II. Method

The meta-analysis using five scientific articles were selected based on the results of research objectives, namely about the effectiveness of the STS approach to the learning outcomes of students in learning science. Student learning outcomes examined include achievement, science process skills, understanding of science concepts, scientific attitude, creativity, and motivation. based on the fifth journals studied acquired 28 sub-studies and calculated the effect size of each journal study. Instruments used in the research is a sheet of coding. Coding sheet in the form of a table containing information about the variables of the journal analyzed. The amount of influence SETS approach to student learning outcomes is identified by the value of the effect size. The magnitude of the effect size was calculated using the formula Glass (1981) as follows.

\[
\Delta = \frac{\bar{X}_E - \bar{X}_K}{S_K}
\]  

(11)

Delta (\Delta) indicates the magnitude of the effect size, $\bar{X}_E$ shows the average grade of experiments, $\bar{X}_K$ shows the average grade control and $S_K$ shows the standard control class division. The amount of delta (\Delta) shows the effect difference expressed in units of standard deviation to the standard deviation of the experimental class control class. A positive result is indicated value most effect size [11].

III. Results and Discussion

A. Research Result

Research studies are grouped according to the type of variables studied were (1) those types of competencies that are influenced divided into achievement, science process skills, science concepts, scientific attitude, creativity skills and motivation, (2) a group long treatment time is divided into four weeks, 9 weeks and more than 10 weeks, (3) group of fields of study are divided into chemistry, physics, biology and science. Journal of experimental research results are used in Table 1. That Substudy have been classified and calculated of effect size. After calculated the effect size, then calculated the mean interval much influence. The median interval great influence on the direction to be
positive in the amount of 1.589 to 2.076. Based on the average interval overall learning approach STS positive effect on student learning outcomes. Based on the results of learning are affected, the magnitude of the mean effect of STS learning approaches are presented in Table 2.

<table>
<thead>
<tr>
<th>No.</th>
<th>Article Title, Author, Journal Name</th>
<th>Year of Publication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The Effect of Science-Technology-Society Teaching on Students’ Attitudes toward Science and Certain Aspects of Creativity, Mee-Kyong Lee; Ibrahim Erdogan (International Journal of Science Education)</td>
<td>2007</td>
</tr>
<tr>
<td>2</td>
<td>The effects of science, technology, society, environment (STSE) interactions on teaching chemistry, Nuray Yörük, Inci Morgil, Nilgün Seçken (Natural Science)</td>
<td>2010</td>
</tr>
<tr>
<td>3</td>
<td>The Impact of a Science/Technology/Society Teaching Approach on Student Learning in Five Domains, Hakan Akcay • Robert E. Yager (Journal science education technology)</td>
<td>2010</td>
</tr>
<tr>
<td>4</td>
<td>Effectiveness of Science-Technology-Society (STS) Instruction on Student Understanding of the Nature of Science and Attitudes toward Science, Behiye Akcay, Hakan Akcay (International Journal of Education in Mathematics, Science and Technology)</td>
<td>2015</td>
</tr>
<tr>
<td>5</td>
<td>Effect of Science Technology Society Approach on Achievement Motivation in Biology of Secondary School Students of Kasaragod, Smitha. E.T, Dr. P. K. Aruna (Jurnal of Humanities and Social Science (IOSR-JHSS))</td>
<td>2014</td>
</tr>
</tbody>
</table>

The calculations show that the average effect are occurred in science process skills followed by a scientific attitude and creativity skills. A big influence is shown by the average value of a large effect size. Consistency influence STS approach is indicated by the value of the standard deviations smaller than average. Based on the length of time of treatment, the mean magnitude of the effect of STS-learning approach is as follows.
The calculations show that the average effect of STS approach has a great influence on the long treatment time of 9 weeks. Long time 4-week treatment gave little effect on student learning outcomes. Based on the standard deviation of the length of time each treatment showed consistency for smaller standard deviation from the mean. Based on the type of field of study, the magnitude of the mean effect of STS approach is as follows.

<table>
<thead>
<tr>
<th>N</th>
<th>Four Weeks</th>
<th>Nine Weeks</th>
<th>Ten Weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td>Σ∆</td>
<td>0,752</td>
<td>46,10726</td>
<td>0,79327</td>
</tr>
<tr>
<td>Δ</td>
<td>0,188</td>
<td>2,195584</td>
<td>0,79327</td>
</tr>
<tr>
<td>SA</td>
<td>0,173835</td>
<td>1,353016</td>
<td>0</td>
</tr>
</tbody>
</table>

The calculations show that the greatest influence learning approaches STS are shown in the field of science studies. Consistency STS influence learning approaches to students' competence in the field of science studies indicated by standard deviation value which is smaller than the average.

<table>
<thead>
<tr>
<th>N</th>
<th>Chemistry</th>
<th>Biology</th>
<th>Physics</th>
<th>Science</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>21</td>
</tr>
<tr>
<td>Σ∆</td>
<td>0</td>
<td>0,793</td>
<td>0,752</td>
<td>46,107</td>
</tr>
<tr>
<td>Δ</td>
<td>0</td>
<td>0,793</td>
<td>0,188</td>
<td>2,195</td>
</tr>
<tr>
<td>SA</td>
<td>0</td>
<td>0</td>
<td>0,1733</td>
<td>1,353</td>
</tr>
</tbody>
</table>

B. Discussion
Overall learning approach STS influence on student learning outcomes. The learning outcomes is the ability of the students after receiving lesson experience [7]. Based on Bloom's taxonomy, learning outcomes
are grouped into the realm of attitudes, knowledge and skills [12]. In this meta-analysis study, learning outcomes in the cognitive and affective domains are presented in Table 5.

<table>
<thead>
<tr>
<th>No</th>
<th>Knowledge</th>
<th>Attitude</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Achievement</td>
<td>Motivation</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Science Concepts</td>
<td>Creativity</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Science Process Skill</td>
<td>Science Attitude</td>
<td>-</td>
</tr>
</tbody>
</table>

The analysis showed that the STS approach has a considerable influence on the overall science learning. Learning science is a discipline that has a strong interaction between science and society, influence each other and interact with highly relevant between the two [5]. There are differences in achievement, scientific attitude, skills and motivation of students in chemistry, physics and biology that use STS approach [13;14;15]. STS learning can improve student skills and more competent in understanding the concepts than students who received traditional learning [5].

Further analysis shows that STS approach has a considerable influence on the science process skills. STS approach emphasizes the mastery of science process that trains students to integrate understanding of science with technology and social life through an understanding of everyday [3]. Thus, students are accustomed to learning skills to carry out scientific activities so that students' science process skills can develop.

According [16] Science Process Skills (KPS) is the student's ability to apply the scientific method in understanding, developing and finding science. KPS is very important for every student in preparation to use scientific methods in developing science and are expected to gain new knowledge / develop the knowledge you already have. Research conducted [17] states that there is interaction between creativity and science process skills of learning achievement. Students with creativity and high science process skills will have no difficulty in doing experiments and learning processes [14]. Process Experimenting and learning are supported by the guidance of the teacher. Then, students will more easily understand the teaching materials that will have an impact on learning achievement.

STS approach has a considerable influence on student learning outcomes if applied within 9 weeks compared to 4 weeks or more than 10 weeks. 9 weeks gives a great influence because students will be familiar with applied learning repeatedly, this is in accordance with the theory of behavior according to Pavlov (1849-1936) is if a treatment is given over and over it will bring as desired reaction of those treatments. With repetitive learning students become accustomed to undertake the applied learning.

STS approach requires students to think critically and act scientifically. STS approach emphasizes the learning process is to train students to think, assess, solve problems and make decisions erect so that students can understand the concepts based on business and student learning experience [6]. This is consistent with the theory of constructivism is the teacher in the learning process does not give the knowledge directly to the student, the student must build knowledge that is based on students' learning experiences [18].

Learning by using STS approach done on the long term will produce better learning outcomes for students. Students take a long time to be able to construct their understanding well. The process of constructing and associate new information with relevant concepts contained in a person's cognitive structure takes time and repeated treatment so that the treatment of learning undertaken during the nine weeks more influence on student learning outcomes compared to just four weeks.

The learning process is carried out for more than ten weeks did not have a great influence on student learning outcomes. This is because the learning process is too long and monotonous without variation method would produce saturation [19]. Boredom experienced students will result in no change in student learning outcomes.

IV. CONCLUSION

Based on the study meta-analysis of the effect of STS approach to the learning outcomes of the various aspects of the conclusion that the STS approach has a major influence on science learning, aspects of the science process skills, and if applied in teaching approximately nine weeks.

REFERENCES
A PRELIMINARY VALIDATION STUDY OF DEVELOPING AN INTERACTIVE MULTIMEDIA MODULES IN PHYSICS LEARNING

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Abstract—Some of skills required in the 21st century are critical thinking, Information Communication Technology (ICT) literacy, and socio cultural interaction. Physics learning should be directed to develop these aspects. This paper describes a preliminary validation study of developing an interactive multimedia module that covering the 21st century skill. The method of this research is Research & Development. The subjects of this developing study were 10th grade student of senior high school in Padang, Indonesia. The data presented are the result of the define, design, and validation phase of product. Based on questionnaire analysis show that students interested in learning physics using ICT reached 76.7%, but the fact that teacher have not been using teaching material based on ICT, Problem Based Learning (PBL) model is not maximized, the students' critical thinking skills are only 69.3% and the learning outcomes of students yet fully achieve the minimum completeness criteria. Based on the analysis of questionnaires and observation, generally seen that not maximal adherence to the learning process that impact on the learning outcomes of students. One way that can resolve these problems is using interactive multimedia modules in PBL model aided games. The validation of design show that interactive multimedia modules is valid.

Keywords: Critical Thinking, Interactive Multimedia, Instructional Modules, Physics Learning, Problem Based Learning

I. INTRODUCTION

Education in the 21st century it is important to ensure students have the skills to learn and innovate, skills in using information technology and media, as well as be able to work and survive by using life skills. One of skill to learn and innovate include critical thinking and problem solving. The skills in using information technology and media include; (a) the information literacy, (b) media literacy and (c) ICT literacy. While the life and career skills include; (a) flexibility and adaptability, (b) the initiative and organize themselves, (c) social interaction and culture, (d) the productivity and accountability. Science education should be directed to develop these three aspects.

Physics as a science, should taught with fun. In the learning process, educators stimulate learners with the knowledge of the natural phenomena around learners and presented in the media of information technology. So that the learning of physics in schools should provide opportunities for learners to use technology and to train the critical thinking skills of students in solving physics problems through collaboration and communication with peers, teachers, or others who have the same interests.

Results of research [1] show that computer assisted learning can contribute to the student's attention is relatively high compared to the usual learning. This is also consistent with the results of [2] which suggests that the effectiveness of interactive media reached the category of very effective, based on the results of student learning, which reached 87% and improving the competence of students. While, results of research by [3] showed that the use of animation and graphics in learning can facilitate assimilation of scientific knowledge.
Furthermore, the results of research suggested by Lee and Osman [4] the use of multimedia modules allow to help learners visualize abstract concepts. Interactive multimedia module allows educators to present learning materials with interesting and varied. Interactive multimedia module to make it more attractive, educators also can combine with the game, considering the use of game-containing education will be beneficial for learners. Results of research conducted by [5] indicate that the game can teach academic and non-academic skills, and motivate learners to collaborate, share information, and improve the work of learners. Results of research [6] showed that the use of game-based multimedia modules in science learning proved to be more efficient.

In addition, to realize the process of learning physics as expected in the national education goals, then we need a model to student-centered learning. One model of learning that is recommended in the curriculum of 2013 is a model Problem Based Learning (PBL). PBL is a learning model of learning that exposes students to the issues interesting and relevant to everyday life. During learning, learners are not given the issue directly but through stages, ranging from the presentation of phenomena, situations, demonstrations, or other sources.

The research conducted by [7] on the Problem-Based Learning and Nature of Science (NOS) showed that PBL can help teachers to explain some aspects of the natural sciences. One of the advantages of PBL is to foster critical thinking skills of students through problem solving. As the results of research [8] which showed that the model PBL can improve students’ critical thinking skills reached 32% in physics learning materials. Furthermore, the results [9] showed that the use of interactive multimedia software module with PBL has effectively enhance the understanding of physics concepts and learning outcomes of students. So with the application of this model is expected not only to improve learning outcomes but also improve critical thinking skills to solve problems.

In this article, we will describe the process of designing interactive multimedia modules in the PBL model aided games, to improve students’ critical thinking skills in learning physics and results of the validation of the design.

II. METHODS

A. Type of Research

The type of this research was development research. To initiate the development of this research, it conducted preliminary research to uncover the needs analysis used in the development of interactive multimedia modules. Research procedure can be seen in Figure 1.

![Research Procedure Diagram](image-url)

**FIGURE 1. RESEARCH PROCEDURE**
B. Research Subject

The subjects of this developing study were 10th grade student of senior high school in Padang, Indonesia Academic Year of 2015-2016.

III. RESULTS AND DISCUSSION

The results obtained at each phase of development regard to the development process of interactive multimedia modules in PBL model aided games can be described as follow:

A. Stage 1: Defining

Before carrying out the research, the researchers identification of the needs analysis for development of interactive multimedia module include; front end analysis, learner analysis, concept analysis, task analysis, and instructional learning analysis.

Front End Analysis

Based on front end analysis, the implementations of PBL models in the learning process amounted to 82.4%. The average percentage of use of learning materials in class only 51.9%. Furthermore, the results of questionnaires showed that the average motivations of learner in physics learning using interactive multimedia are reached 76.7%. But in reality, educators do not use interactive multimedia instructional materials in teaching physics. Based on interviews, it is known that the teaching materials are used in the form of printed teaching materials in the form of textbooks and student worksheet released by publisher

Learner Analysis

Critical thinking skills at the beginning of the students obtained 69.3%. Previous research by [10] showed that the overall average of the critical thinking skills of students of SMAN Padang is only 32% are included in the category is not critical. In detail, the critical thinking skills of students can be seen in Figure 2.

![FIGURE 2. CRITICAL THINKING SKILLS OF STUDENTS](image)

Based on Figure 2 can be seen that the level of critical thinking skills were highest evaluation level (36%) while the lowest is at the level of induction (26%). Based on the analysis of questionnaires and observation, is generally seen that not maximal adherence to the learning process. It is also an impact on learning outcomes of students who are not yet fully reached the minimum completeness criteria (KKM) as shown in Table 1.

<table>
<thead>
<tr>
<th>No</th>
<th>Aspect</th>
<th>Learning Outcomes in Projectile Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Average Value</td>
<td>73.78</td>
</tr>
<tr>
<td>2</td>
<td>The number of learner completeness</td>
<td>13</td>
</tr>
<tr>
<td>3</td>
<td>The number of learner incompleteness</td>
<td>19</td>
</tr>
<tr>
<td>4</td>
<td>The Number of learner</td>
<td>32</td>
</tr>
<tr>
<td>5</td>
<td>percentage of completeness</td>
<td>49%</td>
</tr>
<tr>
<td>6</td>
<td>percentage of incompleteness</td>
<td>51%</td>
</tr>
</tbody>
</table>

(source: Physics Teacher of SMA N 1 Padang)
Based on the analysis of questionnaires and observation, is generally seen that not maximal adherence to the learning process. It is also an impact on learning outcomes of students who are not yet fully reached the minimum completeness criteria (KKM) as shown in Table 1.

**Concept Analysis**

Learning outcomes of learners in mind that the value of daily test students on the material parabolic motion is very low. Therefore, the authors tried to improve the learning process in a parabolic motion of matter. To optimize learning in this matter, it is necessary to analyze the concept. Based on the analysis of the concept, it is known that the motion of a satellite dish consists of material facts, concepts, principles, procedures, and metacognition.

**Task Analysis**

Based on the results of interviews about the task given by the teacher in mind that the task given in the form of training and home work. The tasks given not stimulate learners to think critically and do not lead learners to use ICT.

**Instructional Learning Analysis**

In reality, physics learning implemented to date have not been as expected. This is evident from the results of observations conducted in SMAN 1 Padang, on 15 April 2016 through a questionnaire. The statements in the questionnaire refer to indicators of use of teaching materials, implementation of PBL models in the learning process, critical thinking skills, and motivation of learners in learning physics using interactive multimedia.

Based on the observation that has been described above, it can be concluded that there are some things that cause low competence of learners. First, the low percentage of learners critical thinking skills can be caused by educators do not implement the learning process according to the syntax model used. Second, the students have not been involved to the maximum in solving the problems of physics so that learners are not very active in learning activities. Third, instructional materials used does not comply with the conditions of learners, the low interest of students towards the material being studied. Besides that the teaching materials used do not stimulate learners to develop critical skills.

To overcome these problems educators as facilitators need to make quality instructional materials for the process of learning physics fun, meaningful, and interesting that not only increase the interest, motivation, activities, and understanding learners but also can improve students' critical thinking skills. One way that can be used is to use interactive multimedia modules which, combined with the game, considering that 70% of students prefer to play games in spare time, rather than studying the physics of matter. This required learning model application of Problem Based Learning to the maximum to enhance the critical thinking skills of learners.

**B. Stage 2: Design**

Based on the needs analysis and then created a prototype as shown in Figure 3. Interactive multimedia module design using Adobe Flash Profesional CS 6. The menu in interactive multimedia produced has interactive buttons, video, sound, text, images, simulations and games.

The component of interactive multimedia modules are module description, instruction, learning scenario, learning activity, author, and reference. The material appropriated with KI and KD in the curriculum. To make student interest do the task, evaluation laid in the game.

**C. Stage 3: Validation**

Validation is done by several experts and practitioners. The tests showed that products made are valid, with the score validation in Table 2.
### Validator Score

<table>
<thead>
<tr>
<th>Validator</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Validator 1</td>
<td>94.87%</td>
</tr>
<tr>
<td>Validator 2</td>
<td>93.48%</td>
</tr>
<tr>
<td>Validator 3</td>
<td>95.56%</td>
</tr>
<tr>
<td>Validator 4</td>
<td>93.68%</td>
</tr>
</tbody>
</table>

---

**FIGURE 3. DESIGN OF INTERACTIVE MULTIMEDIA MODULE FOR LEARNING MATERIAL OF PARABOLIC MOTION**

### IV. CONCLUSION

Based on the results of define phase has been known that in the implementation of learning in a high school in Padang city, never use interactive multimedia-based teaching materials. Percentages of critical thinking ability of learners are still low. Implementation of the PBL model in physics teaching is not optimal. One way to overcome this is using interactive multimedia modules in the PBL models aided games to enhance the critical thinking skills of learners. Based on the validation results, the interactive multimedia modules that have been produced are valid. In the future will conduct product testing for learning physics to determine the effectiveness and practicalities of the product.

### ACKNOWLEDGMENT

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### REFERENCES


PRACTICALITY OF LEARNING BASED ON THREE SCIENTIFIC QUESTIONS (PBTPK MODEL) TO INCREASE CRITICAL THINKING ABILITY AND UNDERSTANDING THERMOCHEMICAL CONCEPT OF STUDENTS

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Abstract—This study is part of a development model of PBTPK. The PBTPK’s model is a learning model to study the concept of problem solving aspects of ontology, epistemology, and axiology (Three Scientific Questions, as TPK) to improve critical thinking skills and student understanding of Thermochemistry concepts. The object of this research is to obtain the learning model quality, which is valid, practical, and effective. The design study’s followed the Research and Development. Practicality models of PBTPK assessed is based on a physical observation (observer) and the recording of cognitive (learning software), tested on 20 students who programmed the course of Basic Chemistry I with the topic Thermochemistry in Chemical Education Studies Program Tadulako. The practicality assessed of enforceability syntax the PBTPK models which consists of six stages. The average measurement results practicality of PBTPK models for each phase respectively were: 97.5%; 95.83%; 95.83%; 95.00%; 95.00%; and 98.33%. Based on the results showed that the development model of practicality PBTPK qualified models categorized as very high, so it can be concluded that the model is practical PBTPK.

Keywords: Practicality, PBTPK Model, Critical Thinking, Understanding of Concept

I. INTRODUCTION

Chemistry is one of the disciplinary field of science that deals with the properties of matter, the structure of a substance, a substance changes, laws, principles that describe changes to the substance, concepts, and theories that explain the change of substance. When viewed from the side of the philosophy of science, the concepts in the sciences (including chemistry) refers to the three questions, namely questions relating to aspects of ontology, epistemology, and axiology. This suggests that the high-level thinking skills including critical thinking skills have an important role to understand the material chemistry [5].

According [8] that the same chemistry learning by learning to develop thinking skills to solve problems. Achievement was measured using a variety of chemical problems at the molecular level that can be solved by learners appropriately. That is why by studying chemistry it is expected to develop critical thinking skills of learners. It can also mean that if learners are trained to improve critical thinking skills, the understanding of the problems in the learning of chemistry can be overcome.

Critical thinking skills are necessary thinking skills of students in making decisions that are trustworthy and responsible. Besides critical thinking skills is also critical that the inquiry of students who think critically will perform the activity of thinking in investigating problems, asking questions, giving new answers, find information, and draw conclusions [11].
The results of the study conducted on students of the fifth semester at the University FKIP Tadulako [1], obtained a general description that the level of critical thinking skills of students for all assessment criteria the highest was 80.8% (a score of 42 out of a maximum score of 52) and the most low 48.1% (a score of 25 out of a maximum score of 52) with the average of the overall sample was 64.6%. This indicates that the level of critical thinking skills of students of Chemistry Education FKIP Tadulako against Thermochemical material is still relatively low. Nevertheless, according to [7] that the students' critical thinking skills can be improved through learning in the classroom. This is because learning is the result of thinking. Their retention, understanding, and active use of knowledge can be created through the learning experience in which students learn to think about what and how to study it. Further explained that through the application of problem solving steps in the learning of chemistry with the aspect of epistemology of science can foster students' critical thinking skills [2].

According to [6], the fundamental problem in chemistry learning today are (1) obtaining an understanding of chemical by learners is not intact, and (2) are not optimal development of higher order thinking skills (higher order of thinking skills = HOTS). Learning is not fundamentally produces incomplete understanding and less potential for developing students’ higher level thinking skills (HOTS) learners. Further explained that in order to carry out the chemistry learning in accordance with the demands of Curriculum 2013 is required: (1) understanding of chemical materials fundamentally by teachers, (2) the ability of teachers to exploit the subject matter to improve the character and HOTS learners, and (3) the ability of teachers making optimal use of ICT in learning.

The fundamental essence of this learning model developed is a form of chemical problems presentation authentic and meaningful to the students to be solved through fundamental assessment cooperatively to help improve critical thinking skills and student understanding of concepts. Model PBTPK is one model of learning which is based on different stages of learning are identification difficulties, problem-solving plan, the implementation plan, communicate, checking back, and evaluation with the aim to improve critical thinking skills and student understanding of chemical concepts. Study concept in which students overcome difficulties to solve the problem referring to the questions relating to aspects of ontology (definitions, theory / law, for example, the existence of, and the similarities/differences), aspects of epistemology (the background, methods / procedures, relations and difficulties), and aspects of axiology (the meaning and benefits).

Characteristics of this model is formulated based on the study of theory and analysis at the preliminary stage and development. PBTPK models are developed based on the characteristics of a learning model according to [3], which gives an overview there are at least four (4) specific characteristics of a learning model, namely: (1) rational logical compiled theoretical designer, (2) the rationale of the learning objectives to be achieved and how learners to achieve these objectives, (3) the activity of teachers and learners are required so the model is applied effectively, and (4) the learning environment needed to achieve the learning objectives.

The quality of the resulting model design based on three criteria [9]. The first is the validity, which include relevance (content validity) and consistency (construct validity). Second is the practicality, the design study model developed can be applied in real field. Third is the effectiveness, namely the implementation of learning model in the field to deliver the result destination.

II. Methode

The design used in this research is the design of research and development, which refers to the steps [4] and modified by [12], which consists of three stages: (1) a preliminary study, (2) development model, and (3) testing / implementation of the product.

Practicality learning model is measured using an assessment of the RPP containing syntax PBTPK models and learning environment that describes the activities undertaken by faculty and students. Implementation models PBTPK observed through the implementation of syntax contained in Learning Implementation Plan (RPP) and outlined in the Student Activity Sheet (LKM) for each study. The learning activities are carried out consisted of learning I, II, III, IV, and V. Source of research data derived from students enrolled in the school.
year of 2014/2015 as many as 20 students who have not been taught the material in the course Thermochemistry Chemistry I.

Assessment of the practicality of the model BPTPK using the assessment sheet following the syntax and the learning device models supporting PBTPK. Data practicality BPTPK models is generally performed by observers. The activities carried out in the analysis process are as follows:

1) To recapitulate observations BPTPK adherence to the model provided by the observer.
2) Determine the average every aspect of every lesson observations.
3) Calculate the average percentage keterlaksanaan for every aspect of observation by dividing the total score of each aspect of the observations obtained from the observer to the maximum score.
4) Interpret data interpretation percentage rates of learning implementation as proposed as follows [10]:

\[
\begin{align*}
80.1\% & \leq KP \leq 100\% & = \text{very high} \\
60.1\% & < KP < 80.0\% & = \text{high} \\
40.1\% & < KP < 60.0\% & = \text{moderate} \\
20.1\% & < KP < 40.0\% & = \text{low} \\
0.0\% & < KP < 20.0\% & = \text{very low}
\end{align*}
\]

The criteria used to declare BPTPK models have a degree of adherence to good when the average percentage of votes each aspect observed minimal located in the high category.

### III. RESULTS AND DISCUSSION

One of the criteria that must be owned by a learning model according [9] is to have practicality. Practicality is understood that the design study model developed can be applied in real field. Practicality models BPTPK observed through the implementation of syntax contained in the RPP and described in LKM for each lesson. Assessment of adherence to the syntax made by observers who observe the learning activity (physical observations) and recorded in the activity log on learning software (cognitive recordings). The function of the use of the software is to verify whether the physical shows think assessed by observers actually done by students which is visible from a thought that is recorded in the learning software. The results of the physical observations of the enforceability syntax BPTPK models can be seen in Figure 1.

![FIGURE 1. RESULTS ASSESSMENT MODEL SYNTAX IMPLEMENTATION PBTPK THROUGH PHYSICAL BARRIERS](image)

Based on Figure 1 implementation of each stage of the PBTPK models of physical observation and recording of cognitive learning can be described as follows:

a. Implementation of Phase 1 (to identify difficulties)

The expected results of the implementation of phase 1 PBTPK models are students write down the difficulties experienced to solve the problem in detail. Difficulties include ignorance of concepts related to problems or difficulties in determining the steps you want to be taken to resolve the problem in question. Based on the results of physical observations show the implementation of phase 1 models PBTPK percentage increase of the learning I through V of learning (Figure 1). The results were verified through physical observation of cognitive student records on the implementation of phase 1 PBTPK models whose results are presented in Figure 1a.
Based on Figure 1a can be described as follows: (1) there is a correspondence between the physical observation and recording of student cognitive. That is, the physical observations of students write the difficulties encountered to resolve the issue in accordance LKM evidenced by the results shown in cognitive recording student working on LKM, (2) records of students learning cognitive 2 increased with the experience received at study 1 through referrals lecturer and continued to rise in future learning, it shows that students are able to write down the difficulties encountered in solving problems, (3) on learning three physical observation achieve maximum value and is supported by cognitive recordings. It is influenced by physical activity students carry out practical work and the seriousness of the students working on the LKM. The ability of students utilizing the media with good cause physical barriers to learning and 5 have increased in line with cognitive recordings produced.

Based on the results of the assessment of physical observations are supported by cognitive recordings showed that the students were able to identify the difficulties encountered in solving the problem, so it can be concluded that the first phase PBTPK models performing well.

b. Implementation of Phase 2 (completion planned issue)

The expected results of the implementation of phase 2 PBTPK models, among others: (1) students in groups conducting a study through books and website resources on concepts that are closely related to the problem you want solved, (2) the student is able to assess the concept based on the aspect of ontology, epistemology, and axiology. The results of the physical observations indicate that the percentage of stage 2 increased enforceability of learning I through V of learning (Figure 1). The results were verified through physical observation of cognitive student records on the implementation of phase 2 PBTPK models presented in Figure 1b.
Based on Figure 1b can be described as follows: (1) observations of the physical conduct studies using the concept of source books and websites related to the proposed settlement of the problem is evidenced by the results shown in cognitive recording student working on LKM, (2) the recording of cognitive student conduct studies concepts through resource book goes seriously and earnestly. But still having trouble doing a study to utilize the website. This is due to examine the concept of activity directly from the Internet when learning takes place is a new thing for students. Efforts are being made to overcome this form of assistance and referrals intensive lecturer. Repairs are performed on the learning I have a positive effect in improving the ability of students conducting a study concept through books and website resources on further learning. (3) physical observation and recording of cognitive learning III has the same trend (decline), this was due to the active student learning III thus carry out practical activities of reviewing books and websites has decreased, (4) provision of guidelines charging LKM in particular the link between the concepts assessed by the question aspects of ontology, epistemology, and axiology as supporting the success of the model PBTPK, pay attention to the suitability of time each stage with a time of learning in the classroom, and further improve assistance to each group, in general cause increased physical observations on learning IV and V.

Based on an assessment of observations of physical, cognitive, and suggestions / comments observers indicate that the student is able to assess the concept through books and websites, associate trouble with the question aspects of ontology, epistemology, axiology, and utilizing the media, so it can be concluded that the enforceability of phase 2 models PBTPK successfully with good.

C. Implementation of Phase 3 (implementation plan)

The expected results of the implementation of phase 3 PBTPK models is that students are able to implement the results of the study by answering questions aspects of the concept of ontology, epistemology, and axiology in solving problems in groups. The results of the physical observations indicate that the percentage of implementation of phase 3 of each lesson are at very high category (Figure 1). The results of physical verification observation through recordings on the implementation of student cognitive stage 3 PBTPK models presented in Figure 1c.
Based on Figure 1c can be described as follows: (1) The second chart shows that the student has implemented a plan to resolve the problem results in accordance with LKM, (2) the seriousness, activeness and cooperation of students in implementing the plan problem solving in groups according LKM become a good assessment of the observations of the physical, it is supported by the seriousness in mengimplementasikan plan problem solving is also shown by the recording of cognitive students who tend to have increased in every lesson, (3) there are some constraints experienced by students in the learning of writing I related symbols, formulas, chemical reactions, and the molecular structure of the software program. This obstacle is overcome by encouraging students to describe the symbols, formulas, and molecular structure written. Through these improvements, the student cognitive recording goes well in future learning.

Based on the results of observations assessment of physical, cognitive students, and suggestions / comments observers indicate that the student is able to implement the plan in accordance with problem resolution and utilize a plan drawn up with a good learning media. Therefore, it can be concluded that the implementation of phase 3 models PBTPK going well.

d. Implementation of Phase 4 (communicate)

The expected results of the implementation of the fourth stage of the model PBTPK is active in the student group discussion among both asking and answering / responding to questions from other groups related to the problem that has been solved in groups. Implementation of phase 4 illustrates that students demonstrate involvement and thinking skills to solve problems to get the support of others on the answers given. The percentage of students vote physical barriers to adherence to phase 4 on learning I was 87.5%. Several attempts were made related to the advice / comments observers, among others: (a) assigning to all the groups prepare presentation materials and study results randomly select the group that the task of presenting the study results, (b) a group that is not the task of presenting the results of a study commissioned to provide feedback. Improvements based on the results of the implementation of the fourth stage of the learning I above led to the implementation stage 4 increased in further learning (Figure 1). Results of the assessment of physical observations at every study shows that students are able to actively communicate the concept and the work of the group, so it can be concluded that the implementation of phase 4 models PBTPK going well.

e. Implementation Phase 5 (check back)

The expected results of the implementation of phase 5 BPTPK models are: (1) students to check back for the answers that have been obtained (ranging from the implementation of phase 2, 3, and 4), (2) Students have confidence in yourself for the accuracy of the answers that have been acquired, and (3) The students argue against the belief that answer truth. Based on physical observations, the percentage of implementation of phase 5 is constant on learning I, II, and III and an increase in learning IV and V (Figure 1). The results of the physical observations were verified through cognitive recording student results are presented in Figure 1d.
Based on Figure 1d can be described as follows: (1) on physical observations it appears that active students to check back for the answers that have been given in stages PBTPK models. These results are supported by the recording of cognitive accordance with LKM, (2) physical observation by checking the back of the stage 2, 3, and 4 correspond LKM indicated by the same percentage of students with cognitive learning footage II to V. Physical observations are supported by student cognitive recordings indicate that students are able to check back in solving the problem. By karean it, it can be concluded that the implementation of phase 5 PBTPK models have gone well.

f. Implementation of Phase 6 (Evaluation)

It is expected from the implementation of phase 6 model PBTPK is a student in earnest following the evaluation given by lecturers based LKM. The evaluation is conducted by students at this stage aims to measure students' critical thinking skills through the answers to LKM at learning software. Based on physical barriers, the percentage increased enforceability of stage 6 of the lessons I through V of learning (Figure 1). The results of the physical observations were verified through records at the implementation stage of cognitive student PBTPK 6 model. The results obtained are: (1) all students are active in the evaluation of the LKM working in the learning software, (2) the evaluation results obtained by the students have different percentages on every indicator of the critical thinking skills to any learning. Therefore, it can be concluded that the implementation of phase 6 models PBTPK has gone well.

Results of the assessment of physical observation and recording of the whole student cognitive stage of the model above indicates that the syntax PBTPK models can be implemented in the field. Each stage of learning is well aligned and mutually affect enforceability of the other stages. Based on these results, it can be concluded that the model is practical PBTPK.

IV. CONCLUSION AND SUGGESTION

Conclusion

Based on the analysis of the practicality of the model PBTPK above, it can be concluded that the model is a practical means PBTPK syntax PBTPK models can be applied in teaching in the field.

Suggestion

To obtain the learning model which in valid, practical, and effective, so the effectivity assessment device of PBTPK model also need to be validated by the experts before doing the trials of PBTPK model and publishing the result. Therefore, hereinafter shall be assessed in terms of the quality of the learning model effectiveness.

REFERENCES


REAL LABORATORY BASED LEARNING USING VIDEO TRACKER ON TERMINAL VELOCITY

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Abstract— Real laboratory based learning in this study is the use of real events that have been recorded in the form of digital video to be analyzed. The purpose of this study is to assess the potential use of video tracker to study terminal velocity. Video tracker is free software that can be used to analyze digital video. This software can obtain the motion variables such as position, velocity and acceleration of the video. Stages of research start from the explanation video software usage tracker, recording the motion of objects in a fluid, terminal velocity measurements using video software tracker, analyze the variables that affect the speed of the terminal through a variety of fluid types and shapes of geometry objects. The results showed that the video tracker can be used to obtain the value of terminal velocity. In addition, the variables that affect the terminal velocity can also be obtained.

Keywords: Real Laboratory, Video Analysis, Terminal Velocity

I. INTRODUCTION

Meaningful learning is learning that makes real life as learning objects. a real laboratory of learning that make everyday event as learning objects. as an example to teach students the concept of free fall motion with friction students are required to practice the movements, recorded with handycamp and analyzes the video tracker to obtain the position data and velocity as a function of time. The advantage of this method is that students can at any time play back the video and analyze it because it is saved in digital video. Benefits of this method is to hone inquiry students, enabling scientific approach, this method encourages students to make direct observations of the natural order and obtain a mathematical formulation.

Research on the use of video analysis for learning has been carried out. Video tracker can be used to measure the viscosity of the air using a pendulum swing system [1]. Video analysis can also be used to analyze the drag forces in the laboratory [2]. Linear and quadratic drag forces can also be demonstrated using high-speed cameras [3]. Measurement of fluid viscosity also allows the use of video analysis [4,5]. Relations terminal velocity and viscosity can be demonstrated using a video tracker [6].

II. METHOD

Experiments carried out consisted of two parts, namely investigating the influence of fluid towards terminal velocity and mass effect on the speed of the terminal. In the first part of the test specimen used in the form of marbles with a mass of 5.5 grams of a diameter of 1.5 cm. While the fluid used there are three kinds, namely glycerin, oils and grease. In the second part of the test specimen used in the form of two cubes with 2 cm each side is made of aluminum and copper with respective masses of 20.9 g and 67.5 g and two cylinders of the same size but of different materials. In the second experiment the resulting video size measuring 720 pixels.

III. RESULT AND DISCUSSION

Learning labs in this study using the inquiry approach guided. Teachers have determined the purpose of the experiment and the steps undertaken in conducting the experiment. The first students were asked to conduct experiments to determine the effect of fluid towards terminal velocity. Test pieces used are marbles with a mass of 5.5 grams, a diameter of 1.5 cm. Fluid used there are three kinds, namely glycerin, lubricant and cooking oil. Step experiment starting from recording events marbles free fall on each fluid is then analyzed the
resulting digital video using video tracker software. Video footage of each fluid is shown in Figure 1. In this
figure, ponds marbles at the time of free fall on each fluid.

![Figures 1(a), 1(b), 1(c)]

**FIGURE 1.** (a) GLYCERIN, (B) COOKING OIL, (C) LUBRICANT. TEST SPECIMEN USED MARBLES OF THE SAME DIAMETER

The processing of data using video tracker is shown in Figure 2. Step data processing starting from the
opening of video files using the video tracker and specify the coordinate axes. After that, set the scale
calibration and set the tracker mode. In this experiment using mass point tracker with an interval between
frames 100 ms. The data taken is the change in position over time. The table and graph position versus time are
presented in Figure 2 the lower right and upper right. Furthermore, the position data is processed using
Microsoft Excel.

![Data Processing Using the Video Tracker to Obtain the Position of Objects as a Function of Time]

**FIGURE 2. DATA PROCESSING USING THE VIDEO TRACKER TO OBTAIN THE POSITION OF OBJECTS AS A FUNCTION OF TIME**

Graph of the change in position over time of three different fluids are presented in Figure 3. The terminal
speed by applying linear regression on each graph. Based on Figure 3 is known that the terminal velocity of the
cooking oil of 0.007 m/s, glycerin 0.008 m/s, and the lubricant 0.010 m/s. Based on these results it can be
concluded that the terminal velocity is influenced by the type of fluid. These results can be attributed to
equation 1

\[ v_t = \frac{2\pi gr^2}{9\mu} (\rho_f - \rho_b) \]  

where \( v_t \) terminal velocity, \( g \) acceleration of gravity, \( r \) radius of marbles, \( \mu \) viscosity, \( \rho_f \) density of fluid, dan \( \rho_b \) density of marbles.
In this experiment the mass of the object, the density of the fluid, the radius of the object, the gravitational acceleration equal value for all three types of fluids. Thus the difference in fluid viscosity expressed differences so that it can be concluded that the viscosity affects the terminal velocity.

Equation of velocity ($v$) free fall motion as a function of time ($t$) in the fluid expressed in equation 2

$$v = -v_t \left(1 - e^{-\frac{t}{\tau}}\right)$$

where $v_t = \frac{mg}{c}$ as terminal velocity dan $\tau = \frac{v_t}{g}$ as characteristic time. Time characteristics of each fluid are presented in Table 1.

<table>
<thead>
<tr>
<th>Fluid</th>
<th>Terminal Velocity (m/s)</th>
<th>Characteristic time (s)</th>
<th>Velocity at $t = 5\tau$ (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking oil</td>
<td>0.010</td>
<td>0.001</td>
<td>0.00993</td>
</tr>
<tr>
<td>Glycerin</td>
<td>0.008</td>
<td>0.0008</td>
<td>0.00794</td>
</tr>
<tr>
<td>Lubricant</td>
<td>0.007</td>
<td>0.0007</td>
<td>0.00695</td>
</tr>
</tbody>
</table>

According to the table one can conclude that in the interval of 0.005 seconds the object has reached terminal velocity. Meanwhile, the time interval between frames in the video tracker used is 0.1 seconds so that the third graph looks linear velocity despite exponential equation as in equation 2.

The second trial is to investigate the influence of the mass to the speed of the terminal. Objects used cube and cylinder of aluminum and copper materials. Implementation of the experiment is shown in Figure 2. In figure 4A and 4b are shown on the conditioning of the test specimen in order to experience free fall. At first objects in the hold using the hands to the starting position and then quietly released. In the picture shown 4c and 4d position of objects at the time of free falling.
The results of the fourth recording video using a video tracker processed to obtain a change in position of the object each time. Furthermore, to obtain a linear velocity of each motion used linear regression with Microsoft Excel. Chart position changes each time the cube object and each cylinder is shown in Figure 5 and Figure 6.

![Graph of a change in position of the cube each time](image)

**FIGURE 5. GRAPH OF A CHANGE IN POSITION OF THE CUBE EACH TIME**

In Figure 5 can be obtained terminal velocity of aluminum cube and copper cube respectively by 0.012 m/s and 0.014 m/s. In this experiment the same cube size while its mass is different because it is made of different materials. Therefore, the damping force constant (c) both the same thing. Based on the equation $v_t = \frac{mg}{c}$ it can be concluded that the mass is proportional to the speed of the terminal.

![Graph of a change in position of the cylinder each time](image)

**FIGURE 6. GRAPH OF A CHANGE IN POSITION OF THE CYLINDER EACH TIME**

In Figure 6 it can be seen that the terminal velocity of cylindrical aluminum and copper respectively 0.009 m/s and 0.011 m/s. Terminal velocity greater than the copper cylinder aluminum cylinder for larger mass.

IV. CONCLUSIONS

Video tracker can be used for laboratory-based study on the topic of terminal velocity. Variables associated with terminal velocity can be observed. Type of fluid and the mass of the body affects the terminal velocity.

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EDUCATION SEXUAL REPRODUCTION IN SHIFTING CULTURE
(A LITERATURE REVIEW)

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Abstract—This study aims to determine the level of sexual reproduction at cultural shift. This study was designed as a descriptive research method literature review. The existing literature as a source of research analyzed descriptively. The results showed sexual education is still a taboo to talk about sex crimes even increasing numbers in statistics of violence women and children. The culture has shifted through diffusion also be the cause. Cultural shifts are affected by the spread of information and technology media. It takes effort immediately to minimize the number of these crimes, one among these efforts was to introduce sexual reproductive education as early as possible. The family is the first source of information to anticipate the understanding of sex information that comes from those who are not responsible. Communities as the first means of a culture is formed, the environment can form the soul of the child through the process of association, repetitisi and imitation.

Keywords: Education Reproduction Sexual Reproduction, Culture Shif

I. INTRODUCTION

Adolescents Indonesia is currently experiencing rapid social change from a traditional society to the modern society, which also changed the norms, values and lifestyles. Teenagers who formerly maintained largely by the family system, indigenous culture and traditional values that exist, have been prone to erosion caused by rapid urbanization and industrialization. This is followed by the media revolution that is open to the diversity of lifestyles and career choices. These developments resulted in an increase adolescents' vulnerability to various diseases, particularly those relating to sexual and reproductive health, including the growing threat of HIV / AIDS [1].

In addition, violence against children in Indonesia is increasing from year to year. The data reported by the Indonesian Child Protection Commission (KPAI) released that from 2011 to 2014, violence against children has increased significantly. In 2011 happened 2,178 cases, in 2012 there were 3,512 cases, in 2013 there were 4,311 cases and in 2014 there were 5,066 cases. While cases of children in conflict with the law from 2011 to 2015 reached 6,006 cases, cases of parenting 3,160 cases, education 1,764 cases, health and drug 1,366 cases and cases of pornography and cybercrime there were 1,032 cases.

This violence also occurs in at least three areas, namely in a family environment, school environment and in society. The trend of violence against children was seen to increase with perpetrators of violence against children committed by their peers or categorized still in the world of children.

Studies of youth in Indonesia generally concluded that the values of life of youth is in the process of change. Indonesian teens today seem more tolerant of premarital sexual lifestyle. For example, research conducted by various institutions in Indonesia for the period of 1993-2002, found that five to ten percent of women and eighteen to thirty-eight per cent of young men aged 16-24 years have had sexual intercourse before marriage with a partner of their own age 3-5. Other studies in Indonesia also strengthens the description of their increased risk sexual behavior of adolescents. These findings indicate that the 5% -10% of young men aged 15-24 years with no / not married, had sexual activity that is riskier 6-9. Furthermore, the results of research on the need for reproductive health services in 12 cities in Indonesia in 1993, showed that
their understanding of sexuality is limited to 6.11. The findings of various studies show that an increase in sexual activity among young people, is not accompanied by increased knowledge about sexual and reproductive health, including HIV / AIDS, sexually transmitted diseases (STDs) and contraception.

The behavior of adolescent life that change is not matched by knowledge adequate, according to Lukas[2] in fact of life, 75% among young people can say they did not get the lighting at all from his parents about the subject of sex. While the rest (25%) of young people get the lighting just sex vague. Consequently, for those issues to be sex remains a vague and has no meaning as a marriage provision in the future.

Most teens do not know the function of maintaining the cleanliness of the genitals, they assume is not the important thing to do. Most learners acquire information related to reproductive health but not of the family of the print media/ electronic followed from the school/teacher. The amount of understanding of sex education and attitude/behavior of sex among teenagers is very varied, but everything is still in the low category [3].

In this paper, the authors discuss some research results related to reproductive education sexual, family roles and review a cultural shift therein.

II. Method Empirically

This study is a meta-analysis, which analyzes the results of research on sexual reproductive education in shift of culture.

III. Discussions

Today our society is a modern society which is too complex. This condition is the product of advances in technology, mechanization, industrialization and urbanization, which has led to many social problems. Social problems, we know as a disease of society or a social disease [4]. This is in line with the results of Hanum that the problem of sexual deviation, including the relationship premarital sex, most informants stated that it was not solely due to the parents’ fault, not solely because parents do not provide sex education, but can also be occurs due to the social environment and interaction, can also be due to the influence of erroneous information from the electronic media, such as TV, and so on [5]. Therefore they are more dependent on the fertilization of religious faith. In this case sex education can be done within the framework of religious education. In Islam, for example teaches that where there are two men and a woman only, then the other is the devil. In the Christian religion can be started with the teachings of the love that is responsible, and so on.

The development of information technology, such as digitization technology have an impact on the creation of individual freedom [6]. Conditions of modern life turns vulnerable to the emergence of deviant behavior as a result of open information systems, individual freedom, hedonic lifestyle, and so forth [7].

The characteristics of modern society have differences with the characteristics of traditional community life. Conditions changed society from traditional to modern life, revealing new phenomena in society. The changes that occur both planned direct and indirect impact on the change in lifestyle of the people. Some important changes occurred due to changes in lifestyle and behavior [7]. Some important changes have occurred as a result of modernization according to M. Francis Abraham, among others, systematic changes, functional changes and changes in traditional attitudes [8].

Another impact of modern life is deviant behavior. Deviant behavior is a form of social deviation in society [7]. Rock as quoted by Supardan, concluded from the various opinions of sociologists and criminologists, that social deviation as behavior forbidden, should be limited, censored, threatened with punishment, or other labels that are considered so bad that the term is often paired with violation of rules [9].

One form of deviant behavior group is free or sex free sex. Free sex committed by juveniles in lately has been worrying all parties. Based on data obtained from the ministry that in 2009 that the study results at city center of Jakarta, Medan, Bandung and Surabaya are shown as 35.9 percent of teens have friends who have had sexual intercourse before marriage. In fact, 6.9 percent of respondents had had sexual relations before marriage (Vemale.com, December 3th 2012)[11]. The emergence of behavioral free sex and contacts on teenagers because of several factors, among others: (a) as a result of social control that is weaker than the
family, (b) the influence of friends socially and (c) the development of modern technology, especially teknologi communication tends to present an image of porn and porn videos [7].

There are many factors that cause deviant behavior. Muzaimi states: The occurrence of deviant behavior and the high crime rate in Indonesia is caused by several factors such as poverty, dysfunction norms and laws, disharmony related elements as well as national character has shifted [7]. In addition, also as a result of an education system that no longer teaches ethical values, including religious education that only emphasizes the cognitive aspect.

The above description shows the importance of the role of education and religion to suppress the rate of deviant behavior. Religion is part of the culture, then the above Santoso aligned with that culture and education are two elements that can not be separated because each binding. Culture is alive and growing because of the educational process, and education itself is contained within a cultural context. In a certain sense it is essentially the process of education is a dynamic process of acculturation [10].

So there is a real culture in the learning process, in Abdi Bowl states in respect deeply moral, code- moral code, and the minds of people about what should be done. Individuals and organizations are realizing the value of honesty, integrity, and openness will act with honesty, open, and integrity, because it is the right thing to do. In the context of education, a person or people will realize that learning (education) is the right thing to do, a person or the community will act to do what is espoused, ie, learning or otherwise [12].

There are a lot of important knowledge to be given to adolescents one of them is knowledge is very important and sensitive to be given to adolescents is knowledge about issues of sexuality or better known reproductive education. Reproduction is one of the key characteristics of living things to maintain the existence of the species over time while the Sexual general is something related to the genitals or matters relating to the case intimate relationship between men and women. Sexual characteristics of each sex has different specifications. Along with the primary and secondary growth in adolescents towards maturity were perfect, appears also desire and drive to channel their sexual desires.

According Septiawan, sex education is needed to bridge the gap between curiosity. Sex education is not a means to learn about how to have sex, as it is regarded by many that this form of education as prohibited because they can berekses worse in adolescents. Sex education is a discussion that is realistic, fair and open is not a mere moral dictation. In the sex education given factual knowledge, puts sex in its proper perspective, related to self-esteem (sense of self-esteem), the planting of confidence and focused on improving the ability to make decisions. Sex education directly and indirectly affect the morals of a child. A child may misbehave due to sex education less attention. The effects of sex education that less can we see in everyday life starts from minors who abuse girls her age, ranging from holding the genitals, kissing in front of people like people who are married, and the other cases are frequent in proclaimed in the media. Of course it is not in accordance with the moral and indigenous peoples who embrace traditional oriental [13].

There are 6 destination sexual education according Septiawan, namely;
1. Providing understanding sufficient regarding changes in the physical, mental and the emotional maturity with regard to sexual problems in adolescence,
2. reduce fear and anxiety in connection with the development and sexual adjustment (roles, demands and responsibilities),
3. Shaping the attitude and give sense to sseks in all manifestations vary,
4. giving understanding that the relationship between human beings can bring satisfaction to both individual and family life,
5. giving understanding on the need for moral values that are essential to provide a rational basis to make decisions related to sexual behavior, and
6. provide knowledge about the mistake and sexual perversions that individuals can protect themselves and against the exploitation that can interfere with physical and mental health [13].

However, we need to realize that education sexual and reproductive health is a sensitive topic that requires advocacy on related authorities and public education on the importance it is given. This is because most of Indonesian people is still taboo in respect of this sexual reproductive education. Therefore, it becomes
important to understand the cultural norms surrounding sexuality that sexual and reproductive health education is unacceptable. When it comes to reproduction must not only do we talk about things that are mere biological but also further include cultural, religious and economic.

Jacob culture also regulates the matter of reproduction such as arranged marriages, the ceremony happened in the series of reproduction and the process of parenting. Culture also regulate existing laws with fines that accompany their customary these laws [13]. Volenhoven states that customary law is the religious laws, institutions and customs. While the culture form consists of three things; as a complex of ideas, values, norms, rules and so forth [14]. This is the ideal form of culture that is abstract, intangible and yet seen alive in the minds of concerned citizens where culture is alive, as a complex pattern of activity and action of man in society which is better known as a social system and a Repository objects man's work [16].

According Sarlito in his book Adolescent Psychology, the general education of human sexuality clearly and correctly, which includes the processes of conception, pregnancy until birth, sexual behavior, sexual intercourse, and aspects of health, psychological and social. The problem of education provided must include the norms that exist in society, which does not violate the rules, which in Allow your community, and how to implement the community without having to interfere with the rights of others [17].

The effect of background socio-cultural sex education in rural Java is quite thick. Java community living in a social construction that can not be separated from cultural elements. Hence in regard to sex elements of social and cultural looked coloring. The influence of socio-cultural background that appears in the rural community perception towards sex education. In the family of Java is frequent misuse of sex among teenagers. In addressing this issue, many parents would blame the social environment. Parents also assumes that there is appreciation of the values of religion is wrong that until irregularities sex. This means that religion in the eyes of the parents should be the controller of sexual activity. Javanese countryside large part stating that sex education is not the responsibility of parents. The Javanese still taboo on sex education for their children. Sex education is not part of their lives. The Javanese are talking about sex to their children only a small fraction. As if parents in Java submit an overall sex education to the teacher of the Koran, religious, priests and religion teachers in schools. The issue of menstruation (menses) and signs of mature physically let me be given to others, because they are taboo (inappropriate) discuss it with her own child. Delivered by Java parents about sex may be said in the form of sexual ethics guidelines. Delivery was withheld by certain symbols [5].

Hanunon research results relating to sex education for women, according to Javanese tradition in rural that the majority of informants stated that in the Javanese tradition there is no specific ways to deliver sex education to children -children them, what more to women. Others replied that if any symbolic nature, not openly, or in a manner known sanepa or some sort of figurative language. Figurative language such as child or toddler wadon iku satru munggwing cangklakan, which means that the daughter was an enemy to the shoulders of the parents or the enemy is a burden in families, they became a kind of problem that can not be resolved through a strategy of sexual education for women. In this case most of the informants assume correctly that the child she could be satru munggwing cangklakan, but it was not merely his daughter error [5].

There is a concern that grounded connection with the implementation of sexual reproductive education; namely the sexual reproduction of Education will trigger free sex, it is a concern of local government or school because of reproductive health and sexuality education was considered to affect teenagers behave more permissive. Discourse of sexuality education aimed at preventing 'free sex' is in line with the findings and Oetomo Holzner, sexuality education has been using ban discourse (discourse of prohibition) [18]. Construction adolescent sexuality in related policy ie Health Act No. 36 of 2009, although no mention of prevention against premarital sex, but did mention that the maintenance of the health of adolescents is intended to prepare to become adults who are healthy and productive, social and economic (article 136 paragraph 1), and done so teenagers free from various health problems can hamper the ability to undergo a healthy reproductive life (paragraph 2) [19].
The family as the smallest unit of social life is very large role in shaping a person's defenses against social disease early. Parents are busy with their own activities, regardless of how the development of their children is the beginning of the fragility of the child's defense against social ills. Often parents just tend to think his outward needs to work hard regardless of how children grow and develop [20]. As in according to Elly Risman Musa. There needs to be communication within the family, between husband and wife, between parents and children [21].

However, the role of parents in child care change with the growth and development of children. Father and mother both have an important role since her unborn child. But there is little difference in touch of what is shown by the father and mother [22].

Rochaniningsih states: Mothers tend to foster a feeling of love and love children through interaction involving physical touch in affection, While fathers tend to feel confident and competent in children through activities that involve physical play. Parents have an important role in the care and guidance to their children's behavior. In the development of children of parents acting as satisfying the needs of children, child development, a role model for children, and forming self-concept in the family [19].

The family is composed of individuals who are part of a larger social network. Therefore the family duties is the direct responsibility of each individual in society. The main characteristic of a family is that the primary function of the family can be separated from each other [23]. The functions include: (1) birth; (2) the physical maintenance of family members; (3) the placement of children in society; (4) social control.

The family is the first institution in the life of a child, where he studied and declared themselves as being social individuals and social beings. In the family, children generally intimate interaction. Everything that is done for children affected families and vice versa. The family is the basis of forming behavior, moral and educational level of the child.

Sex education in the family is one alternative to equip children with information about sex, health, and reproductive problems correctly. Ability, skill, and willingness of parents in providing sex education will determine the feelings of children in the future will come.

Education in the family will affect the morale of the Child, as the research results Septiawan Based on test results influence made it known no influence significant among the Sex Education in Families Against child Moral Formation in RW 01 Hamlet Village VII Kekah Terbanggi Great Central Lampung. It can be seen from the results of data processing using the chi square formula wherein x² count is greater than x² table (count ≥ x² tables), ie 39 ≥ 9.49 at significance level of 5% (0.05) and degrees of freedom = 4, and has a degree of closeness between variables influence in the medium category with contingency coefficient C = 0.68 and a maximum contingency C max = 0.81. Based on a comparison between C with Cmax then the result was 0.83 which is the category of very powerful. So that the test results can be seen that the more good sex education is given, the better sooner a child's moral development. This shows that the Influence of Sex Education in the Family Child Against Moral Formation in RW 01 Hamlet Village VII Kekah Terbanggi Great Central Lampung. The sooner sex education is given, then the sooner the child know the positive and negative effects of promiscuity in society. The better the sex education given to children in the family, then it will be better the child's moral formation. That is what is expected of all parties, that the sex education provided will form the morals and behavior of people getting better and be accepted by society [13].

Parents have a function as a child educator first gained knowledge of parents, especially mothers, fathers and other members. Thus a person's personality is formed as a result of the combination of heritage properties, talent parents and the environment in which it is grown. The first neighborhood that initially provides a profound influence is the family itself [24].

Lestari states As a parent you are obliged to instill identity and social role that appropriate with types sex child. Differences in gender and the role of accompanying the child something to be learned, and sometimes can not be taken for granted. He also need explanation, why her brother's body is different from other woods, why clothes different mother premises clothing dad, why different sounds and the mother nature with child ayah.Ini all confusing, if not trying to explain it to a child, and could arise in the development of emotional
problems, as well as in social and personal development of children. While you've been trying my best to adjust the answers to the age of the child, not necessarily your child can absorb the information in an instant. One of the tasks of development must be achieved at the time the children are learning about sex and accompanying role. Learn to recognize the roles of sex, in addition to means to introduce children in group sex, also on the nature, attitude and role expected of him according to gender [25].

Parents are educators on the basis of blood ties a function and role is as protective of each member family, parents are heads of households. The family is the smallest living as a community of people country wide. The base of the tranquility and peace of life lies in the family Installs gat the importance of family life that then Islam views the family not only as a communion of life's smallest, but more than that as an institution of human life that can give the possibility of injuries and happy world and the hereafter.

This is in line according with Sugianto that the essential thing about sex education is taught to children in a way that is good and right, at the right age, in accordance with its development function, provided by the family and school environments with full responsibility [26]. Furthermore Hasan said sex education should be fully within the context of ideology and teachings of Islam so that teens gain knowledge of physiological (sexual organs and their functions and reproduction as well as the risk of disease) right along with the understanding of the sanctity of sexual relations in Islam are getting sin fouled guilt in the view of Islamic law, especially in view of God [26].

Religion and Reproductive Health and Sexuality Education. As has been shown by Bennett, reproductive health and sexuality education is religiously appropriate (religiously Appropriate) is important in the implementation of reproductive health and sexuality education in Indonesia. It is also a concern of teachers who provide this material in schools, such as the following,

"the reference was to return to the teachings of religion, the substance may reproductive health but also show the package and packaging must of course be put on religion. So far reproductive health education was delivered via subjects Biology, in cognition was already fulfilled the information. But the problem becomes counterproductive because rooted in religious values, there is little wrong with the way of delivery, so that instead of being scared but instead motivated to seek to know, but one. "[26].

According to Sugianto, sex is not something dirty, as taught in most cultures. Sex is a gift from God to man [24]. Islam provides a framework of rules to enjoy the blessings of God, which is not only given to get a descent. Sexual behavior is something that must be enjoyed together as a gift, but it should be in a bond legitimate religion and state, with the conditions that are listed in the Marriage Law in Indonesia. So that sexual health education in Islam can prevent teens from promiscuity because it has clear boundaries socially different sexes. It would also require an understanding of delinquency "teenage pregnancy" category of a psychiatric disorder or a criminal act to determine Islamic counseling in a mental rehabilitation institution or correctional institution. Therefore, the issues surrounding the teenager needed counseling Islam is right for teens as the next generation of national struggle can be the name of nation with the works in accordance with the ability of adolescents [25].

Therefore, the Islamic doctrine of sex performed by a counselor Islam can be summarized, among others: 1) Sex is always considered as something serious, and should be maintained as such. Sex is not something to fool around or simply having fun. Sex is never considered as an accident or are made as test materials. Chastity, nakedness, politeness and respect is always a character's sexuality. 2) Sex was never discussed separately purely for fun. Sex is always attributable to marriage and family life. Sex is seen as superior human relationships are bound in a strict regulation. Thus, sex in marriage is a religious and rewarding. Sex outside of marriage is to be punished and the innocent even cause feelings of guilt. 3) Sex is a personal "privacy" between partner. What happens is confidential and is not to be discussed with outsiders. The human factor in marriage and sexual relationship is more than merely a matter of bodily pleasure. 4) Regulations on the subject of sex is not to be changed because of pressure of a social group or a change in social attitudes [25].
Therefore, sexuality education and reproductive health needs to be looked at sexuality in a comprehensive manner, which recognizes the various dimensions of sexuality facing youth that may influence the decision to undergo sex teens are at risk or not. The presence of sexual desire, sexual pleasure, gender relations, religious teachings and cultural norms, sexual and reproductive health risks and social risks should be discussed in adolescents based on their lived experience. Because according to this study, there are students who have been practicing the behavior of unprotected sex, resulting in STIs and unwanted pregnancy [18].

IV. CONCLUSIONS

1. Educational sexual reproduction is an attempt to convey information to children and adolescents in order to give knowledge and information.
2. Education of sexual reproduction in an effort to educate and prevention of irregularities sexual reproduction
3. family is the first place in providing information on sexual reproduction as the smallest unit of society, which is part of the culture.
4. Religion as a control in the study of sexual reproduction
5. cultural shift education reproduction of something taboo becomes necessary to delivered with religious restrictions, norms, moral and cultural packaging.

REFERENCES
AN EVALUATION OF APPLYING ICT IN THE IMPLEMENTATION OF CORE SCIENCE LEARNING

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Abstract—This research aimed to determine the level according to the application of ICT in the implementation of core Science learning. This evaluation research use the Countenance Stake Model that are antecedent (input), transaction (process), and outcomes (result). Respondents in this study were Science teachers and students in Junior High School in Yogyakarta that consist of SMPN 5, SMPN 8, SMPN 15, and SMP Pangudi Luhur 1 Yogyakarta. Data collection techniques using purposive sampling using the instruments observation sheets, questionnaires teachers, and questionnaires learners. Data were analyzed using a quantitative approach with t-score and a qualitative approach. The results of this study is the suitability of the use of ICT in the learning process quite well, it was shown that on average the suitability of the use of ICT 53,21% on core activities. The application of ICT in the core activities in science teaching can still be continued but need modifications to be good or even better implementation.

Keywords: Applying of ICT, Core Science Learning, Evaluation

I. INTRODUCTION

Challenges to be faced by the people in various countries in the era of all-round this technology is the ability to survive on work and education competition in the world. The technology is developing rapidly every year. Almost all countries are competing to create technology in order to meet the needs of the world market. So that it can say that the technology as an indicator of the progress of a nation. A nation will prosper if it is able to make, and proficient in using it. Now this technology is no longer a need for tertiary but the primary requirement. This is evidenced by the many people who have a dependency on technology, many eager to buy the latest technology and use it for ease in working, studying, or doing everyday activities. So the technology greatly affects the lifestyle of today's society.

Technology is defined as the design of products, systems, and processes by using knowledge of the science needed, and can affect the quality of life [1]. One type of technology is the Information and Communication Technology (ICT). ICT consists of communication technology and information technology. Information technology is all related to the process, the use of tools, manipulation, and management of information. Communication technology as a using tools to process and transfer data from one device to another device [2]. ICT consists of hardware and software. The examples of hardware technology are computers and other digital, while the examples of software technology are application software, internet connection, and local network [3]. The kinds of ICT is used in teaching and learning are laptops, computers, LCD projectors, internet, electronic library (e-library), electronic books (e-books), electronic learning (e-learning), electronic school books which is accessible by computers, digital cameras, television, radio, OHP, e-mail [4]. Each type of ICT not only have one function. Many people make innovate technology with collaborate several kinds of technological devices into one, so the functions are given more diverse. Thus it will be easier for society to use it every day.

ICT were only for communication deliver news or messages before, this now it can be used in various fields of commerce, industry, and education. Because education can be implemented through learning, so learning is being an important part in improving education. Successful learning is influenced by the use of ICT as a medium of learning. The use of ICT in education, especially in the classroom is very important because it can provide the opportunity for teachers and learners to operate, store, manipulate, and get the information back, encouraging independence and learning active, encouraging responsibility in distance

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learning, motivate teachers and students to continue the use of ICT outside school hours, plan and prepare a lesson, designing materials, facilitating the sharing of knowledge reference source [22].

ICT can be used in learning-oriented learners. Learning by using technology can provide many and satisfying experience for learners. Learning activities require students more productive and helped learners solve complex problems to improve their cognitive skills [5]. This is supported that ICT can be used to facilitate and improve the management knowledge [6]. ICT can be used to enable learners in the activities of exploration, investigation, higher level thinking, and argued [7]. Thus ICT can help learners learn, actively construct knowledge, and reach an understanding of the most good.

Nowadays many education experts to implement various types of ICT in their learning. Application of ICT in learning at least must meet three conditions, there are: (1) the teacher and the student should have easy access to technology devices including internet connection, (2) the availability of digital content (teaching materials) that is easily understood by teachers and students, (3) the teacher should have knowledge and skills in using technology and resources to help students achieve academic standards. Optimal use of ICT can be done by the teacher if it has two competencies [8]. The competencies required are technical competence and pedagogical competence. ICT technical competence includes the word process, email, digital photo, the fulfillment of electronic documents, use spreadsheets, online discussions, production of electronic presentations, and online business transactions. While competence pedagogy ICT includes (1) preparing learning requires learners using ICT, (2) understanding of the situation of pedagogy which to use ICT, (3) find curriculum resources that are useful on the Internet, (4) use the internet to support learners doing learn, (5) use ICT to monitor learners' progress, (6) evaluate the learning outcomes of students, (7) use ICT to streamline the presentation, and (8) use ICT for collaboration with others [9]. It can be concluded that teacher very important to have technical competence and pedagogical. If less pedagogical competence possessed by the teachers, the students also do not get optimal understanding.

Application of ICT can be done one of them in learning science. Science is defined as the activities of investigation and interpretation of the events in the natural environment, physical, and in the human body [10]. Studied in science is not just about nature and the human body but also about interactions with technology and society [1]. Science as a set of knowledge and ways of learning about the universe by using a scientific method which includes investigation, observation, measurement, and careful experimentation. Learning science is currently required to be taught in an integrated manner that examines a phenomenon in terms of Physics, Chemistry and Biology, or even be combined with other subjects [11][12][13]. In the teaching of science to use learning strategies that are tailored to the material, using the strategy of group learning, using the strategy said to improve critical thinking, using the strategy of the investigation, using the strategy of manipulation in the experiment, using the strategy of alternative assessment, using technology media, strengthening concept [14]. Thus the teachers are required to be good at choosing suitable learning strategies to teach science.

Learning science have done by learning process skills. The science process skills consist of basic skills and integrated skills. The basic skills include observing, inferring, measuring, communicating, classifying, predicting, using the relationship of time and use numbers. While the integrated science process skills include control variables, operational definitions, formulate hypotheses, formulate model/design, interpreting the data and conduct experiments [15][16]. Thus we can conclude that to studied science need trained science process skills, because it is expected to encourage students to be active (student center). Learners need to actively seek information to construct their own understanding but still improve interaction with teachers and friends. This can be facilitated by applying ICT in science learning [17].

Application of ICT in science learning a positive impact on teachers and learners. By using ICT in the form of interactive Encyclopedia can reduce the saturation of learners, can increase the motivation of learners, to increase understanding of learners, and can assist the teacher in the learning process of the solar system [18]. Using ICT 94.40% can enhance of motivation and learning outcomes students experiencing [19]. Teaching Science with use ICT can change learner’s achievements includes knowledge of the subject matter, ICT skills, motivation to learn, self-learning ability, communication skills, handling of information, collaboration skills, self-direct learning, problem solving, achievement, and self-esteem. Besides that, application of ICT can also change the way the teacher's teaching which includes the quality of teachers in guiding learners, managing time to help learners, solving problems, preparing learning, managing the class, guiding class discussions, guiding collaboration with students, getting communication with the outside world, giving the new contents of learning materials using a variety of learning resources, perform a
variety of learning activities, facilitating the needs of learners, facilitating the motivation learners, recording the development of learners, and improving confidence. Using ICT in learning can help teachers determine the materials to be delivered, determine the learning objectives, start learning, organize groups, choose learning resources, determine the locations studied, planned instructional time, decided the time required, decide recess, featuring achievements, monitor the progress, facilitate feedback, and choose a learning activity [20].

Based on research conducted by previous researchers, it is known that the application of ICT is important to do in learning science. Teachers often use ICT in the core part of science learning, because at this stage do transformation of information and knowledge construction with use strategies, approaches, and methods adapted to the material being taught, and the characteristics of learners. This learning is done with the required learning scientific approach and using a variety of sources one of which is ICT. Thus the hopes of application of ICT are facilitate learners in display issues, observe, ask, do chores, collect information, try with virtual, make reasoning/associate, communicate, engage in interactive learning and inspiring, build learner motivation, make active participation, creative, independent, and develop an attitude of others.

Application of ICT in the core activities on science learning need to be evaluated to determine their effectiveness. Evaluation as the process describe, acquire, and provide descriptive information and judgments about the value and benefits of the purpose of multiple objects, design, implementation, and its impact in order to guide decision making, serving, needs to accountability and promote understanding of the phenomena involved [21]. It can be concluded that the key of the evaluation is the comparison between the objectives and the reality to produce a decision whether to proceed, modified, or terminated. Many models of evaluation that can be used. Each evaluation has specific criteria model based on its purpose. These criteria as indicators in carrying out the measurement. The evaluation of the application of ICT also need criteria as a benchmark for making a decision. Evaluation of the application of ICT can be made a variety of viewpoints, can be in terms of technical and pedagogical terms. Based pre-survey conducted in the area that became place study showed that of the five schools which became the target of research has never been to evaluate the application of ICT in science teaching core activities. So that it encourages researchers to conduct research evaluation of the application of ICT in the core activities on science learning in order to determine whether the application is in conformity between the expected/be the criterion by which accomplished.

II. RESEARCH METHODE

This type of research is the program evaluation. Evaluation model used is Countenance Stake model that consists of delineation (description) and judgment (judgment) on something that is evaluated. Besides that it’s divided into antecedent (input), transaction (process), and outcomes (output). This research was conducted by the procedures in Table 1.

<table>
<thead>
<tr>
<th>Intend (destination)</th>
<th>Observation</th>
<th>Phase</th>
<th>Standard</th>
<th>Consideration</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowing suitability of applying ICT in the core activities on Science learning</td>
<td>Application of ICT in learning on core activities</td>
<td>Antecedent (input)</td>
<td>Preparation of the application of ICT (facilities and infrastructure support)</td>
<td>Support or not support</td>
<td>% concordance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transaction (process)</td>
<td>• ICT facilitates show the problem</td>
<td>• Continue be modified</td>
<td>• Dismissed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• ICT facilitates the activity observed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• ICT facilitates propose activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• ICT facilitates the provision of duty</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• ICT facilitates analyzing activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• ICT facilitates communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• ICT facilitates interactive learning</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• ICT facilitates learning inspirational</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• ICT facilitates motivation builder</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• ICT facilitates creativity builder</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• ICT facilitates development of attitudes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>outcomes (outputs)</td>
<td>handling constraints</td>
<td></td>
<td></td>
<td>Yes/No</td>
<td></td>
</tr>
</tbody>
</table>

TABLE 1. PROCEDURE EVALUATING OF THE ICT APPLICATION
Research have done in five junior high school in Yogyakarta. Respondents in this research taken by purposive sampling technique. This sampling take respondents in special circumstances. The total number of respondents are 5 science teachers and 345 students. This study is limited implementation to the theme of the solar system. Data collected by spreading (1) questionnaire, (2) observation, and (3) interviews. Questionnaire filled out by teachers and learners to obtain information related to adherence to the application of ICT in the core activities in science teaching from the perspective of teachers and learners. Observation sheets filled out by observers to assess adherence to the application of ICT in core activities at Science learning from the viewpoint of the observer. In this study, the observer is the researcher. Guidelines for interviews filled out by the researcher to obtain information from teacher related to the constraints faced by teachers in implementing ICT. The instrument used in this study has been tested the validity of the content, the empirical validity and reliability by using V Aiken and IRT with the Quest program and count the Alpha-Cronbach. It has done to obtain a decent instrument used in the research. Data were analyzed using quantitative approach by t-score and qualitative approach by description. After analyze with t-score thus compare with the criteria category in Table 2.

TABLE 2. CRITERIA CATEGORY[17]

<table>
<thead>
<tr>
<th>No.</th>
<th>Score range</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$X_i + 1.85 S_{Bi} &lt; \bar{X}$</td>
<td>Very good</td>
</tr>
<tr>
<td>2</td>
<td>$X_i + 0.65 S_{Bi} &lt; \bar{X} \leq X_i + 1.85 S_{Bi}$</td>
<td>Good</td>
</tr>
<tr>
<td>3</td>
<td>$X_i - 0.65 S_{Bi} &lt; \bar{X} \leq X_i + 0.65 S_{Bi}$</td>
<td>Enough</td>
</tr>
<tr>
<td>4</td>
<td>$X_i - 1.5 S_{Bi} &lt; \bar{X} \leq X_i - 0.65 S_{Bi}$</td>
<td>Less</td>
</tr>
<tr>
<td>5</td>
<td>$\bar{X} \leq X_i - 1.85 S_{Bi}$</td>
<td>Very less</td>
</tr>
</tbody>
</table>

III. RESULT AND DISCUSSION

A. Antecedent

Based on the research obtained information that in all schools the study who had been providing infrastructure facilities such as LCD screens and in each classroom and science lab. The school also provides a computer lab with a sufficient number of computers for all students, as well as providing wifi in schools to enable teachers and students to access the internet. In addition, there is provided a 1-hour lesson each week for subjects on ICT.

B. Transaction

Based on research that has been done shows adherence to the application of ICT to facilitate their respective core indicators in science learning activities appropriate Figure 1.

![Figure 1](image-url)

**FIGURE 1. RESULTS OF THE ANALYSIS OF THE APPLICATION OF ICT TO FACILITATE ADHERENCE TO EACH INDICATOR OF THE CORE ACTIVITIES OF LEARNING SCIENCE**

Figure 1 illustrates that the application of ICT very well to motivate learners to learn by 94.69%. This occurs because learners more interested in observing and interested in learning through ICT like video, power point, and edmodo. ICT excellent facilitates creativity with a percentage of 91.50%, this is because
ICT can facilitate learners to be creative in presentations or assignments. ICT very well be used to facilitate the observing of 85.00%, this happens due to the use of ICT teachers easier to show the phenomenon of the solar system, and students more easily observe clearly. ICT excellent to facilitate the independence of learners in the learning of 83.57%, this can occur because students can seek additional information from various sources, including the Internet, in addition to teachers and books as learning resources. ICT is also very good for facilitating interactive learning amounted to 82.89%. Communication between students and between students and teachers can be performed using ICT in the classroom and at home. So that learning is not limited by space and time. ICT excellent to facilitate learners conducting reasoning of 78.97%, this corresponds to the activity observed. Additionally ICT is also very well facilitate teachers to assign work to students. By using ICT teachers can deliver assignments to learners if there had given directly due to certain circumstances.

The application of ICT is well used to encourage learners to ask with a percentage of 72.24%. This can happen because of the appearance of the phenomenon of using ICT to encourage learners to have curiosity and encourage them to dare to ask the teacher. ICT well to encourage learners to develop an attitude of both discipline and responsibility by 83.57%. ICT well to encourage learners to participate actively amounted to 68.17%. ICT well to encourage learners to communicate opinions and the results of discussions with your teacher and friend of 67.81%. ICT well to facilitate teachers in presenting the problem of 64.63%, and ICT well to facilitate an inspiring learning for learners of 56.02%. But in this core activity is still lacking in the application of ICT to facilitate learners to trying the virtual. This can happen because teachers don’t provide virtual yet. They show the information still use video, picture, and power point.

Based on the results of research related to the application of ICT in science learning is a core activity if accumulated or triangulation of data from questionnaires learner, teacher questionnaire, and observation sheets, the obtained results as shown in Table 3.

<table>
<thead>
<tr>
<th>Point</th>
<th>Statement</th>
<th>Armature Learners</th>
<th>Teacher Questionnaire</th>
<th>Observation Sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>47.08</td>
<td>59.23</td>
<td>47.54</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>56.88</td>
<td>48.37</td>
<td>63.45</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>39.90</td>
<td>48.37</td>
<td>63.45</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>42.73</td>
<td>48.37</td>
<td>58.15</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>54.49</td>
<td>59.23</td>
<td>58.15</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>61.68</td>
<td>37.52</td>
<td>58.15</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>25.52</td>
<td>37.52</td>
<td>36.93</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>35.54</td>
<td>59.23</td>
<td>36.93</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>57.76</td>
<td>59.23</td>
<td>63.45</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>49.48</td>
<td>59.23</td>
<td>63.45</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>55.14</td>
<td>59.23</td>
<td>36.93</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>51.00</td>
<td>59.23</td>
<td>58.15</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>50.13</td>
<td>48.37</td>
<td>36.93</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>52.53</td>
<td>48.37</td>
<td>63.45</td>
<td></td>
</tr>
</tbody>
</table>

Based on Table 3 can be seen that the results of the triangulation of data from questionnaires learner, teachers questionnaire and observation sheet showed that the percentage of the application of ICT in the core activities in science learning by 53.18%. When compared with the categorization criteria, the application of ICT in learning science credible form the core of this uncategorized good enough.

Based on the results of field observations obtained information that during application of ICT in the core activities in science teaching these obstacles encountered was the difficulty of connecting a laptop or computer in LCD. But this can be resolved. While the constraints of poorly controlled is a wifi connection that is sometimes smooth, sometimes difficult.
IV. CONCLUSION AND SUGGESTION

Based on the discussion from the aspects antecedent, transaction, and outcomes if the interlink between aspects of it can be concluded that the application of ICT in the core activities in science teaching can still be continued but with modifications to its implementation to be good or even better.

ACKNOWLEDGMENT

Unspoken thanks to the Natural Science Education Graduate University of Yogyakarta, companions in research Decentralization Degree, friends and all those who help the settlement of this paper.

REFERENCES

OUTDOOR LEARNING BASED LOCAL WISDOM IN PHYSICS

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Abstract—This paper aims to introduce learning innovation by using environment based local wisdom of Central Java applied in physics learning. Indonesian’s local wisdom less cared especially urban areas, it makes Indonesia crisis culture. Physics learning seldom use environment as a learning media making students are inactive in learning. Outdoor learning demand students to be active and self-supporting in executing study, so physics concept can be accepted through perception directly by exploiting local wisdom of local area. This learning have the character is student center, where the teacher as facilitator and instruct learning to matching with the one which planned. Collecting data in this paper from study literature related to outdoor learning, local wisdom, and physics learning. Main outcomes of this paper is study materials physics can be explained using outdoor learning based local wisdom. Usage of outdoor learning based local wisdom is expected can be applied in physics learning by develope it become a learning model.

Keywords: outdoor learning, local wisdom, physics concept

I. INTRODUCTION

Physics is the part of science that applies the problem solving principle that the learners do [1]. The troubleshooting can be applied to the learner through the outside learning by utilizing the various facilities in the school environment and nature as the sources [2]. In fact, several teachers on learning physics in Indonesia are still using the conventional class. Actually, learning physics is centered on the teacher who builds the class atmosphere, careless, lack of motivation in learning and less of creativity [3, 4]. The center point on the learning physics that mentioned before, make the learner difficult in connecting the physics material with the daily life [5]. The learning process which is associated with the real life assumes that the learner will be easier in understanding physics. Outdoor learning can be applied to the learning which is directly related to the real life and environment [6]. It has been proved by Susetyo (2008) that the usage of outdoor learning will improve the learner skills and the way in understanding physics concept [7].

Outdoor learning is an instructional activity that conduct in the outside of the classroom and directly related to the environment or nature. The learning activities require student to do the observation thoroughly to obtain the data and put it on the worksheet [8]. The usage of nature as the medium of learning is an effective means of improving the knowledge, experience, creativity and motivates the students to discover new things by using nature [9, 10, 11].

Outdoor learning activities also can use an experimental method by using natural materials to involve students in learning process and raises their ambition in doing the experiments [12, 13]. The student involvement in observation or experiment will lead the students to the collaboration, therefore it will build the students ability to analyze and solve the problem through the data experiment [14, 15]. The experiment result or data that obtained, it will be an information or knowledge about the physics that have been studied [16].

Outdoor learning focuses on experience and education environment which is affect the student intelligence, curiosity, aware for the environment, and help in solving the problem [17, 18, 19, 20]. Thereby, the outdoor learning is an learning that more emphasize on observation, experiment, and discover new knowledge through nature and environment. Based on the explanation before, it will improve the skill and the interest of student in study physics.

Today, Indonesia is experiencing a cultural crisis as the loss of human values, religion, and culture. The one cause of this crisis is the influence of education that imported from foreign country. Therefore, it is our obligation to preserve the culture of our nation [21, 22]. In fact, learning science in school especially physics rarely apply the science with the value of local wisdom. This case make the students feel that learning science is less meaning [23, 24, 25]. Here, the researchers assume that student can understand the
Physics materials at school without loss the value of local wisdom [26]. Indonesia has various local wisdom and we can preserve the local wisdom by linking it in the physics learning process. The usage of local wisdom, not only preserve the culture, but it also increases the creativity and the result of students. This case is proved by Agustina (2011) that the process of learning by using the local wisdom in cycle 2 has higher average in the test of creativity and study result than cycle 1[27].

Local wisdom arises from attitudes, behaviors, and thoughts that cannot be separated. If all of them is lost, then the knowledge will be faded ploddingly [28]. Education that based on the local wisdom teach the student to be rooted in their nation, religion and the situation where they life. Thereby, the problem of the cultural crisis will be solved [29].

Outdoor local wisdom-based learning is a teaching or learning that emphasize the students to do the observation or experiment on local wisdom in their own region. It will be happen, when the learning is done outside the classroom or school for fun learning and increasing the students’ awareness of their environment.

II. PURPOSE

This paper have two aims. The first, to introduce learning innovation by using environment as learning media, where that environment relate with local wisdom especially in Central Java. The second, to introduce Indonesia’s local wisdom especially Central Java has physics study and can be made as learning media in comprehending physics concepts having the character of abstraction.

III. RESEARCH METHOD

Collecting data is used in this paper is study literature. Study literature is done by study book and article related with outdoor learning and local wisdom in Central Java. Study of local wisdom to physics concept, writer study relevant physics books.

IV. RESULT

The result of this paper is study physics concept can be applied through outdoor learning based local wisdom. Central Java have variety of local wisdom, there are dance, traditional games, custom ceremony, traditional building, and traditional transportation. All variety of local wisdom can’t be integrated in physics learning. This paper explains local wisdom Central Java relate with physics concept and can be applied in learning through outdoor learning based local wisdom. Local wisdom of Central Java are found on physics concept shall be as follows:

A. Gasingan

_Gasingan_ have any physics concept such as friction force, circular motion, rotation motion and axis wheels relation. _Gasingan_ is made from bamboo. The top of _gasingan_ in form of circle, so that form is according to circular motion concept. We can calculate the linier velocity by calculate its period beforehand. The period can be calculated by the duration rotary time divided with amount of _gasingan_ rotation [30]. _Gasingan_ always rotate to its center, the statement as according to rotation motion. From this theory we can determine period, frequency, planets rotation, etc [31]. _Gasingan_ rotate on the land will make contrary direction of the land rotation as the direction of friction force. Existence of friction force of _gasingan_ make the fast rotation of _gasingan_ become slow and finally will be stop. The stick that existing in the _gasingan_ will rotate in the same direction with the top of _gasingan_ because both _gasingan_’s stick and _gasingan_’s top have same rotary center. So that, the angle is formed _gasingan_’s stick and _gasingan_’s top always be same [30].

B. Enggrang

_Enggrang_ is a traditional game in the center of Java. _Enggrang_ is made by bamboo and its need balance and concentration in playing it. If the left hand of player pull _enggrang_’s stick then the right hand of player push other _enggrang_’s stick will felt heavy. That’s because there are gravitation and weight. Gravitation and player’s balance make the _enggrang_ and player’s body stay up in the earth [32, 33].

C. Gatheng

_Gatheng_ is a game by using stone media which consist of five until ten stone. One of the stone as a mother stone. The mother stone thrown, and then be in effect the concept of vertical motion, and when the stone fall, the stone be in effect the concept of free fall motion [34].
D. Dir-diran

Dir-diran is a game using marbles. When the marble is played, that marble will collision with the other motionless marble. The collision marbles will be happen inelastic collision, so that the velocity of the marbles can be calculate by using conservation momentum law [35].

E. Bentik

Bentik is game made from bamboo and consists of bentik children and a bat. When the bat exerts give a force on the bentikchild, bentikchild will be flying into the air for a few seconds, so it applies the concept of impulse. After a few seconds later, the bentik child will be collide with objects that are nearby or where he fell, and that the applicable momentum of laws [36].

F. Yeye

Yeye is game using rubber media with spliced up into a rope. On the side of the rope pulled by two different people, when two people were attractive the rubber straps, rubber straps will be longer than the first. This includes the concept of strain [37].

G. Kites

Kites is one of traditional game and have some concepts of physics, that are balance (center of gravity), dynamic fluid, dynamic power, and vectors. The concept of equilibrium is used when making kitess (center of gravity) and the binding thread on the kites, so it can fly with equilibrium [38]. The kitess can fly because there is a force that lifts laying kites upwards, the aerodynamic force. Similarly with the plane, it can fly because the force [39]. Researchers from Delft University of Technology (TU Delft) utilize the capabilities of high-flying the kitess to generate wind potential energy at altitudes above 200 meters that can not be achieved by conventional windmill. The wind above that altitude is very strong and has the potential to generate capacity electrical energy [40]. The kitess flying in the air, is not right on top of the player, but it is with a certain slope vector so that players can see clearly of the kites [41].

H. Sepak pesong

When slipper throw be touched stack slipper then collision, this event is change momentum and impulse[42]. When sepak sepong player arrange slipper, player must attention equilibrium and stability of rotational equilibrium so that stack slipper strong [39].

I. Kasti

When ball is thrown and then ball touch kasti player so this event is impulse event. Impulse can add and alter direction momentum in set of time [43].

J. Panjat pinang

Panjat pinang pillar is smeared by oil. This panjat pinang pillar become slippery so friction force between pillar and player’s feet is smaller. This event making difficult player to climb [44]. At the time of installing reward above panjat pinang pillar have to pay attention equilibrium so that strong. Besides, panjat pinang player have to look for way and attention equilibrium with mutual cooperation so that player can take reward [39].

K. Bekel

Bekel ball games is one of Central Java’s traditional game that usually played by girls. This game consists of a ball made of rubber and some little seeds. The essence of this game is that someone taking the seeds as fast as possible before the ball bounces twice on the floor. Bekel games apply physics concepts such as momentum and impulse that is when the ball of bekel bounces on the floor there will be a collision. The concept of momentum occurred to this game because the ball is constantly moving and every moving object has momentum [45]. The applicability of the momentum concept of this game applies the concept of impulse because the impulse itself is a change of momentum. In addition, the collision between ball and floor occur and make the ball bounces back. This physics concept is called the resilient collision, where the floor is quiescent while the ball keep moving. When the ball bounces on the floor, there will be a conservation of momentum. The total collision on momentum system before a collision occurred is as the same as total collision of system after a collision occurred [46].However, this only occurred if the system does not receive any interferences from outside. The collision between ball and the floor, the energy will lost, then it will not occur any conservation of momentum.
L. Tok Tak

_Tok Tak_ is one of the traditional games origin from Central Java, which is almost similar to badminton, but the racket of this game is made of wood. _Tok tak_ has a concept of physics such as parabolic, momentum and impulse motion. It occurred when the ball hit the wood racket. When the ball is released after doing service, it will occur a parabolic line. The parabolic line depends on the service type, sharp dip and float, which aims to have score. Basically, the parabolic line moving is the principle of this game. The concept of momentum and impulse of the game occurred when the balls hit and have the speed. On the other hand, there are also collisions between ball and wood racket in order to change the direction of the ball. The collision is called an half resilient collision, so that it occurs a conservation of momentum not a kinetic energy. It may occur because the collision resilient is converted into another kind of energy such as motion, sound, and so on[47].

M. Temple

Some of traditional heritage temples in Central Java applied to equilibrium and gravity forces of physics concept. The concept of equilibrium is important because there will be a lot of sciences that have been applied. From the rock of temple building, it is found that the force of physics is the gravity force that has down direction and work on the stability of rotational equilibrium. Based on Newton III, the force that works on the temple stone shaped cuboid and cubeis the same as the force that work on pedestalthe temple stonein the bottom temple but opposite direction [48]. By recognizing the principle of equilibrium, we could understand about why the building of the temple stands strongly. In addition, there is equilibrium of static force where an object is not moving or static. It is because all of the work forces and resultant are zero [49]. The stability of rotational equilibrium conceptalso applies on the temple building in order to recognize the location of its stability of rotational equilibrium.

N. Joglo

_Joglo_ is the traditional house of Javanese. The physics concept applied from _Joglo_ is that the equilibrium and stability of rotational equilibrium. The equilibrium concept is obtained by determining the stability of rotational equilibrium and counting some of the parts of _Joglo_, such as its roof and body. It is done to know the strengthens of _Joglo_. The concept of _Joglo_ applies static equilibrium where an object is rest and the forces and the resultant of the forces is zero [47].

O. Nyadran

Nyadran is a Javanese-Islamic people tradition in welcoming Ramadhan. Usually, people prepare the food for this tradition and eat together. The food is put in _tomblok_ made from bamboo and they take _tomblok_ on their head. It is found that the physics concepts are also applied, which are equilibrium and Newton. The person who puts _tomblok_ on her head should have a good balance in order to hold _tomblok_. If an object is not or moving constantly, the speed is zero and the thing is in a balance [50]. It is also applied gravity force, normal force, of this we know that the Newton III Law where force is always comes pairs. When a tomblok laying on his head tomblok will give force to the head of the person, then the person's head will exert a force on tomblok as a reaction to the applied force so that a person will feel pain or heavy in the head. When an object exerts a force on the other, the second one exerts an equal force and has opposite directions on the first object [48]. It is known as Newton III. The nature of action-reaction force pairs are always magnitude, in line, in opposite directions, and working on different objects so that both of action-reaction can not be summed [51].

P. Andong

_Andong_ is a horse-drawn vehicle in which physics concept applied, for example Newton’s law, work , and energy. Newton’s 1 law explains that there is a tendency of an object to remain at rest or in constant motion in a line as known as inertia. The law occurs when _Andong_ is at rest or when _Andong_ is running and then it is suddenly braked. The second law explains that acceleration of an object is proportional to the total force and inversely proportional to its mass. The direction of the acceleration is equal to the total force. When _Andong_ running with various passenger mass will influence the acceleration. The third law explains that when first object force the second object, the second object will give the same force in contrary of direction to the first object. Action-reaction force of _Andong_ is the force between tire of _Andong_ and asphalt [52].

Work in physics defined as multiplication between force causing object move with displacement of the object unidirectional with _Andong_ force. Horse do “work”, so there is displacement. Kinetic energy is the energy had by object because its motion. Kinetic energy at _Andong_ influenced by passenger mass with velocity of _Andong_ [53].
Q. Elo Progo River

_Elo progo_ river is a river in Magelang that used for rafting. Physics concept that we can learn be from _Elo Progo_ river is vector and fluid in motion. Vector[54] must have a value and a direction. The principle of the vector can be used to calculate the wide of river by represent. Fluid in motion is a fluid that moving or flowing by certain velocity [55]. In physics learning about _Elo Progo_ river or any other rivers in Central Java, it can be applied through calculation of the velocity of river’s flow, the volume of fluid and the rate of water’s flow.

R. Batik

_Batik_ is painted cloth by using wax. Physics concept found in making _batik_ is Heat. Heat can change the matter’s temperature and the matter’s shape [56]. To make _Batik_, a craftsman must prepare wax stalk to be heat, so that the wax melt. In the process, the Heat change wax’s temperature and then change wax’s shape from solid to be liquid. The purpose of melting the wax is to be written the cloth on as batik patterns.

S. Keris

_Keris_ is a weapon traditional which have expansion concept. Expansion is the movement of atom constituent the object because of warming [57]. The hotter the temperature of an object, the faster the vibration between atoms spreading in all directions. The vibration of atoms makes the object expand in all directions. Expansion occurs in solid, liquid, and gas. Substances of a _keris_ occurs expansion of solids because the _keris_ metal is heated. In _keris_ production is found a process of heat transfer by conduction. Heat transfer by conduction is process of heat transfer through a substance without transfer by accompanied of the particles. Transfer of Heat by conduction occurs because particles in the edge of the substance contacting with the heat source vibrate.

V. CONCLUSIONS

Outdoor learning based local wisdom is learning innovation through environment based local wisdom of Central Java applied in physics learning. Local wisdom of Central Java can be applied outdoor learning are _gasingan, enggrang, gatheng, dir-diran, bentik, yeye, kites, sepak pesong, kasti, panjat pinang, bekel, tok-tak, temple, joglobin, nyadran, anddong elo progo_ river, _batik_, and _keris_. It can be integrated in physics concept, they are circular motion, rotation, forces of friction, equilibrium, motion with constant acceleration, conservation of momentum, momentum and impulse, elasticity, newton’s law, work and energy, vector, dynamic fluids, dan heat. Outdoor learning based local wisdom is expected can be applied in physics learning in form learning model, where researcher can develop guidance book of model, teaching materials, and student’s work sheet.

REFERENCES


IMPROVING SCIENTIFIC AND ECOLOGICAL LITERACY THROUGH ENVIRONMENTAL EDUCATION TO MAINTAIN ENVIRONMENTAL SUSTAINABILITY

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Abstract—Trends in scientific and ecological literacy is an importance challenge in science education over the world. Globalization make population growth, environmental changing, and degradation of environment. There are so many environmental problems we faced because of lacking the scientific and ecological literacy. As the preventive step, it requires action of education to maintain environmental sustainability. The suggested innovation is to integrate the environmental education (objectives, concepts, and skills) into the science and other subject areas. Environmental education make student realize their role in environmental degradation and make decision in real life problem. Student not only know the knowledge of natural world but also recognize the relevance and application of ecological concept to understand human impact in environment. The purpose of this article is to indentify an innovative approach to make student maintain environmental sustainability for future. This study include qualitative research method using literature review. Each data were analyzed to identify its relevance for improving scientific and ecological literacy through environmental education. Based on analysis result, environment education can improve scientific and ecological literacy to maintain environmental sustainability. Studies indicate that the attitude toward science and attitude toward environmental is influence each other. Through the environmental education helps the student understanding “learn how to learn”, specifically to solve the environmental problems. Solving the problem needs the good literacy of science and ecology. So the environmental education increases the scientific and ecological literacy in order to maintain the environmental sustainability.

Keywords : scientific literacy, ecological literacy, environmental education, environmental sustainability

I. INTRODUCTION

The longer the number of people who inhabit the Earth the population will be more and more. While the amount of natural resources available is limited. This will cause a great impact on the availability of natural resources for humans will continue to exploit nature to meet the needs of life. This would give rise to serious effects if the exploitation process is not accompanied by the process of planting. This means that at some point the natural resources available will be threatened exhausted, then how future generations can survive if there are no resources?

Globalization will cause many environmental problems. Though the environment is where the place we live. Our dependence on the environment could no doubt anymore. According to Riley and Andrew “Environmental problems” is a ubiquitous but vague concept, and we begin by clarifying the nature of these problems and how they emerge from human use of the environment by employing some basic concepts from ecology [1]. Environment has given us many benefits. Firstly, that the environment has given us a lot of natural resources for the necessities of life, both natural resources and renewable natural resources that cannot be renewable. Secondly, every day we produce a lot of waste as a result of the consumption process. The environment that will be our place to throw the waste. The impact of the waste would be bad to ourselves if we are not good in managing waste in the environment. The latter is, every living creature definitely need a suitable place to live, human beings are no exception. Environment will provide a suitable place for us to live [2].

But what about today’s conditions have made us aware that we have been abusing the environment and care for the environment by performing actions that are not concerned about ethics. As a result, a lot of
natural disasters, such as floods, forest fires, drought, exhaustion of natural resources, and so forth. It all is the impact of human activities that are not responsible.

In the modern era, as now, a lot of things that have been based on technology, not only for scientists and technique alone but on all aspects of life requires literacy. Literacy is the ability to understand a person to gain knowledge based on reference to a certain knowledge. While the definition of scientific literacy is still being debated and much to interpret. But one thing that can be deduced from the scientific literacy is that what should people know about science in order to live more effectively, accompanied by concern for the outside world [3].

Science literacy has become something essential that must be owned by everyone. Literacy is an important component in managing the natural resources and to maintain the quality of the environment [4]. Understanding and ability with regard to scientific literacy will give a boost to a person's own ability in personal decision-making and play a role in the formulation of policies relating to the environment that could impact their lives. Building capacity in science literacy is the goal of science education. Therefore, the educational environment is essential to apply if you want to create a generation that is sensitive to environmental issues and can simultaneously solve the problem.

Individuals who already have the ability to either science literacy and the ecological literacy will not only have existing knowledge of science and the environment and environmental issues alone. But the individual who will also have the literacy skills must have the attitude and behavior of the pro-active in the environmental movement. They should have the values of a caring attitude towards the environment, including conservation, prudence, and stewardship [5] [6] [7].

Based on the results of the study showed that students will not experience an increase in environmental science literacy skills when taught by teachers using the traditional way of learning in the classroom [8]. Then, it is important that before a person can have the attitude and behavior to respect the environment, first they have to have a sense of awareness and have knowledge about the environment. Research by Braus showed that changes in the behavior of an individual should be preceded by awareness and knowledge that is more to do with the problems encountered. Therefore, to increase awareness of and attitudes to be concerned about the environment, the steps that can be done is to give a special portion for providing environmental education there is minimal at the high school level and at university level. Given that it is hoped will raise awareness and knowledge of the scientific and ecological literacy so that it will change the attitudes and behavior of someone in general to have an attitude of care for the environment in order to maintain environmental sustainability [9].

How that can be used to maintain the sustainability of the environment is to promote environmental education in formal education. That is an indirect way and took the stage for the realization of environmental sustainability. With the presence environmental education will increase science literacy and environmental literacy. Given the literacy skills better, it will embody the attitude and behavior of environmental care that will lead to sustainability of the environment will be maintained. Environmental education should contain the following objectives; (1) understand and meet basic human needs and facilitate the development of the individual personally, (2) maintaining and improving the quality of the physical environment, (3) to conserve and use natural resources wisely, and (4) develop an understanding of freedom of communication among a people -people in aspects of local, national, and global [4].

Research conducted by Nelso, trying to improve science literacy and environmental literacy by using the novel as a medium of teaching. The subjects of the study were primary school students aged 9-10 years on average. They compared whether the novel can improve science literacy and environmental literacy in the classroom as well as their attitude. Media novel drafted by applying permaculture, which is an approach that combines the knowledge of the ecology of the ethnic or cultural. The results showed that they increased vocabulary of the knowledge of science and the environment and become more aware of the issues related to environmental issues. Some students report that they feel happier to learn outside the classroom (in the outdoor environment) using permaculture approach, compared with those studying in the classroom [10].

Innovation approach offered is to integrate environmental education into the curriculum structure. With the environmental education, especially at a formal level will help students to learn how to learn as they resolve the problems that exist in real life and assist them in decision-making. The push for implementing environmental education not only to align with teaching and learning activities in schools and create exciting but also to comprehend to the students so that they have a role in order to solve the degradation of environmental quality, serious problems faced by humanity today [11].
II. METHOD

This research using methods of literature review. According to the [12] literature review is an objective, thorough summary and critical analysis about the relevant available research or non-research literature on the topic being studied. Meta-synthesize is the technique used in this research that is the non-statistical technique used to integrate, evaluate and interpret the findings of multiple qualitative research studies [13]. Writer studied the literature and the finding of articles, books, and other sources like dissertations, conference and proceedings relevant to a particular issue, area of research, or theory, providing a description, summary and synthesize data. The use of environmental education indirectly affecting environmental sustainability through scientific and ecological literacy are the topics being focused on. Unlike the generalization, meta-analysis aims to transforms the individual findings into new conceptualizations and interpretations [14]. Writer synthesize that the mastery of scientific and ecological literacy by the people can encourage the environmental sustainability.

III. RESULT AND DISCUSSION

1. Environment Education improve Scientific Literacy

Scientific literacy is one of the fundamental to an individual’s full participations in all activities society. The understanding and abilities about scientific literacy can provide individual to make personal decisions and appropriately participate all activities. Before the activity of the action performed by someone concerned about environment, then it should be required prior knowledge about the underlying environment. It’s included the the knowledge that deals with all issues related to the environment. People with knowledge about environment, environmental awareness and action will be formed in each individual.

The one of most effective and efficient way to provide sufficient knowledge to someone is through education. Education will be able to change the behavior of a person. Education is provided through formal education to integrate with curriculum through environmental education. Integration of environmental education into formal education expected the wider community, especially children in early age will be taught environmental education can improve the ability of scientific literacy.

Environmental education is a problem-focused learning. Problem-oriented education provides students experience in applying their knowledge to a particular problem or issue from environment. Environmental education can make students construct their own investigation. Students have direct experience to use their high order thinking skills like creative thinking and critical thinking. Environmental education provides the real issue, problems, and context of the world to learned.

Environmental education can help student to learn how to learn. Learning how to learn have four aspect: (1) learning to know. An environmental curriculum help student learn to know about different information environmental problems and issues from different sources; (2) leaning to do. Student select and apply the information and technique for solving the problems; (3) learning to be. Student make decisions on particular issue based of informations; (4) learning to live together. Student participate in public activities and communicate what they know and can do.

Scientific literacy referred to an individual’s scientific knowledge and use of that knowledge to identify scientific questions, to explain scientific phenomena, and to draw evidence-based conclusions about science-related issues [15]. Scientific literacy consisting of four aspects: (1) Context aspect, recognizing life situation involving science and technology; (2) Knowledge aspect, understanding the natural world; (3) competency aspect, demonstrating competencies that include identifying scientific question, explaining phenomena scientifically and using scientific evidence as the basis for arguments, conclusions and decisions; (4) Attitude aspect, responding with an interest in science support for scientific inquiry and motivation to act responsibility toward.

Environmental education can improve in all aspect of scientific literacy. Since environmental education is about content, awareness, attitude, and participation in environmental protection and resource conservation. Students who have understood environmental education were not only aware of the resources and knowledge of environmental problems that exist. Students should also have attitudes that contribute to actions.

Learning with environmental education can make impact the scientific ecology for the student. The students with less scientific literacy can use common scientific knowledge and simple factual
knowledge in making decision for evaluating conclusion. In other hand, students with more developed scientific literacy through environmental education will demonstrate ability to create or use conceptual knowledge to make predictions or give explanations, to formulate and communicate predictions and explanations with precisions, to analyze scientific investigations, to relate data as evidence, to evaluate alternative explanations of the same issue, to communicate explanations with precision and can contribute with the action.

2. Environment Education improve Ecological Literacy

Ecological literacy is the ability to understand natural systems that support life on earth. Focus of ecological literacy emphasis on understanding the principles of the all organization of environment and the potential application to build a sustainable human society. Environmental pollution and other environmental disturbances reflect of ecological crisis. This means ecological awareness must be an essential skill for every person and it's start from educational aspect.

Education is a way to sentize people to aware of the environment issues facing the world. One of the strategies is the integration of environmental education on learning activities in formal school. Environmental education builds students aware and concern about the environment. Students will have the knowledge, skills, attitudes, motivation and commitment to be able solve the current problem and prevent new environmental problems.

Learning through environmental education provides implication on ecological literacy. Environmental education helps in improving ecological literacy of students. Students have more knowledge about the principles of environment for decision making through environmental education. Student can use their knowledge of ecological concept. Knowledge is acquired through the scientific method of systematic observation, measurement, experimentation, formulation, testing, and modification of hypotheses [16]. Environmental education make student know more about the real object of the issue or phenomena, so they can more understand for decision making.

Students with ecological literate can understand environmental issues and realities by identifying cause and effect relationship. They can recognise the relevance and application of the ecological concept and knowledge to understanding impact on environment. Concept of ecology such as (1) trade off; (2) succession; (3) population dynamics; (4) element cycles; (5) global ecology (human impact) [17]. That concept can be the fundamental information based environmental learning. Environmental education is expected to increase ecological literacy by changing the mindset and behavior of student in positive way to environmental problem. The existence of environmental education can utilize various learning environment with practical activities and provide direct experience.

3. Scientific and Ecological Literacy Maintaining Environmental Sustainability

It has been described in the introduction above that the purpose of scientific literacy and the ability to have ecological literacy is to ensure that environmental sustainability is maintained. But that's a person can have the literacy skills they must be preceded by a process of education, that is environmental education. Environmental education in this case indirectly would sustain the environment by improving science literacy and ecological literacy.

Why in this case we take the variable that scientific literacy and ecological literacy that play a role in maintaining environmental sustainability? Research more about the person's behavior and achievements in the field of science shows a positive correlation [18]. With particular through education and intervention on behavior will be able to change the behavior of people about science [19]. Students who have the attitude and good behavior on the environment will also have an attitude and good behavior towards science. Especially in terms of changing the behavior involved the active participation of students in activities on matters relating to the environment associated with science. This relationship indicates that the attitude towards the environment and attitudes toward science shows their relation one to another.

Scientific literacy is very required in the world in which is now being flooded with advances in technology and environmental degradation [20]. In this case, the ecological literacy and science literacy with respect to each other in terms of equipping the public to have a good understanding in decision-making based on good knowledge and understanding of the issues that are now circulating. Based on the opinion said that scientific literacy is part of the ecological literacy [11]. The relationship can be assumed is that like an egg, the egg yolk is science literacy while the egg is
ecological literacy. Based on this relationship that the science literacy will support ecological literacy. In the above perspective, someone who already has a good literacy about science certainly would support that person also has both ecological literacy. The linkage between the two can be symbolized as a symbiotic mutualism [21] as through environmental education can improve scientific literacy [22] and will also increase ecological literacy.

Based on that understanding that with their capabilities in science literacy and environmental literacy that both are interrelated, then it will directly affect the surrounding environment. Their literacy skills both to science and the environment will initiate the formation of attitudes and behavior to have a sense of caring for the environment. Attitudes and behaviors that will either translate them into actions that will keep the sustainability environment.

IV. CONCLUSION

Literacy to science and literacy to ecology is needed in order to achieve environmental sustainability. Literacy of both to science and to ecology can be formed due to environmental education. By integrating the environmental education to the formal school, hoped the student will have the good scientific and ecological literacy. After the scientific and ecological literacy already achieved, the attitude and behavior of environmental awareness can be attained. Both, the science and ecological literacy have linkages that scientific literacy will affect ecological literacy. If someone already has a good scientific literacy and ecological literacy, then it directly maintains the environmental sustainability that will be ensured, as a result of the inception already caring attitudes and behavior to environment.

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REFERENCES


THE EFFECT OF THE INQUIRY APPROACH THROUGH 5E LEARNING CYCLE ON THE SCIENCE PROCESS SKILLS

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Abstract—This study aims to reveal the effect of the inquiry approach through 5E learning cycle on the science process skills of students in learning biology. This study is quasi-experimental research using the pretest-posttest control-group design. The population was all students in science class of XI grade at SMAN 6 Yogyakarta 2015/2016 which consists of seven classes. The sample was established using the cluster random sampling technique. The experimental classes were taught by using the inquiry approach through 5E learning cycle and the control classes were taught using the approach commonly the steps that lead to direct learning. The data were collected through an observation sheet to observe the students' science process skills. The data analysis used the independent t-test to see the implication of the inquiry approach through 5E learning cycle on the science process skills. The results show that the inquiry approach through 5E learning cycle has a better effect on science process skills compared to the conventional teaching approach at the significance level of 0.000.

Keywords: inquiry approach, 5E learning cycle, science process skills, cognitive ability

I. INTRODUCTION

Education is an attempt to build a complete Indonesian people, as stated in Law No. 20 in 2003 on National Education System in article 1, clause 1 states that education is a conscious and deliberate effort to create an atmosphere of learning and the learning process so that learners are actively developing their potential, personality, intelligence, character and skills needed him, society, nation and state. Education has the objective to be achieved, one of which is the human form to become a better member of society who have intelligence, knowledge, personality, character and skill. In achieving the goal of education through the learning process, the Indonesian Government Regulation No. 32 in 2013 on National Standards of Education, in article 19, clause 1 states the learning process in the educational unit organized interactive, inspiring, fun, challenging, motivating the students to actively participate and giving enough room for innovation, creativity, and independence in accordance with their talents, interests and physical and psychological development of students.

Biology in education is an educational tool. As an educational tool, biology is expected to support the achievement of a goal in learning. Biology is one branch of science that deals with how to find out and understand living things systematically. Biological materials is not only a mastery of knowledge in the form of a collection of facts, concepts and principles, but a process of finding too. Therefore, to studying biology, students do not just memorize enough subject matter but should be able to understand, do research, and evaluate the object.

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Biology provides a variety of learning experiences to understand science concepts and processes associated with living things [1]. Correspondingly, according The National Government Regulation No. 22 In 2006, one of the goals is to develop biology learning experience to be able to propose and test hypotheses through experiments, and communicate the results of the experiment orally and in writing. Biology learning more emphasis on the provision of direct experience to develop the competencies that the students explore and understand the universe around naturally. Learning biology is also directed to find out and doing so can help students to gain a greater understanding of himself and the natural surroundings. Learning biology does not always depend on the teacher, but also the interaction between students with the object to be studied in order to achieve certain goals, which is to build the knowledge, skills and values formation.
Based on the above, the biology lesson should give students direct experience through a scientific process involving various science process skills and deliver students to the learning objectives to be achieved. Therefore, researchers thought that learning in schools need to develop science process skills, especially in biology learning because according to the nature of biology is to understand the concepts and scientific processes. One of approach to teaching biology that provides direct practice and can develop skills through the scientific process is a process of learning by inquiry approach through the learning cycle.

Inquiry-based science learning is an approach to teaching and learning of science that comes from an understanding of how students learn science through inquiry, and focus on the basic content to be learned [2]. Inquiry-based learning, students engage in many activities and thought processes of scientists to produce new knowledge [3]. Inquiry-based learning activities begins with scientific questions, and then the students do investigations, data analysis, and finally use the results to answer questions [4].

In the inquiry approach, the teacher plan situations so that students are encouraged to use the procedures used by the research experts to identify problems, ask questions, propose steps to research, providing exposure, make predictions, and explanations that support the experience. Teaching science by inquiry involves teaching students the science processes and skills used by scientists to learn about the world and helping the students apply these skills involved with learning science concepts. Students are helped to learn and apply these processes through conducting problem centered investigations designed for learning specific science concepts. The teachers help students generate questions to guide these investigations [5].

Inquiry-based learning is the learning that occurs when learners build understanding of new information linking him to previous knowledge in an organized manner and systematically. In this case, the inquiry learning is an activity explore issues in accordance with the real-life use of the process and apparatus of investigation [6]. Inquiry refers to activities seeking information, usually through a question. In addition inquiry is an activity of exploration and investigation are students looking for answers to questions or issues that was obtained from teachers, textbooks or from themselves [7].

When students are involved in the investigation, they describe objects and events, asking a question, build explanations, trying to give an explanation of the scientific knowledge, and communicate their ideas to [8]. Inquiry is not the only way to teach science, but the inquiry is considered important for inquiry-based learning directs students to the kind of learning that goes along with the way scientists do their work, helping students develop a deeper understanding and practice critical thinking skills [9].

Learning biology with inquiry approach can be accompanied by the learning cycle. By inquiry approach through 5E learning cycle makes the students to engage in many learning activities are sequential and thought process scientists use to generate new knowledge. The learning cycle by Cavallo & Laubach [3] is a teaching procedures that are consistent with the nature of the investigation on science and children learn naturally. Learning cycle is the way to draw up an investigation into the school science and occur in several successive phases. Learning cycle direct the children to learn through scientific investigation by asking them explore materials, then build a concept, and finally apply or extend the concept to other situations [10].

Learning cycle developed in the 1960s by Karplus and Thier (1967) on the Science Curriculum Improvement Study (SCIS). At the beginning of the learning cycle developed in three phases: exploration, invention, and discovery. In 1988 Lawson modify the terms used in the learning cycle into exploration, term introduction, and concept application. Furthermore, the learning cycle is being turned into 4E: exploration, explanation, expansion, and evaluation [11], then developed and elaborated further by the Biological Science Curriculum Study (BSCS) into five phases known as called 5E (engagement, exploration, explanation, elaboration, evaluation) [12].

The first step is, engagement, the teacher presents the objectives and the ability to be acquired by students. Teachers foster interest and curiosity of students to the material being studied. The teacher's task at this step is accessing the knowledge of students and helping them become involved in a new concept through the use of short activities that encourage curiosity and pose prior knowledge. The activities of this step to make a connection to their past experience and expose the misconceptions students, and organize students' thinking on the learning outcomes of learning activities. The second, exploration, aims to build student experience, to be able to introduce and discuss the concept, process, or skill. In this phase,
students conduct an investigation and during the activity the students have time to be able to explore objects, events, or circumstances. The role of teachers in the exploration phase is as a facilitator or coach. Teachers start the activity and allow students time and opportunity to investigate objects, materials, and the situation is based on the ideas of each student's own phenomenon. The third, explanation, teachers should encourage students to explain concepts in their own words, ask for evidence and clarification of their explanations, listen critically on friends or teachers and directing for discussion. The activity of the students in this phase is to demonstrate their understanding, develop explanations based on previous experience, using the formal language, the scientific term, and content information to assist them in describing and explaining [13]. The fourth, elaboration, students apply the concepts and thinking skills in new situations that are similar and use the definitions and more formal. Students applying information obtained previously to ask questions, express exit, make a decision, conducting experiments and record the results of observation. The fifth, evaluation, teachers can assess what the students understand and can do the students at this time, encourages students to develop metacognitive skills, and determine what should happen in the next learning cycle [13]. This phase is expected to encourage students to further enhance their understanding, skills, as well as high-level reasoning skills. In addition, this evaluation step students are expected to develop the ability to think reflectively and able to perform self-evaluation.

Learning cycle is an inquiry-based teaching approaches that can be useful for teachers in designing curriculum materials and instructional strategies in science. It is centered on students with activities that provide the basis for observation, data collection, analyzing the activities, events and phenomena [14]. Using the learning cycle in the classroom helps to facilitate the investigation because the learning cycle focused on constructivist principles and emphasis on explanation and investigation of the phenomenon, using evidence to support the conclusion and experiments [15]. Learning cycle can increase the development of reasoning through experience and interaction at different ages. Learning to cycle arranged structured learning can make students actively involved in the learning process [16]. Learning cycle is a research-based learning tool that helps students explore the concepts in science and help the teacher when planning lessons with the aim to help students deepen understanding of the concepts being taught. 5E learning cycle has a sequence of learning experiences so that students have the opportunity to build an understanding of the concept of time. 5E learning cycle with activities in every phase accommodate students to actively construct their own concepts by interacting with the physical and social environment [17].

In addition, the learning cycle is a student-centered learning and students who experience learning with 5E learning cycle will better understand the subject matter and have science process skills. Science process skills are skills of scientists who are used to acquire knowledge and develop knowledge through training activities such as engaging in practical activities. Skills process are the ability to think that scientists have used to construct knowledge, solve problems, and formulate results [18]. The science process skills as the ability to think is used to create the appropriate theory and knowledge, solve problems and formulate results and is a tool that helps to learn and understand scientific studies [19]. Science process skills are specialized skills that facilitate science learning, to enable students to develop a sense of responsibility of students in their own learning, improve learning, and teaching them to research methods [20]. Science process skills include intellectual skills, related psychomotor and affective skills related to learning science in all its aspects. Skills process refers to the process of cognitive or thought process in which students are involved when studying the subject. Exercise skills learned this process produces a specific topic, such as definitions, explanations of terms, concepts, principles, laws, theories, and others in the subject domains [21]. Science process skills also support the development of student language because, as a part of using these tools, students are simultaneously called on to engage in discussions with others. The need to communicate what is being seen or to describe ideas to another person challenges a child to articulate his or her thoughts [22].

Science process skills into two parts: the basic science process skills, include observing, measuring, classifying, inferring, predicting, communicating. The second is the integrated science process skills, includes the skills of identifying variables, constructing hypotheses, analyzing investigation, tabulating and graphing data, defining variables, designing investigation, and experimenting [23]. The American Association for the Advancement of Science (AAAS) classifies science process skills within fifteen [24]: to observe, measure, classify, communicate, predict, infer, using numbers, using the relationship of space / time, questions, controlling a variable, hypothesis, operationally define, formulate models, designing experiments and interpreting the data.
Inquiry approach through 5E learning cycle aims to make learning into a series of strategy planning. Students no longer be passive in learning, but students can develop skills, analyze, and evaluate, experience and discussing and sharing understandings with other students. Students collaborate with other students to solve problems and investigations are planned.

This inquiry-based learning, including both because it involves students in live experiments. Implementation of inquiry approach through 5E learning cycle showed better learning outcomes than the control class and can be applied in various races, tribes, and ethnic [25]. There were significant differences between the level of achievement of students who have been given the teaching learning model-based investigation 5E learning cycle and students who have been awarded teaching with traditional methods [3].

From the above explanation, this study has the problem formulation is there influence of inquiry approach through 5E learning cycle of the science process skills in biology learning? Based on the problem formulation, this study aimed to examine the effect of inquiry learning approach through 5E learning cycle of the science process skills students in learning biology.

II. METHODOLOGY

This research is quasi-experimental research (quasi experiment). This study was selected because it is not possible to randomly select a perfect sample of research and it is not possible to control all the variables in the conduct of research.

This research was conducted in SMA Negeri 6 Yogyakarta located on the street C. Simanjuntak No. 2 Yogyakarta in February 2016. The study population was all students in grade XI IPA at SMAN 6 Yogyakarta. Class XI-IPA SMA 6 Yogyakarta are divided into several classes: XI-IPA 1, XI-IPA 2, XI-IPA 3 XI-IPA 4, XI-IPA 5, XI-IPA 6, and classes XI-IPA 7. in this research, sampling is done by using cluster random sampling technique. Classes are taken as samples come from populations that are homogeneous or have the same variant. Random cluster sampling technique is not based on a select sample of an individual, but rather based on a group (class). Data collection techniques in this research is to use the instrument in the form non-test observation sheet used to determine students' science process skills during the learning process. The data described in this study is data from the observation science process skills of students. Hypothesis test to determine the effect of inquiry approach through 5E learning cycle of the science process skills students are using the test independent sample t-test.

III. RESULT AND DISCUSSION

In this study, students' science process skills are assessed consists of the skills to observing, measuring, classifying, inferring, communicating, tabulating and graphing data, designing experiments and experimenting. Here are the average score of science process skills in each of these aspects in both classes are summarized as follows:

<table>
<thead>
<tr>
<th>No</th>
<th>Aspects</th>
<th>Experiment class</th>
<th>Control class</th>
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<tr>
<td></td>
<td>Total score</td>
<td>%</td>
<td>Total score</td>
</tr>
<tr>
<td>1.</td>
<td>Observing</td>
<td>81</td>
<td>90</td>
</tr>
<tr>
<td>2.</td>
<td>Measuring</td>
<td>87</td>
<td>96.7</td>
</tr>
<tr>
<td>3.</td>
<td>Classifying</td>
<td>75</td>
<td>83.3</td>
</tr>
<tr>
<td>4.</td>
<td>Inferring</td>
<td>72</td>
<td>80</td>
</tr>
<tr>
<td>5.</td>
<td>Communicating</td>
<td>69</td>
<td>76.7</td>
</tr>
<tr>
<td>6.</td>
<td>Tabulating and graphing data</td>
<td>75</td>
<td>83.3</td>
</tr>
<tr>
<td>7.</td>
<td>Designing experiments</td>
<td>71</td>
<td>78.9</td>
</tr>
<tr>
<td>8.</td>
<td>Experimenting</td>
<td>69</td>
<td>76.7</td>
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<td>465</td>
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<td>Mean</td>
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The overall average in each aspect assessed on the skills of the experimental class is higher than the control class. Based on data obtained through observation, it is known that the acquisition of the average score of students' science process skills experimental class and control class is different. It can be said that learning the experimental class that is learning by inquiry approach through 5E learning cycle better than the control class that uses a direct instructional model of the science process skills.
After obtaining the value of the science process skills of students from acquiring a score, then tested the hypothesis by using t-test, in this case t-test used is independent sample t-test. From the test results of independent sample t-test known significance value 0.000 < 0.025 so that the implementation of inquiry approach through 5E learning cycle has a better influence on students’ science process skills.

During the learning process in the classroom experiments using inquiry approach through 5E learning cycle make students more active to dig their knowledge with the help of worksheets that have been adapted to the learning cycle. The first phase is the phase where the teacher engagement that attract students’ attention and arouse the curiosity of students to the concepts or topics to be studied. Moreover, at this phase the teacher also informs the learning objectives to be achieved. The material studied by students in this study is a matter of the digestive system. At this phase of the engagement, teachers draw students’ attention to the pictures and videos related to the material being studied. After attracting the attention of students, followed by questions that correspond to the lesson topic that will be discussed at each meeting. Then students will give a response in the form of ideas or answers. The idea and the students’ answers are taken as the beginning of students’ knowledge of the material to be delivered. Furthermore, in the second phase, namely exploration, students are involved actively to explore or excavate knowledge of a tiny group that has been formed while teachers as facilitators. Student activities at this phase in the form of activities of experimentation, observation, recording observations, and reading literature. The third phase, explanation, students are required to explain the concepts they are studying in their own words. In this study, after a discussion with the group of students and then the students present the results of its exploration in classroom discussions using their own language. The third phase is known as a phase to present the concepts, processes and skills brief. The fourth phase is the elaboration, this phase skills that students can do is to do an advanced practicum and deepen this concept has been given. The fifth phases, namely evaluation, conducted an evaluation to compare previous knowledge with new knowledge gained through both oral and written quizzes.

Learning to use the 5E learning cycle cultivate the curiosity of students to conduct research. Through the phases that exist on 5E learning cycle which has successive phases (engagement, exploration, explanation, elaboration, evaluation), keep students engaged in the learning process. That is, the 5E learning cycle provides a direct experience of the students. It can be concluded that the inquiry approach to learning through 5E learning cycle can assist students in developing science process skills through the experience of students. The learning cycle arranged structured learning can make students actively involved in the learning process [16]. The 5E learning cycle of learning by helping students to learn concepts through experimentation, draws conclusions, solving problems relevant to the experiment, and discuss their observations and discoveries with friends on class [26]. 5E learning cycle is an effective way to help students like science, understand concepts and apply scientific processes and concepts for an authentic situation [27].

IV. CONCLUSION

Based on the results of research, it is known that the inquiry approach through 5E learning cycle has a better influence on science process skills in learning biology. This is expressed by the acquisition of science process skills scores in the experimental class is higher than the control class. In addition, also tests the hypothesis by using the t-test and the known significance value 0.000.

REFERENCES


Table 2. DATA SCIENCE PROCESS SKILLS STUDENTS

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SCIENCE TECHNOLOGY AND SOCIETY APPROACH (STS) IN BIOLOGY LEARNING PROCESS TO DEVELOP SCIENCE PROCESS SKILLS AND SOCIAL SKILLS OF STUDENT

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Abstract—Challenges in the 21st century require students to have the competence and skills such as the ability to communicate and cooperate, the ability to create, and literacy. One of the best preparations to confront the challenges is through education. Preparation of competence in education is to use learning. The learning process should be directed to meaningful learning, where the students doing real experience that relating to the material obtained in class learning. One of the good approach is used to meaningful learning is the STS approach. STS approach is a way where learning is associated with issues and problems that exist in the community. Based on STS, the students' science process skills can be developed. A correlation between STS and science process skills to make students able to identify the problems that occur in the field and find solutions based on scientific methods, such as former scientist doing research. Science process skills developed through STS approach can also develop students' understanding of biological concepts. In the invention of the concept that students need social skill. Social skill that is a student's ability to interact and communicate with the community and society when finding a complex issue. With the good ability of social skills, then it is likely that conflict will occur can be minimized because the students learn how to interact and put himself in the environment. In addition, with social skills, the delivery of information on the results of scientific work that has been done, can be delivered and received by the audience well.

Keywords: STS, Science Process Skills, Social Skills, Biology Learning

I. INTRODUCTION

The development of the global era is often called the 21st century characterized by technological advances and rapid information. This causes the space and time become infinite, so the acquisition of information more easily obtained. Characteristics of the most prominent global era are (1) computing is the development of computing machines to do the job quickly and accurately, and (2) automation that is work that is routine with standard procedures were replaced by machines [1]. Based on that the students should be trained in the proper use of technology, the development of high-level mindset to be able to distinguish information that is right or wrong, as well as the competence to face the challenges of the times.

Based on statistics data of PBB during the period around 2010 to 2035, Indonesia will be during the dependency ratio, that is the level of dependence on non-productive age population (elderly and children) to the productive age will experience the lowest point [2]. So that in this period the number of young people in productive age will overflow. This will be the momentum to prepare qualified young generation to be competitive global arena. Forms for young generation the best is through education. Because it is through the education of students can be trained to develop skills, mindset, and attitudes by using approaches and learning strategies appropriate to developmental level of students.

Basically the 21st century education requires students to have the knowledge and skills that can be used to face problems in their environment. While the Partnership of 21st century skills learners identified that the 21st century should be able to develop competitive skills that focus on developing Higher order thinking skills [3]. In order for the 21st century educational demands can be met, then the learning
process should be directed to meaningful learning. Meaningful learning is learning that relate the material obtained by the circumstances in school environments where students are located.

One approach to learning that is in accordance with the demands of the 21st century is the STS approach (Science, Technology, and Society). On STS approach Students are taught techniques incorporate issues of social and active learning, so that students are expected to have an interest in science and positive attitude towards scientific process [4]. Based on that with the approach of STS students are trained to develop the mindset is based on the reality that occurs in the community, so that more learning is contextual.

The aim of STS is a learning process that emphasizes how to acquire knowledge as practiced by scientists. Where knowledge is obtained through a skill known to science process skills. Science process skills are the tools used by students to investigate the world around them and to build the concept of science. The basic science process skills occurs when students work on science activities. In doing science activities will certainly generate new information or knowledge that can be applied in everyday life and are used by the public [5].

Global Era currently makes the students as though life in the digital age. This is due to the easiness of life be a side effect of the development of technology and information. Based on this social skill learners having problems. Social skill problems that occur include the lack of communication and collaboration with fellow learners. While to know and face the problems that arise in the community of learners can not work alone, they have to establish communication and cooperation with the people and their communities. Based on that learners need to be equipped with the social skills that can be built through a learning process.

Scientific paradigm of the 21st century is how the link between science and society. Increasing attention to environmental issues, energy, food, health, and social problems, requires learners to find information about the causes and solutions to these problems by applying the knowledge they gained from the learning process. Best mastery of science will make students ready for the challenge and ready to enter the job market in the future.

When linked to the study of biology, which expects students to understand the nature of biology that has aspects of a process, product, attitude. The point is that students understand not only knowledge about natural phenomena, but also the knowledge discovery process through scientific work and scientific attitude. Therefore, the STS approach can improve science process skills of students because students are taught discover new knowledge or a solution to a problem through the process of science, and improve social skills because knowledge is built based on the contextual issues that developed that encourages students to be directly involved in the community.

II. METHOD

This research is grounded theory. Grounded theory is qualitative research method that uses a systematic procedure aimed to develop action-oriented theory, interaction, or process on the basis of data obtained from the research arena. Grounded theory is the theory of inductive discovery methodology that allows researchers to develop a theoretical report common traits simultaneously a topic in the field of empirical observation record data. Grounded theory is a methodology that attempts to construct theories about the important issues of public life. Grounded theory should be fundamental to the theory. The purpose of this study is to reconstruct the theories used to understand the phenomenon.

III. DISCUSSION

Globalization is a process that has positive and negative consequences. Positive consequences is that students will have the breadth of knowledge aspects of technology and opportunity, as well as the opportunity to collaborate with many people in solving problems. While the negative consequence is the emergence of social inequality, growing individualism, conflict, and the emergence of environmental issues such as greenhouse, global warming, and the exploitation of natural resources in excess [6]. So to avoid negative consequences and maximize the positive consequences that education plays a very important.

Education can not be separated from the learning process. The learning process in accordance with the demands of the times will produce students who have the preparedness to face any kind of problems. So
that the learning process should be directed so that learners can mempertanyakan and find the problem and to find appropriate solutions to these problems. In addition students should also be trained to think analytically and how making the right decision, as well as scientific skills.

The learning process that can lead students to have competence in accordance with the global era is the approach of Science Technology and Society (STS). The model STS means focusing on the individual needs of students, namely, the concept of knowledge and skills process useful in the daily life of students. As well as focusing on social issues or problems that occur in the home environment, school and community. STS also focuses on job or career because it can train students to identify and solve a problem [7].

NSTA research results (1990) [8] suggests that learning science by using STS approach has several differences when compared with the usual way. The difference is in the material and application aspects linked learning materials, creativity, attitudes, processes and concepts of knowledge. From the aspect of the link material and material application lesson, students learn with STS approach can connected material learned with everyday life, and to see the benefits of technological development and its relevance. From the point of creativity students are many asked, skilled in identifying possible causes and effects of the observation. In terms of attitudes, students' interest in science increased and curiosity also, and science is seen as a tool to solve problems. They see science as a process of skills that can be used and need to be developed [9].

Science process skills are the kinds of skills that are expected to develop in accordance with the progress of science and technology in society. Science process skills are specialized skills that facilitate learning science, activate students’ thinking, develop a sense of responsibility in learning, improve learning and teaching conduct research methods [10].

Science process skills is carried out by scientists as they conduct research and investigations. Science process skills that must be developed on students include the simplest is observed up to the highest capability is the ability to experiment. Science process skills into two parts: the basic science process skills include observing, measuring, classifying, inferring, predicting and communicating. Integrated process skills include the skills to identify variables identifying variables, constructing hypotheses, analyzing investigation, tabulating and graphing the data, defining variables, designing investigation, experimenting [5].

Application of the scientific work undertaken by students with STS approach should be applied in a community environment, this application requires social skills, so that the delivery information can be in accordance with the desired goal. Social skills the skills we use to communicate and interact with each other, both verbally and non-verbally, through gestures, body language and our personal appearance. Having good social skills allows individuals to have positive relationships with others. The term “social skills” includes your child's communication, problem-solving, decision-making, self-management and control, and relationships with classmates and friends. Difficulties with social behaviors may interfere with learning, teacher acceptance, and exclusion from school activities.

Social skills basically consists of communication skills, conflict resolution, team building and basic skills interaction. Communication can be done orally or in writing. As social beings who live in the community the studentshould have a good communication skill, this case so that the delivery of ideas and question about a problem can be communicated well and understood by the interlocutor. While the team building skill is a must that always be used lifelong. Team building necessary skills so that students can solve complex problems alongside their communities. Team building skills intention is mutual understanding, helped among others, so that the goal can be achieved. In addition to the mastery of social skills for studentsto avoid conflicts that might occur in their community. Social interaction with the basic skills of studentsin the community can be established, so that the problems that arise can be resolved together. This capability also in the future be very useful when students have entered the world of work that promotes interaction and cooperation.

When linked between sains process skill that trains students to develop the scientific procedures then social skills need to be used to present the results of new discoveries and break throughs that have been made. With the social skills of students, students can socialize with people and their communities and express their opinion on an issue in the discussions. In addition to the SPS the students will be able to discover and develop its own facts and concepts based on the findings that they get into the environment.
Social skills are basically very supportive sains process skill this is because social skills are formed from social interaction between students with the community and have a mutual relationship that can affect the mindset and behavior of children. Basically when a student who has the social skills that are less visible that looks much different from the students who have good social skills. Students who are good social relations will be more effective in carrying out social relationships because he is able to select and perform the appropriate behavior in accordance with the demands of the environment.

Learning biology is part of learning sainc that relates to nature, and scope of the study of biology more is specified in living being and the environment.

"Biology is the science that is quite old, due largely derived from human curiosity about him, about the environment and about the continuity of its kind. Biology study of the physical structure and function of human organs with all curiosities. All the tools of the human body works each, but each other to help each other. Biologists studying the device around or environment. Both of these aspects, both the human body and nature, is seen as a system. In any system there are components that support each other so that the whole system can take place [9] ".

In addition to the study of biology is also studying the diversity, structure, physiological processes, relationships between living things and interactions with the environment. Linkages between human life in the environment, human beings require to have relevant knowledge of other living beings and their environment. But there a litiny in the field suggests that the biology of learning commonly demonstrate achievement of learning outcome careless than optimal. One consequence is the lack of contribution of the students in the community and the environment [11]. This is due during this study only focused on the biology of memorization process, students are not trained to go straight spaciousness and observe in accordance with scientific procedures. Where as the core of biology learning is that students can find ascients discover dearlier findings.

With STS approach where students are trained to use the environment and carry out scientific work as scientists do to find a concept earlier. Then it will be a meaningful in biology learning and technology development and rapid information can also be put to good use, because the process of learning contain students center make students actively seek, ask opinion on an issue, and put forward the idea of a solution to these problems.

The focus of the study of the 21st century that is now growing to environmental problems, the following implications, make learning biology plays an important role. Because basic research in biology is with regard to the survival of living beings and their relation with the environment. The use of STS approach as facilities to learning so that students have the ability to process science and social skills are very appropriate for use in learning, so that students in the future to have provision when they are in the working in future and people's lives.

**IV. CONCLUSION AND SUGGESTION**

Global era is a necessity that the positive and negative impacts should be faced with the full preparation and creativity generation in order to be competitive in global arena. One of the best form of preparation is through the education process. Preparation of competence in education is to use learning. The learning process should be directed to meaningful learning where the students experience real experience relating to the material obtained in class learning.

One good approach is used so that meaningful learning is the STS approach with this approach students do not just sit in class but using all the resources available in the environment. STS approach is a way in which learning is associated with issues and problems that exist in the community. Based on the students' science process skills can be developed. A cross between STS and science process skills to make students able to identify the problems that occur in the field and find solutions based on scientific methods, such as former scientist doing research.

In the invention of the concept of social skills that students need a student's ability to interact and communicate with the community and society when finding a complex issue. With the good ability of social skills are then possibility of conflict that will occur can be minimized, because students learn how to interact and put himself in the environment. In addition to the social skill informing the results of scientific work that has been done can be delivered and well received by the audience.
ACKNOWLEDGMENT

Weasa writers give thanks to biology education figures that has been inspiring us through their research that they have done. So we can bring more information about the good learning process for the students, so the students can best face the challenges of the times.

REFERENCES

CLASSROOM MANAGEMENT IN SCIENCE EDUCATION

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Abstract - Classroom management is one of the most important skill that should be have by teachers in science education and should be done by teachers for effective and efficiency learning for students in the classroom. The aim of this study is to inform teachers in science education how to do the better and the efficiency classroom management. On the other hand, this study will shows to all teachers especially in science education to use their ability and capacity as a teacher to manage the classroom particularly in learning. Teaching is not only about ability and capacity for teaching subjects matter to increase students academic ability on science but also about teacher skills in manage the classroom because teaching is an art. In this study using literature review about classroom management that can be use in science education. The study addresses the following topics: pedagogic competence, ability in classroom management for learning in science education, pedagogic competence in classroom management for learning in science education, and classroom management for learning in science education. The result of this study are teachers should have pedagogic competence especially in classroom management for science education, and classroom management is one from many things that related to and will espouse learning process.

Keywords: Classroom Management, Science Education, Pedagogic Competence

I. INTRODUCTION

A. Background Issues

Education is one of the elements that are important in human life and needed to change the lives of not knowing to knowing, bad attitude changed into a good attitude, and the lazy characters become diligent character, and make the people to care for others. The world of education begins with a classical education that is more about mastery of academic subjects because it is very practical, easily prepared, easy to implement, and easy on evaluating and easily combined with other types of education or learning.

In some books written that education is a process undertaken to humanize humans. Therefore, education should be formulated and designed in such a way that makes it useful in the classroom and knowledge shared was worth it for the students. Learning in the classroom will not be successful without the intervention of teachers, tools and instructional media, students, and all things related to the learning itself. Rusman [1] states that learning is a system, which consists of various components that are interconnected with each other.

In fact the teacher in the classroom has not been able to connect every component involved in learning. On the other hand, teachers require a competency, namely pedagogic competence in order to be able to pick and choose media, methods, strategies, and approaches [1] corresponding to the learning in the classroom.

Given the fact that, especially in rural areas that have not been able to access information widely, the paper with the title "Classroom Management in Science Education" was written to provide information to any prospective teachers and teachers about how to do manager good and efficient learning in the classroom especially in Science Education, both in primary school or in secondary school. The paper is expected to be able to bring awareness to every prospective teachers and teachers that the importance of managing learning in order to create Indonesian people to compete as well as the generation that not only has the ability in academics but other skills needed for survival.

B. Formulation of The Problems
In this study there are few problems that should to investigate in classroom management for Science Education. The problems are
1. What ability should be needed in classroom management for learning in science education?
2. Why pedagogic competence is necessary and related to classroom management for learning in science education?
3. How is the best efforts to learning effectively for classroom management in science education.

C. Purpose
The aims of classroom management in Science Education are
1. To know the ability that should be needed in classroom management for learning in science education
2. To inform that pedagogic competence is necessary and related to classroom management for learning in science education
3. To shows that the best efforts to learning effectively for classroom management in science education.

D. Benefit of Writing
The benefit of classroom management in Science Education are
1. Teachers can make learning more effective and efficient.
2. Students can learn more favorably, especially in science education
3. The classroom atmosphere is more comfortable and organized so as to facilitate students and teachers to learn and tasks given.

II. THEORETICAL BACKGROUND AND DISCUSSION

A. Definition of Learning
Rusman [1] suggests that learning is a process of interaction between teachers and students, either direct interaction such activities face to face or indirectly, by using a variety of instructional media. Same sense is also said in the Law on National Education System of 2003 Chapter I Article 1 paragraph 20 that learning is a process of interaction of learners with educators and learning resources in a learning environment.

According to Warsita learning is an attempt to make students learn or an activity to make learners learn [1]. In addition, Sudjana argued that learning can be interpreted as any attempt systematically and deliberately to create that happen activity educational interaction between the two parties, is between the students (learners) and educator (learning resources) conducting the learning process [1]. Additionally, Hamalik said that learning as a combination composed include the human element, material, facilities, equipment, and procedures that influence each other to achieve the learning objectives [1].

Based on some sense it can be concluded that students' learning is a process of interaction invitation every learning resources used in the learning process, both physical and mental interaction of learners through which this interaction learners will acquire knowledge and achieve educational goals. Learning plan prepared properly will create a more effective learning activities and media usage will greatly assist students in achieving the learning objectives.

B. Definition of Pedagogical Competence
Competence or skill or ability is mastery that must be owned by a person to face the real situation and can solve every problem faced by the ability or competence he had. The same thing Ngainun been suggested by Naim [2], that the word literally competency can be defined as the ability. Competence according to Indonesian dictionary is the ability to master the grammar of a language in the abstract or spiritual. Another understanding conveyed by Usman [3], that "competence is the ability or the authority of the teacher in carrying teacher profession.

Meanwhile, pedagogic means science education or science teaching (Dictionary of Indonesian). A similar notion was delivered in Wikipedia pedagogy is the science or art of being a teacher. This relates to the strategies used by teachers in teaching or learning style. Etymologically "pedagogy" comes from ancient Greek and literally means "to guide the child". Pedagogic itself comes from the Greek word "paedos" means usher, guide. Thus, pedagogical means helper boys in ancient Greece, whose work drove her employer's child to school or an expert to guide children towards life purpose.
In the same address Hoogveld from the Netherlands suggests that pedagogical problem is the study of guiding children toward a specific purpose, namely that he was later able to independently complete the task of his life. According to Langeveld pedagogic interpreted with science education, more focused on the thought, reflection on education. Thus, it was concluded that pedagogy is a theory that is thorough, critical and objective, develop concepts about human nature, the nature of the child, the nature of the purpose of education and the nature of the educational process.

In the explanation of Law No. 19 Year 2005 Article 28 of the Indonesian National Standard mentions that pedagogical competence is the ability to manage learning of learners that includes an understanding of the learners, the design and implementation of learning, evaluation of learning outcomes, and the development of learners to actualize various potentials has. Pedagogical competence is competence related to the ability of teachers to manage learning, understanding teachers will be learners who have diverse characteristics, lesson planning, implementation of learning that educates and dialogue, the use of technology in the learning, evaluation of learning outcomes, and the development of learners[4].

Although it has a mention of a different, Naim [2] suggested the competence and professionalism with regard to teachers who master the material field of study as supporting learning, managing learning programs, managing a classroom, the use of media or source, mastering the foundations of education, managing the interaction of learning, assess student achievement, and recognize and organize guidance and counseling programs.

C. Definition of Science

Lord Bullock in Hodgson and Scanlon [5] sees science “as a humane study, deeply concerned with man and society, providing scope for imagination and compassion as well as for observation and analysis”. Definition of science continue to evolve over time and have diverse meanings. There is another sense that says science is a systematic attempt to build and organize knowledge about the universe in the form of explanatory and predictive manner. In addition, etymologically, the word science comes from the Latin scientia meaning "knowledge, expertise", or darisciens (intelligent, expert), is the noun form of scire (to know), may be derived from the meaning "to separate one thing from the other, to distinguish “, and associated with the word scindere (cut, separate) [6].

Not only Bullock who see science as the study of man, concerned with man and society, provide scope for observation and analysis of it however, many experts also deem that science is more in touch with the universe, living things, and everything that can be explained empirical. Thus, in science education needed to perform classroom management skills so that learning science can take place in accordance with what is expected.

D. Ability to Manage Classes in Learning

The ability to manage learning in classroom become one of the most important aspect to be considered in science education not only in primary but also in secondary school and higher school. Classroom management show activities that create and maintain optimal conditions for the process of learning (coaching” report card , termination behavior of learners who distract the classroom, reward for timely completion of tasks by setting norms productive group, and so on).

According to Isjoni [7], there are some skills that should be shown when teachers manage classroom learning. These skills are,

- Response Attitudes, where teachers are aware of and responsive to their attention, the involvement, indifference, and their exclusion from the duties in the classroom. In other words, teachers know what they are doing (wittiness). Isjoni [7] also propose four impression of responsiveness that can be demonstrated to look carefully, approaching motion, making the statement, and react to disturbances and student apathy.

- Dividing attention. Teachers can divide attention when handling two or more activities at the same time. In dividing the attention of the teacher can use visual and verbal ways. By way of visual means teachers can gaze to any activity taking place at the same time monitoring students who are not involved. How verbal means teachers can comment on the activities of the student.

- Students alert. To be able to alert the student teachers can use students how to focus on a phenomena or situations that attract the attention of students.
Demanding Responsibility Students. Teachers hold firm commitment was given to the students related to their responsibilities in completing tasks. In addition, teachers can request feedback from every student on the results of his work.

Giving Instructions are clear. Instruction is given relating to activities and aspects of learning, teachers must give each instruction clearly and not confusing students as well as direct.

Reprimand. Teachers can give warning to students who disrupt classes or other groups in the classroom. The conditions that should be given in these scolds (Isjoni [7] are a) clearly and firmly fixed on the disruptive student and the behavior that must be stopped; b) avoid the rough and painful warning or containing insults; and c) avoid babble or ridicule the teacher, the more prolonged.

Reinforcement. Isjoni [7] also describes two methods that can be used by teachers to provide reinforcement, including a) provide reinforcement to students who interfere with the "capture" these students when behavior is reasonable and "catch" her when behavior that is not fair, then admonished him casually student has resurfaced; and b) provide reinforcement to other students who demonstrate reasonable behavior to become an example of positing attitude towards her other friends.

E. Pedagogical Competence in Managing Classroom

Pedagogic competence in managing the class on learning for science education is closely related to students' learning styles. On the other hand, it also relates to the creation of a challenging situation and stimulate students to learn, giving its own satisfaction in achieving its objectives as well as providing security to students in learning [3].

Classroom management is done to provide and use the facilities for a variety of teaching and learning in order to achieve good results [3]. In addition, classroom management is also made to develop students' ability to use the tools of learning, providing conditions that allow students to work and learn, as well as helping students to obtain the expected results [3]. Mulyasa [4] promoted several issues related to the understanding of teachers to students. The understanding with regard to the level of intelligence of students, student creativity, physical condition, growth and cognitive development.

As a teacher or educator or mentor, teachers are expected to know him/herself, to know the school where teaching, recognize learners, creating a classroom atmosphere that supports, ensuring a state of classrooms, preparation, routine teaching, the use of tools of audio-visual, and reduce workload [5]. The following will discuss a few things related to that aspect.

Know yourself, with regard to language skills possessed by a teacher; talent in the arts can be done; specialized knowledge in the form of mastery of science; general knowledge; teaching skills; and attitudes toward discipline.

Getting to know the schools where teaching, related to learn about and understand the philosophy of the school; know and understand the attitude of other teachers who may assist in the learning process; knowing that the breadth of responsibility that must be shouldered by the teacher; and pay attention to the general pattern of behavior of staff in the school.

Getting to know the students, related to: a) Name, calling students by name will be very beneficial for students or teachers because teachers can build relationships with students; no confusion; attract people's attention; accelerate the division of labor or a task; and students feel safe. b) Background. According to Underwood [5] there is one basic principle that both with regard to the background, is never asked the students about things that you do not wish to be asked. In addition, it is said also that classroom activities should not make you examine a person's background and do not force students to reveal something about themselves if they wish to express". c) Interest, do learning activities related to the student's interest or hobby impressed them so that learning is not boring for them. d) Prior learning experiences, to know the learning experience before they can be done by using a test before starting the learning. Tests were carried out not too long or too short, because the school kids quickly get bored with no activities are to their liking and they want a quick learner. e) Attitude towards learning, students' attitudes shown towards these subjects can be enthusiastic attitude mediocre or even maybe some people think too hard lesson learned.

Creating a classroom atmosphere that supports, gives meaning to the subjects that were done was not in vain; ensure the use of language that is good and true in everyday teaching and ensure the use of foreign languages in the classroom learning foreign languages; balancing fluency and accuracy in conveying the ideas of the student; use correct and polite language; give thrust to the
disciples at every opportunity, whether by using words or just a nod or a brief written comments or words that compare student work to his work in the past and give him a feeling of progress; includes all students in the learning process, especially verbal manner using list attend classes, use the row seat, asks students who have participated to appoint another friend who had not participated, encouraging students are given questions to respond and toss it to another friend, give explanations to students that any work being done with help them for exams and quizzes, and extra-curricular activities other than in the classroom to help the class atmosphere was good.

- Ensuring the state of classrooms, consists of light; air temperature and fresh air; acoustic; line of sight; layout of tables and chairs; possibility to move desks and chairs; other furniture; and means for placing images, charts and so forth [5].
- In preparation, including schemes of work or jobs forum on the work to be done and when to do it; lesson plan; timing; and emergencies.
- Teaching routines, relate to classroom behavior in general (start the lesson, raised his hand, what needs to be brought into the classroom, if necessary make notes, and how to say hello); start the lesson; patterns of interaction in change activities; explanation of the pair and group work; and ending the lesson.
- The use of audio-visual aids. Consists of several tools that can be used, namely blackboards / white; overhead projector (OHP); audio cassette / tape recorder; laboratory; Other audio system; slide projector; video recorder; others who can assist learning; and contact teaching resources that are made.
- Reducing the workload. Can be done with the cooperation; check the work of students in the classroom; pair and group work; limit activity; and prioritize work.

F. Manage Classroom Learning in Primary Science Education

Managing a class in learning the basic education provides its own job to a primary school teacher especially in science education to control the class in order to create an effective and efficient learning. Here are a few attempts according to H.M (2004) that can do also to prevent the problem of classroom management for primary and secondary school teachers in science education.

- Classroom Physical Condition
  - Class physical environment has an enormous influence on learning. There are a few things related to the physical environment of the classroom, including 1) the room where the process of learning, regulated so as not to jostle and does not interfere with other learners; 2) the seating arrangement, made for smooth learning process and allow for face-to-face; 3) ventilation and lighting settings, is done so that students acquire enough oxygen and can be read with adequate lighting; 4) management of storage of goods, carried out in order to facilitate the time of taking and laying back in a predetermined place. In addition, the required maintenance on these items that are not easily damaged and maintained.
  - Socio-Emotional Conditions
    - These conditions have a considerable influence in the learning process because it will excite the participants to learn. Some of the things associated with the condition are 1) the type of leadership, teacher leadership democratic attitude can help create a favorable climate for the creation of teaching and learning conditions are optimal and the students will learn to productive when there are teachers and no teacher; 2) attitudes of teachers, required teacher attitudes that are fair to all students and are able to create a boost in students to make amends; 3) the teacher's voice, is relatively low but it is quite clear with the volume full and relaxing sounds will encourage students to be more willing to ask questions, try it yourself, experimenting directed, and so forth. Sound pressure should be varied so as not to cause boredom in students; and 4) development of report cards.
  - Organizational conditions
    - This condition is carried out both in the classroom and at the school level. Things that are associated with this condition is that 1) the replacement of some of the lessons or lectures in different rooms; 2) teachers who are unable to attend may be replaced by other teachers and was reported by the head of the class; 3) the teacher can solve the problem between all the students that they could not finish; 4) a flag ceremony performed in rotation; 5) other activities that require the involvement of members of the school.
Another important aspect presented by Evertson & Emmer which translated by Rahman on planning regulations classrooms. In the basic education regulations designed minimum of four to eight regulations and includes important regulations. Furthermore, argued also that the regulations made can be discussed specifically with students; emphasizes the positive aspects than negative aspects so that students learn appropriate behaviors; and the teacher should explain these rules to be understood by students and if necessary to use a concrete example (Rahman, 2011).

Student participation in rule making is necessary and that they should discuss the reasons for setting rules and explaining the importance of the needs of special rules they make. Regulations that have been made can be discussed together with the teacher. Teachers can ask them to put forward specific behaviors that should be performed by each student in learning. At low grade rulemaking may last for several days and show examples of concrete indispensable.

Not only can the rules that have to be made along with the students but also the teachers plan the procedure classrooms. This procedure will continue to change with the passing of the school year. The procedure not only written but also taught and practiced by teachers and students. Some of the procedures that can be taught to students (Rahman, 2011), among others:

- The procedure for use of the room, which includes desk teachers and storage area, desk, students and territories other storage, storage for common material, drinking water taps, sinks, pencil sharpeners, toilet, centers and territories equipment, and computer stations.
- Procedures for Individual Employment and Teacher Led Activity, which includes students’ attention during the presentation, the participation of students, talking to fellow students, get help, and when the individual work has been completed.
- Transition in School, which includes starting the day in school, left the room, returned to the room, and end the day.
- The procedure for Learning Small Group, which includes preparing the class for the activity, the movement of students into and out of the group, the expected behavior of the students in the group, the expected behavior of the students outside the small group, use of materials and supplies, and group cooperative activities.
- General Procedure, which include distributing material, interruptions or delays, public toilets, library, resource room, school office, canteen, playground, fire management training and natural disasters, as well as classroom aides.

G. Implementation of Classroom Management in Learning Science Education

By mastering pedagogical, student teachers are expected to understand and implement learning activities in accordance with applicable regulations and in accordance with the needs of students. So that students can receive lessons with better and more enjoyable. Learning in the classroom will not be successful without good classroom management and in accordance with the objectives to be achieved.

Classroom management is a matter that is closely related to the learning process in the classroom. When a teacher do with good classroom management, there will be interaction with students more effectively which will lead to the achievement of educational goals. Thus, classroom management is the ability to be controlled and owned by the teacher in science education. By having this capability, a skill will be seen, not only in the mastery of science but also how the science delivery and enables students to learn to classroom conditions more comfortable as well as take advantage of all the facilities of the school.

The following will present some ways that can be used in managing the classroom so that the material being delivered more effectively and efficiently. These ways are formulated based on several previous discussion and the results obtained in Primary School and also can be useful in Science Education.

- The introduction of school conducted by the Chairman of the Foundation or the school responsible for the elementary school. At the time this is done a can make the vision and mission of its vision, mission and philosophy of the schools that basis. The introduction to the vision, mission and philosophy of the school can be done before the new school year begins.
- After that, teachers can conduct spot checks on the classroom to teach. The checks carried out to ensure that the facility is in a class and set it in accordance with the vastness of space and the freedom of space for students as well as the views of students to teachers when delivery of the
subject matter. In addition to checking the room made for some of these, teachers can put pictures or decorating the room corresponding to the subject matter or theme school year.

- Submission procedures of the school and classroom procedures that have been assigned by the teacher or school staff on the first day to the third day of the start of school. In addition to transmitting it, teachers along with the students simulate the procedures so that students can remember. The procedures in managing the class as noted previously set by teachers and then sent repeatedly to the student when violated by them. Procedures are delivered to students in the form of classroom procedures and the procedures to be followed by the school students. In other words, all students follow school procedures and several students simultaneously adhere to the procedure class.

- Determination of the class rules made by teachers and students of a certain class of elementary school on the first day to the third day early to go to school or for a week at the beginning of the learning process of the school year. In discussing the rules with students, it helps if the rules agreed to by all students so that each student in their application will remind each friend who violate, even warned teachers against violations committed by his friend.

- Any procedures and rules that have been created by teachers, school staff, and students must be followed or obeyed by all public schools. Procedures and regulations that have been made must be done by each student, both in the classroom and outside the classroom. Teachers must hold fast to every word in order to become a trustworthy by students. In fact, students will follow any advice given to him by the teacher who truly can be considered as the reflection of life in the future. Thus, being a teacher is not only convey knowledge but also teaches good life characters protégé, either in school or in the classroom and in the community.

- After the initial stages of classroom management is done, then the teacher can make the learning process in accordance with what has been planned. In each lesson the teacher must always abide by and consistent with any rules and procedures established.

III. METHODOLOGY

The method used in this paper is a literature review method. By giving some explanation of the books resources and support for being written and the ideas that support the theories of some books that source. In this paper discussed about classroom management in the capture of several books source is then associated with a management class on learning in science education both in elementary school and secondary school.

Instruments used in this research is the observation and analysis of documents. Observations made in the books for a source that has a relationship with the title of the research to be conducted. The results of the observation of these books are then used as the data source to conduct research on the management of classes in science education.

Document analysis conducted on the Law governing the learning. Thus, in analyzing the data was based on more than 10 books as the reference source in this writing. The timing of this writing since May 10 until September 15, 2016. The writing is done in Bandung based on several source books that formed the basis of this writing.

IV. CONCLUSION

Managing the classroom is something that is very important for teachers in Science Education because it requires special skills tailored to the development of learners, materials and classroom conditions. Classroom management is needed to create a condition or situation that is comfortable for teachers, especially students to learn. Some things to note for Basic Education teachers manage the class, namely a) the introduction of school; b) know yourself; c) the introduction of the students; d) ascertain the circumstances of the class and the condition of the room; e) show responsiveness to the students; f) preparation related to learning to be done in the classroom and outside the classroom; g) establishment and submission procedures; h) the transition period that is usually delivered in conjunction with the submission procedures and regulations; i) organizational conditions; j) the socio-emotional; and k) reduces the workload.

V. SUGGESTION
Some suggestions can be given to any teachers who perform their duties in Science Education, both in Elementary and Secondary School with regard to pedagogic competence in managing classes, namely
1) Start doing management by implementing rules mutually agreed upon by each student in the class.
2) Have the soul of a teacher to help students under any circumstances. Thus, when the teachers and students of class rules also specify that all students will follow.
3) Be a teacher who obeyed any rules and have consistency in every word and deed.
4) Have the attitude as a teacher with authority and style of a teacher as well as doing his job as a calling because being a teacher is a task very start.

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REFERENCES
Development of Technological Pedagogical Content Knowledge based Lesson Inquiry to Improve Student Teacher Scientific Reasoning

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Abstract - This study aims to determine: 1) Student teachers characteristic of Technological Pedagogical Content Knowledge, 2) Student teachers characteristics of Inquiry Lesson to improve student teachers scientific reasoning; 3) The effectiveness Inquiry Lesson to improve student teachers scientific reasoning; 4) The increasing of Technological Pedagogical Content Knowledge Based Teacher Inquiry Lesson to improving student teachers scientific reasoning. The Method used mixed methods with a good performance by using quantitative and qualitative analysis. Instruments used include: questionnaires, observation, interviews and tests. Experiments in the learning implementation using four classes which consists of 30 students. Data analysis and processing techniques used descriptive analysis, engineering and testing the percentage of independent variable sample t-test. The results showed: 1) The characteristics or traits ability Technological Pedagogical Content Knowledge Lesson Inquiry-based prospective teachers; 2) The characteristics of Inquiry Lesson developed based on the syntax Inquiry Lesson; 3) the effectiveness of Inquiry Lesson in Science Education, according to experts qualified as "very good", education professionals qualified "very good", while according to the students qualified "good"; 4) Increased ability Prospective Technological Pedagogical Content Knowledge Based Teacher Inquiry Lesson to improve student teachers scientific reasoning with an average percentage score of 63.68%, 73% of lesson inquiry aspects, aspects of critical thinking skills with an average score of 60, 42%, reasoning aspects medium category 69.2%, mastery of concepts students with grades A-B as much as 54%. Originality of this research is the ability TPCK as a solution that would impact on science learning in the 21st Century skills.

Keywords: Technological Pedagogical Content Knowledge, Lesson Inquiry, Scientific Reasoning, Science Education, 21st Century.

I. INTRODUCTION

Quality education can be seen from the graduation produced by an educational institution. The quality of graduates is influenced by factors that educational process of teaching and learning activities in the classroom with the mastery of technology and the delivery of a material by lecturers or in English is called Technological Pedagogical Content Knowledge [1]. Quality education is a process that must be done by each institution with the process of improving human resources as part of education. Qualified human resources to be able to follow the development of science and technology [2]. In line with the development of education is rapidly increasing, then the public demand for more educational institutions can make improvements, innovation, and creativity in teaching and learning strategies in facing the challenges of the development of science and technology today [3].

Problems were encountered in the world of education in Indonesia is still low quality of education compared to other countries in the Southeast Asia region. The low quality with regard to how to achieve learning materials effectively and efficiently so that students are expected to master the concepts learned and concepts mastery and can apply these concepts in addressing the problems that occur in the environment [4].
Teachers should be able to provide the stimulus/stimuli that can make learning more meaningful and memorable for learners. Students need to understand what it means to learn, what are the benefits and how to achieve it, so that they will realize that what they are learning at this point would be useful for future life. Teachers should be able to develop and implement a model or approach that can overcome these problems, especially in learning Science Education or Science Education.

IPA/Science is essentially built on the basis of scientific process, scientific products, and mastery of concepts [5]. IPA/Science is also an activity as an aspect of the procedure. IPA/Science is defined as the process activities, then all scientific activities to enhance knowledge about nature and to discover new knowledge. IPA/Science said to be a product, is as a result of the process in the form of knowledge. IPA/Science said to be a product, is a method used to determine something [3]. IPA/Science is closely related to how to find out information about a systematic and contextual nature. It can be stated that the IPA is not just the acquisition of knowledge in the form of facts, concepts, or principles, but also a process of discovery [6].

Learning activities which initially centered on the teacher (teacher centered) and passive students to make students more active in the learning process. Efforts to make students active, learning science should be taught by means of inquiry or practicum in accordance with those contained in the National Education Standards. Research on themes such inquiry conducted [7], the application discovery learning influence on the attitude of students in guided inquiry learning, such as a high curiosity and liveliness of the students ask when learning activities take place. Students should first be familiar with using the learning level inquiry discovery approach larning, interactive demonstration, inquiry lesson, laboratory inquiry, hypothetico Inquiry [8].

The approach at the level of this inquiry, the teacher started to show the scientific process explicitly to students with emphasis on explanations that can help students do the experiment, identify, control variables, and others. At this level, students are focused on the following scientific experiments, but they are the direct guidance of a teacher [8]. Definition Inquiry is a learning lesson introduces a topic by way of demonstration or show a phenomenon to be observed student, then ask questions to the teacher or receive questions from other students. Teachers provide direction to guide the selection of appropriate scientific questions with discussion topics to be tested. Syntax learning activities using the Inquiry Lesson explained as follows: 1) Emphasis on scientific experiment more complex, 2) Master sets out guidelines, lead and ask, 3) Problems of the material provided is not directly given to the activities of inquiry lesson, but the students themselves who must find the problem [8].Based on data from the Programme for International Student Assessment/PISA [9] showed that 61.6% of Indonesian students have very limited knowledge of science, while being able to do simple research as many as 27.5%. Students are able to identify scientific issues only 9.5%, whereas that is able to take advantage of me-science in everyday life is only 1.4%. In 2012, in the field of IPA / Science ranking to 64 from 65 countries [9].

II. METHODS

The method used in this study is a mixed methods [10] with a good performance by using quantitative and qualitative analysis. Shape design of this research is the study of design in the form of embedded designs. In the design of embedded quantitative data will be inserted (embedding) for the purposes of development of the treatment, to examine the process of intervention or to follow up the results of learning that has been done. Instruments used include: questionnaires, observation, interviews and tests. Subjects selected students in-service education program of Biology, Muhammadiyah University of Bengkulu academic year 2014/2015. Experimental class learning activities using the four classes, each class consists of 30 students. Four classes are given the same treatment, namely the lesson inquiry approach. Data analysis and processing techniques were used during the study was descriptive analysis, engineering and testing the percentage of independent variable sample t-test. Implementation of the research procedure by doing things that are in need in the conduct of research, such as preparing format Lesson Inquiry and, schedule of activities, create learning units and lesson plan, and develop instruments in the form of observational learning, pretest and posttest. Collecting data through interviews, observation and documentation and test result data. Selection of the class is made upon consideration of the number of students, characteristics, and abilities of individual students are considered equivalent. This study design is presented in Figure 1.
The chosen approach is the successive approximation (sequential) is a two-phase approach, the approach to data collection and analysis is done before, during and after the intervention. This sequential approach to data analysis is done before, during and after the intervention.

This study begins by determining population and select a sample of the population. Samples will be taken four classes, three classes as an experimental class and the class as a control group. The experimental class based lectures less on inquiry applied while the control class applied learning which is equivalent to the experimental class.

Variables examined in this study were: 1) the independent variable is a variable that affects or is the cause changes or the emergence of the dependent variable. The independent variables in this study are lectures TPCK based Inquiry Lesson; 2) Variable Bound (Dependent Variable) is the variable that is affected by the independent variable. The dependent variable is also called the outcome variable and the variables used in statistical calculations. The dependent variable in this research is the scientific reasoning skills; 3) Variable Control (Control Variable) is the independent variable other than the main independent variables that effect but the effect is controlled by the researcher. The control variable is the teaching, testing, and implementation time lectures.

To determine the ability of Technological Pedagogical Content Knowledge based lesson inquiry then performed engineering and data processing as follows:

a. Validity analysis

The test instrument validity was tested using product moment correlation technique proposed by Pearson (Pearson Product Moment).

b. Reliability Analysis Test

Instrument reliability value obtained from the calculation using the degree of reliability of the instrument [11].
c. Two different test Average

Two different test averages in this study was performed using two independent samples test by SPSS 20 with a significance level $\alpha = 0.05$. Two independent samples t test was used to compare the mean difference between the two (mean) of two independent samples assuming normally distributed data.

d. Determination Enhancement (N-Gain)

Determining how much the increased competence of students as a result of the provision of treatment were analyzed by determining the normalized Gain as used [12].

e. Descriptive analysis

Student perceptions questionnaire using a Likert scale of four rating scale, the range of the interval is the sum of the ideal score (criterion) for all items minus the sum of the minimum score and the result is divided interval answer (class).

f. Qualitative Data Collection

III. RESULTS AND DISCUSSION

Scientific Reasoning skills tests performed using the Lawson Classroom Test of Scientific Reasoning consists of 12 questions. Students got a range of values of 0-4 are grouped at the operational level concrete or located on the logic low level grades 5-8 are grouped in transition or are in the reasoning being, and grades 9-12 are grouped at the level of formal operations that fall within the high-level reasoning. The reasoning is based on the results level, students are grouped by level of reasoning can be seen in Figure 2.

![Scientific Reasoning Test Data Results](image1)

**FIGURE 2. SCIENTIFIC REASONING TEST DATA RESULTS**

![Scientific Reasoning Skills Test Data Results](image2)

![Classification Scientific Reasoning](image3)
The graph above shows the percentage of students in each category of thinking low, medium and high. It was widely perceived that the classification of low reasoning has the highest percentage of students, which was 69.2%, while the lowest percentage of students are in the category of reasoning being that is 11.8%. Category reasoning has a high percentage of students 17.4%.

Reasoning skill student looks still very low, because in the learning process, especially in a group discussion is still much to work individually. This is in accordance with the opinion of Kuhn [13], that reasoning skills gained from the process of thinking of individual and collaborative cognition reasoning through a problem-based learning model. Additionally Based on the analysis of journal articles that have been done, reasoning ability can be improved through the application of some models of learning as inquiry [14-16], Problem based Learning [17-18], based on ICT [19], playing and group discussions [20].

In the context of other studies, in addition to application of learning models to increase the ability of reasoning, it can also be a correlation reasoning towards mastery of concepts [21-22], achievement [23-34], logical [25-28].

Mastery of the concept of achievement were analyzed using analysis document students' scores in the academic year 2014/2015. The data is categorized based on the percentage of students who receive grades of A, B, and C, as shown in Figure 4.

Application of learning strategy in science education can improve the mastery of the concept of student teachers, but the increase is not satisfactory. This is evident from the value of the percentage of students who earn a grade of C has the highest percentage that is equal to 46 %. Whereas that got an A percentage of 24%, and the rest got a B with a percentage of 30 %.

In material science education that many abstract [29] is certainly the increase is not very significant. Mastery of concept of a course material comprehension ability of learners to analyze the meaning of the material. This is in accordance with less statement, mastery is the understanding or the ability to use or know, another opinion stated that the acquisition is the process of developing all kinds of knowledge and technology [30].

Lectures are conducted only emphasis on critical thinking skills, it does not look that activity courses that do lead to the characteristics of creative thinking skills. The method used by the lecturer is lecture and question and answer session with assisted power point and in focus. Students who are active critical in the lecture only one student. Analysis of critical and creative thinking skills were also confirmed using a test critical thinking skills and creative thinking skills tests which can be seen in Table 2.

Analysis of critical thinking skills score shows that the average score of critical thinking skills (60.42 %). This reinforces previous findings that learning requires critical thinking skills are very difficult.
student teachers do. These problems may be experienced also at several other universities in Indonesia even in the world, this is caused by the tendency of students do not think critically but students just think simply in other words just memorize. These facts are found from the analysis of journals related to critical thinking skills of the students are still very low [31-35].
TABLE 2. ANALYSIS % SCORE CRITICAL THINKING SKILLS

<table>
<thead>
<tr>
<th>Indicator</th>
<th>% Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consider the credibility of the source</td>
<td>64,0</td>
</tr>
<tr>
<td>Make and take into consideration the value of the decision</td>
<td>61,0</td>
</tr>
<tr>
<td>Make induction and consider induction</td>
<td>52,0</td>
</tr>
<tr>
<td>Ask and answer questions about an explanation or challenge</td>
<td>60,0</td>
</tr>
<tr>
<td>Observe and consider the results of observation</td>
<td>63,0</td>
</tr>
<tr>
<td>Identifying assumptions</td>
<td>61,0</td>
</tr>
<tr>
<td>Decide on an action</td>
<td>62,0</td>
</tr>
<tr>
<td>Scores Average</td>
<td>60,42</td>
</tr>
</tbody>
</table>

Based on the activities carried out at the stage of inquiry lesson can training 21st century skills. Skills trained include reasoning skills, mastery of concepts, inquiry and thinking skills. In accordance with some of the results of research conducted [36-37] show that some skills can be improved through the application of some models such as inquiry learning, PBL, based on ICT, playing and group discussions. Active student learning through inquiry solve problems with the steps of the scientific method. In contrast to conventional learning, some student less than optimal skills improved.

TABLE 3. DATA EFFECTIVENESS OF STUDENT ATTITUDES ABOUT LESSON INQUIRY

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicator</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Student interest in learning Lesson Inquiry</td>
<td>72%</td>
</tr>
<tr>
<td>2</td>
<td>The response of students to learning Lesson Inquiry</td>
<td>74%</td>
</tr>
<tr>
<td>3</td>
<td>Motivation of students towards learning Lesson Inquiry</td>
<td>71%</td>
</tr>
<tr>
<td>4</td>
<td>Activities of students in the group</td>
<td>76%</td>
</tr>
<tr>
<td>Avg</td>
<td></td>
<td>73%</td>
</tr>
</tbody>
</table>

The data in Table 2 shows that 72% of students are interested in the delivery of a material with a new approach, 74% of students responded well to learning with a new approach. At the motivation looks figures 71% of students stated motivated towards learning and good by 76% of students in group learning activities in the classroom.

Based on the data given to the students, the percentage of approvals obtained show that most students agree that activities in a new model of learning is, in contrast to the usual learning. With this perception is expected to have new experiences so that students naturally arise skills at age 21 complex.

Event delivery of learning materials or TPKC-based inquiry lesson used with the aim to realize all the skills that exist in the 21st century skills (21st Century Skills). Based on the results of the charging scale of attitudes about applied learning, students feel more appreciated with given the opportunity to contribute. Students argued, asking and responding to opinions of other students in group discussions and class discussions. Some theories relating to inquiry learning among which students can learn to analyze their strategic thinking, enrich students' way of thinking, to help students learn about the nature of the tentative emergence of knowledge and appreciate the variety of alternative explanations [38].

IV. CONCLUSION

Based on the research that has been conducted research concluded that in the learning of science education TPKC based Inquiry Lesson is well used in the delivery of learning materials aided by technology (Technological Pedagogical Content Knowledge/TPCK), it of the percentage of the average score of 73%. 21st century learning a very complex views of Inquiry Lesson score 73%, 60.42% of critical thinking skills, reasoning skills category "medium" 69.2%, mastery of the concept of the value of AB 54%, 21st century skills to be possessed by learners which can be realized with innovative instructional strategies and creative. TPKC based Inquiry Lesson should be simulated or tested in advance. The test is done in an effort to anticipate non-performance due to lack of time learning step. Through testing, it can be seen allocation of time required in each stage of learning and weaknesses found in the scenario that has been compiled. Thus it can be done prior to improvement efforts implemented in the actual research.
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LEARNING PHYSICS WITH ANALOGY: USING ANALOGY TO DEVELOP STUDENTS’ CREATIVE THINKING SKILL

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Abstract—Creative thinking is a valuable skill that is needed to be successful in work and life. Teaching students to be creative problem solver has long been a goal of science education reformer. But the methods for introducing creative thinking in solving the scientific problems has not known or used widely. Analogy is recognized as a key mechanism of creativity. Learning by analogy gives students to generate creative ideas, make unusual comparisons, and see the complex relationship. Analogy is a thinking tool that can help build brain tendency to draw connections and comparisons when students learn new material, deepen insight, and apply creative thinking in their daily lives. Analogy is not only stimulate the imagination, but also lead students to understand more deeply by connecting things that are not related. Analogy methods allowed people to break out of the limitations of thinking. The couple two or more categories can generate new creativities or ideas for solution through analogy. Analogy can help students to understand events or items that are unknown via known ones and acts as a bridge between image and logic model. Analogy generally used by students, teachers, and textbooks to make connection between events or items that are known and unknown, especially abstract concepts or ideas. This paper will discuss about the Theory of analogy, analogy in teaching physics concept, and the relation between analogy and creative thinking.

Keywords: analogy, creative thinking, physics

I. INTRODUCTION

Using analogy reasoning is one of the most important sources in developing theories of physics [32]. Important role of analogies can be seen from history of the development of physics: Rutherford’s planetary model of atom, Coulomb’s law similarity with Newton’s law of gravity, carnot’s heat engine is compared with waterfall, Thomson’s analogy between heat and electricity, Maxwell’s application of fluid theory to electromagnetism, and hamilton’s optical-mechanical analogy, and many others [32]. Analogy is not only used to generate physics theories, but it can also used to communicate ideas to others, for example, physicists use analogies to communicate ideas to other scientists and to public [40][45]. Analogies are not only used by physicists, but also by physics teachers and students [40] [45], as well as text books [42]. physics teacher use analogies to explain concepts especially abstract concepts to students [31]. For instance, teachers frequently use wave and particle analogies to explain the behavior of light, which is clearly neither a particle nor a wave. Teachers generally use expressions which are ways of saying to students “let me give you an analogy” as introduction their explanation, such as “it’s just like”, “just as”, “similarly”, and “likewise” [25].

Analogy has been recognized as a key mechanism of creativity [38] [43]. Creativity is a complex mental activity and is essential to human life [10]. Creativity has been associated with other important skills and behaviors such as imagination, problem solving, intelligence, originality, innovation, discoveeey, and adaptation [2]. So, it can be said that creativity is a valuable ability that is needed to be successful in work and life [39] and developing creativity thinking skill is a key to educational succes [4]. Creativity is essential ability to the achievement of a person, organization, or country these days [10]. It is not just related to an invention, but also covers all thoughts and acts. It is a tool for students to process information beyond information given, to deal with new problems and situations systematically, to adopt a critical attitude to information and arguments as well as to communicate ideas effectively [36].
Teaching students to be creative problem solver has long been a goal of science education reformer [11]. But the methods for introducing creative thinking in solving the scientific problems have not known or used widely. To have the ability to think creatively, one must truly understand the basic methods of creative thinking. Creative learning strategies can help students to generate new ideas. With proper techniques in developing creative ideas, students will always thinking about how to develop their creative thinking. Learning physics with analogy is one way to develop their creative thinking skill. Analogy method is a tool that provides assistance to students in solving problems in terms of creativity [42]. Analogy method allowed people to break out of the limitations of thinking. The couple two or more categories can generate new creativities or ideas for solution through analogy. Analogy is considered as an important mechanism of scientific thinking and as a source of creative insight in theory development [20]. Using analogy in physics learning can reinforce students understanding of physics concepts and analogy is an important tool to assist students in their cognitive development and creative thinking by relating the known to the unknown [2] as well as it acts as the bridge between image and logic model [42].

Field of physics based on researchs, experiments, hypothesizes, and thinking from new perspectives, be a proper grounding for creativity development [34]. Physics is a creative subject [4]. It provides many opportunities to stimulate students creative thinking. Education system around the world, especially Asian countries, describes the development of creativity is one of its main goals [34]. The development of creativity is required to prepare graduates for a rapidly changing world. To develop students creative thinking, they should be encouraged to participate in creative activities that allow them to learn and think. Analogical technique is possible to encourage them to be more creative [42]. This paper will discuss about theory of analogy, analogy in teaching physics concept, and the relation between analogy and creative thinking. The focus of this paper is one of the aspect of creativity, that is creative thinking process.

II. DISCUSSION

A. Theoretical Framework Analogy

Some have argued that analogy is a similarity [20] [22] [23] [44]. Analogy is the process of identifying the similarities between two concepts, the concept is familiar (analog) and the other concept which is unfamiliar (target) [44]. Analogy also be defined as a fundamental cognitive process that involves systematic mapping between source and target domain of knowledge [15] [8]. Domains are interpreted attributes and systems of objects as well as relationship between objects [27]. Analog and target have features (Attributes) [25]. If analog and target have similar feature, an analogy can be drawn from them [24]. Systematic comparison between features of analog and target visually or verbally called mapping [25]. Although word mapping is enough to draw an analogy, adding graphical mapping would be better because it activates the cognitive process which form mental images, thus helping students form better representations. Representation of analogy with its parts can be seen in Figure 1.

Analogy is decomposed into the following processes: (1) retrieval: given some new situations in the working memory, learner find analog that has similar features with situation which it can be retrieved from long-term memory; (2) mapping: given two situations, map them by aligning them structurally to obtain similarity and to project inferences from one analog to the other, and score evaluation that provides a numerical measures of how well analog aligned with target; (3) abstraction: the result of comparing the similarity of analog and target may be saved as abstraction; and (4) representation: given partial match, learner may adapt one or both analog to improve match [47] [23].

Gentner has proposed that analogy defined mapping form S to T (M: A→ T), T is called target (domain being explicated) and source or base (domain that serves a source of knowledge) [19][40]. Gentner calls this theory as a mapping structure that aims to use analogy in completing the mapping of one structure to another structure. Mapping has two-part process, the first is to find something in memory to be used as the analog domain, and the second is to determine the characteristic properties of selected domain analog to be mapped to the target domain [48]. Mapping structure assumes that once the correct source is found, the process of making analogy occurs in the mind separately [17]. The center of this concept is idea that prior knowledge is stored and organized into memory of learner who that serves as assimilative context for acquiring new knowledge. Mapping process begins by taking input of two representation (source and target) and then
computes the mapping [47]. Gentner has divided the mapping process into three stages (see Figure 2.) [18]. First step, all possible matches between the elements (features) of each of source and target are fund that produce many inconsistencies. Second step, these matches combined into several clusters (kernel) which are structurally consistent. Third step, some of the kernel are combined into an overall mapping, with the largest and most related kernel are processed again (merge). Each mapping consists of a set of correspondence, each mapping connects particular entities or statements in source with entities or statements in target. Mapping also contains inferences that predicate about the right one in one description based on projecting the structure from the other.

Analogue mapping is the pinnacle of human cognitive [47]. Analogue mapping generally combines the matching features of source and input the new features of target (carry-cover) [21]. To understand this, let us review the difference between pure matching and pure carry-over. In pure matching, learner already knows something about both domains. Analogy conveys that the features of target domain match the features of source domain, so that in this case the analogy more focused on matching system rather than conveys new knowledge. In pure carry-over, Learner initially knows little or nothing about source domain. Analogy determines object correspondences, and learner only conveys system features that are known from source to target. This is entirely new knowledge transmission. Given analogy is matching or mapping depends on learner knowledge. Analogue mapping is viewed as process which form the alignment of two represented situations structurally and then projecting the inferences [23]. During the process of alignment, a match that might be found between elements of each of two situations that represented. This match is then combined into consistent clusters structurally, and eventually into a mapping. As a result of alignment process, candidat inferences is projected from base to target. The alignment process is guided by a set of constraints that lead to structural consistency, that are: (1) there must be one-to-one correspondence between the mapped elements in source and target; and (2) there must be connectivity, thus the arguments of corresponding features also correspond [23].

Central of mapping process is principle of systematicity. Principle of systematicity assumes that comparison promotes systems of interrelated knowledge is crucial to feasibility analogy as a reasoning process. If the comparison process are to generate only isolated feature matches, there would be no natural basis for constraining in which inferences are derived from the match [23]. This principle guide the selection of alignments, thus the selection of the two possible alignments would be more systematic. This principle reflects a implicit choice for coherence and predictive power in analogue reasoning. So that the source domain that possesses a richly linked system of relations will generate candidate inferences by completing the corresponding structure in the target.

B. Analogy in Teaching Physics Concept

Science analogy can be an effective tool to help students understand the concepts, especially abstract concepts and concepts that are difficult to be experienced directly [41]. Ther are very good reasons to use analogies to explain abstract concepts of physics such as atom and electricity [30]. Students will show different interests and levels of prior knowledge and experience. Using analogy provides students the choice of epistemological and ontological. They can use the most reasonable analogy for them to understand difficult concept. Analogy is to believed to assist students learn by providing visualization of abstract concepts, by helping students compare the similarity of students’ real world with new concepts, and by increasing students motivation [45]. Concrete analogy becomes a tool to facilitate students understanding of abstract concepts by referring to the similarities between objects or events in the students’ rela world and the phenomenon under discussion. In this case, the analogy can motivate students because it uses students’ real world experiences that attract them to learn. Learn by analogy can help students understand new problems and phenomena by referreing to students’ experiences. From teaching perspective, analogy can be used as valuable a tool in conceptual change and to enhance students understanding, which open new perspectives [13] [44]. Teaching physics by using analogy will produce meaningful learning, because it utilizes students’ prior knowledge, thus learning becomes relational rather than rote [24]. Meaningful learning formed when students learn new concepts, they find and visualize the relations beteen newly taught context with what they already know [30].

Although analogy can improve learning physics, some researchers found some disadvantage of using analogy [1]. A significant risk of the use of analogy is that students misinterpret the analogy provided by teachers. Relate to this case, there are three things to note: (1) an analog is never base on the exact match between the target and analog. There are always features of analog that are different from those of the target.
These features may mislead; (2) analogical reasoning is only possible if students themselves who describe the analogy. If students have misconceptions in the analog domain, analogical reasoning will transfer them to the target domain, so it is important to ensure that the analogy are drawn by students; and (3) spontaneous use of analogy given by teachers or media learning rarely happens although analogical reasoning is quite common in everyday life. Analogical reasoning in learning situations requires great guidance, thus students do not misinterpret the analogy. Access to the analogy provided is facilitated by surface similarities and by deep structure aspects, but the only deep structure aspect has the inferential power [13]. Analogies can cause incorrect learning, depending on the relations of the analog-target [45]. For example, the development of systematic understanding will be impeded if the analogies are not familiar to the students. If students do not have visual representations, then analogical reasoning can not happen. The excessive use of analogy may cause disruption in the learning process, especially if the teachers do not have enough experiences using analogies in teaching and they have limited basis of knowledge about the analogy they use and the topic that will be teach [9].

It is recognized that many teachers do not have training about using analogy in teaching physics. Abimbola & Mustapha proposed some following guidelines for physics teacher for effective and optimal use of analogies [1].

- Identifying analogies that have attributes of texts or cultural resources in anticipation learning difficulties that may be owned by students. Teacher's ingenuity and creative thinking is required although the teacher have good knowledge of the subject matter and students' culture. A teacher must be able to think of appropriate analogies in spurring effective learning activities.
- The right cue in the analogy provides an opportunity for students to identify the shared attributes between analog and target as well as they can make inferences from analogy. To do this, the teacher should prepare many analogies more than necessary just in case if students fails to achieve the desired objective.
- Identify important attributes of the target for students so that they know clearly the connections between the analogy and the target. With this, they clearly know which attributes can be matched and which can not, thus they can find limitation of analogies by themselves. Students may also be asked to propose their own analogies to help teacher to be able determine whether students already understand what is meant by teacher.
- The teacher should show to students a situation in which some analogies may break down so as not to generalize the use of analogy. Therefore, teachers need to be systematic in using analogies and selective in choosing analogies so that students face no difficulty in learning physics.
- The analogy that used to teach must be related to the students’ experiences and it can be used to promote analogical reasoning, to be able to do this, the teacher must understand students’ prior knowledge and the ways of their thinking.
- Analogy would be more effective if directed at physics concepts which are difficult or unfamiliar. Teacher must change the students’ understanding of evaluation procedures of his teaching in order to find out the effectiveness of his analogies in communicating the right concepts and principles to the students.

If the physics teachers want to apply effective use of analogy in classroom, the analogy used must be relevant to the students as many as possible [44]. To achieve this case, a number of models or approaches teaching for reliable and valid use of analogies in the classroom have been produced. The models are The General Model of Analogy Teaching (GMAT) and The Teaching With Analogies (TWA).

1) The General Model of Analogy Teaching (GMAT)

GMAT has been developed by Zeitoun [46]. GMAT consists of the following nine stages: (1) measure some of the students' characteristics related to analogical learning in general; (2) assess the prior knowledge of the students about topic; (3) analyse the learning material of the topic; (4) judge the appropriateness the analogy to be used; (5) determine the characteristics of the analogy to be used; (6) select the strategy of teaching and the medium of presenting analogy; present the analogy to the students; (8) evaluate the outcomes of using analogy in teaching; and (9) revise the stage of the model. Zeitoun revealed some limitations of GMAT. These limitations are:
analogenes could have little or no positive facilitative effect when (a) the analog used is unfamiliar to the students; (b) the students possess enough background knowledge about topic; (c) students probably lack some abilities such as analogical reasoning, visual imagery or cognitive complexity; and (d) the number of analog attributes of the analogy is limited, while the number of irrelevant attributes is superfluous.

When the students take the analogy literally some misconceptions in the learning of the topic or analog might result.

Teaching with analogies will not help students acquire all the basic attributes of the topic.

2) The Teaching With Analogies (TWA) Model

The Teaching With Analogy Model has been developed on the basis of cognitive task analyses (lessons, textbooks, and websites), theoretical considerations concerning analogy use, and empirical studies on analogical reasoning [13] [25]. The TWA model contains the following six operations: (1) introduce target concept; (2) recall analog concept; (3) identify similar features of concepts; (4) map similar features; (5) draw a conclusion about concepts; and (6) indicate where analogy breaks down.

TWA model undoubtedly helps teacher when uses the analogy in teaching, but it only provides common structures. In step 2 to step 5, it should keep in mind that it is very important to ensure that students understand the analogy according to the way teachers think and make sure that students really know the similarities as teacher has in mind [13].

C. The Relation between Analogy and Creative Thinking

Creativity has many definitions, but its essential is to produce something new or original [3]. Mechanism that contribute to bring new ideas is analogy making [6]. This shows that the new ideas inspired from previous situations that belong or not to the same area than the current situation during manufacture [6]. Many teaching methods that can be used to stimulate creative thinking in practical terms such as the use of analogy, metaphor, visualization, and multiple association [7]. Analogy is viewed as very important psychological process involved in creative cognition [14]. Analog is an important tool for creative thinking because it provides ways of producing and communicating knowledge [5]. Teacher requires a set of varied analogies to stimulate students’ creative imagination [29].

Cognitive research has identified factors that contribute to creative reasoning such as convergent and divergent thinking [26] to produce new ideas. Guilford proposed that divergent thinking is a basic component of creativity. Divergent thinking is the ability to produce a large number of (fluency) of different (flexibility) ideas that are unusual (originality) and richly detailed (elaboration) [12]. Convergent thinking is thinking that produces one answer in solving problem or with a conventional solution [34]. Creative thinking processes involves searching through memory and selects ideas among a set of candidate ideas [17]. The analogy is a cognitive process that involves two domains (source and target). One may assume that the analogy does not require that one come up with something new as find a source in memory which has structurally similarities to the target. It is creative process to involve searching or selection [17].

Creativity is an activity of mind and activities are executed through memory, thus the importance of understanding creativity phenomena is clear. Therefore, creativity can not happen without participation of processes and structures memory. There are no any evidence that short-term-memory (STM) connected to the creative process or ability [37]. STM storage system not only retains the information for several minutes, but also manipulate symbols, identical to human information processing, so that it also called working memory. There is little empirical evidence on how STM affect creativity. Therefore, STM is the central processing unit of human mind which does not take part in the creative process. Thus, the importance of understanding creativity phenomena is clear.

Contrary to the STM, long-term-memory (LTM) can maintain the information for a long time. Three basic categories of memory process in determining efficiency of operations LTM are encoding, storage, and retrieval [37]. This stage determine the way in which LTM associated with creativity. Information may not be placed in LTM storage without encoded first. Only after the information is encoded, it can be stored in memory. Creativity is connected and affected by encoding in three ways. First, we can encode information in a peculiar way, different from what people do. The second way how activity of operations LTM affects creativity is
alternative encoding. Someone that encodes alternatively can utilize unusual encoding, for example, making unexpected associations. The third way of encoding in creativity is selectivity. It is very important to help cognitive representation of problem. Successful problem solver one to able memorize important elements of the problem and while ignoring the less important.

Storage is a place to keep information previously encoded for a long time. Three phenomena related to storage for investigating creativity: selective forgetting, familiarization, and spontaneous recovery. Selective forgetting is apt to account for phenomena of incubation. Incubation is a stage of unconscious idea production following preparation but preceding illumination and elaboration. Familiarization is term to account for the phenomena of incubation. It is assumed that problems worth creative endeavours are complex and difficult, requiring a lot of time and effort to be solved. During the long process of problem solving, almost all trials to seek for solution are unsuccessful, except the final ones that result in solution. Spontaneous recovery consists of the increase in the likelihood of recalling information if it is kept dormant for some period of time, compared to the likelihood of recall at the beginning of learning process. Selective forgetting, and familiarization, and spontaneous recovery are possible mechanisms of insight, according to the modern cognitive theories, is basically a memory phenomena.

Retrieval consists of recalling the information previously encoded and then kept it in LTM storage. The main problem of retrieval amounts to accessibility of information stored in LTM. Creative idea remains in the LTM store for a long time, waiting to be noticed and used. The difficulty lies in accessing such an idea, because it is not kept in memory in its ready made, easy to retrieve form. The act of creation consists of the use of effective retrieval strategies, through which the vital information may be accessed and used in problem solving. Therefore, the problem lies in making the already stored information accessible, thus it can take part in the creative process. The information retrieved with the use of entirely new codes, providing that a problem solver is able to recode the items constituting his knowledge. Analogical thinking is enhanced this way, since notions, memorized events, and other pieces of our knowledge can be retrieved on the basis of their similarity to other area of our experiences. It is a process particularly important for creativity if the analogies are remote and unusual, which means that the pieces of knowledge utilized for building analogy have to be retrieved with cues other than used during the acquisition of knowledge.

Creative thinking is thought continually using creative process in everyday thought, for example is the use of language [33]. Creative reasoning can be traced back through the common generative process: recalling structures from memory, the formation of associations among structures, mental synthesis of new structures, mental transformation of existing structures into new forms, and analogical transfer of information from one domain to another. Creative thinking should be based on the manipulation of existing experience a knowledge. Through experience and existing knowledge, a person will try to find variety of input ideas in multiple dimension and perspective to create new ideas and analogies [10]. Analogy gives students the opportunities to change their knowledge. Analogy aims to foster creative knowledge, in which students are given the new situation, then they have to find ideas from their experience or prior knowledge. Facility by recognizing, noticing, and making use of analogical thought is crucial parts of developing creativity [28]

Previous studies showed that the focus on structural similarities strengthen the conventional way in seeing the given or new situation, and the essence of creativity lies on breaking the conventional structures, and conceptualize the situation in a new way [43]. In this process, surface similarities can act as cues in connecting two objects that are not associated in a new way. Surface level or perceptual similarities may play more central role in creativity. Stojanov and Indurkhya found that similarities with respect texture, shape, color, etc. facilitated creation of conceptual features and conceptual similarities [43]. Fuento & Minervino argued that establishing interdomain analogies is an important role for creativity [16]. Markman et al. showed that certain problem that can not be solved by traditional way, people will try to use their prior knowledge to construct analogies, thus we can say that develop analogical thought can improve creativity [35].

III. CONCLUSION AND SUGGESTION

This paper reviews the literatur on the use analogy to enhance creative thinking of students. Based on the discussion, analogy is a process of identifying the similarities of source and target features. As we know that
the similarities play more central role in creativity. In terms of psychology, analogy and creativity involve memory process, particularly retrieval process. Analogy is one tool to stimulate students’ creative thinking. To create new ideas, it is necessary to use effective retrieval strategies. Retrieval is one of analogy processes. Constructing analogies requires the ability to think creatively, because creativity based on manipulation of experience or prior knowledge, so that it can create new ideas. One recommendation is to examine the relation between analogy and creative thinking empirically and systematically to better understand of scientific process. Further research is needed to examine more thoroughly the different kind model and strategy learning that may contribute to creativity in different domain and task.

REFERENCES


PRACTICALITY INTERPELASI LEARNING MODEL TO FACILITATE CHEMISTRY STUDENTS CONCEPTUAL CHANGE

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Abstract—This study is part of the learning model development called Interpelasi. Interpelasi learning model is a guided inquiry oriented learning model with multiple representations meant to facilitate students’ conceptual change and retention. The aim of this study was to obtain a quality learning model (eligible practicality). The research method is the Research and Development (R and D). Practicality learning model derived from observations 3 observer during the trial by using the learning device that was developed based learning model Interpelasi. Source of research data is a student of chemistry education State University of Gorontalo totaling 30 students. The results showed that the learning model Interpelasi has met the criteria of practicality with a very high category for all phases/syntax model. This indicates that the learning model developed can be implemented in learning.

Keywords: practicality, syntax, Interpelasi learning model

I. INTRODUCTION

The learning model is a pattern or form a conceptual framework that describes a systematic procedure for organizing a learning experience to achieve the learning objectives [2]. Furthermore [1] mentions four specific characteristics of a learning model that can be used to achieve the learning objectives, namely (a) rational theoretical logical compiled by the designer, (b) the rationale of what and how students learn (learning objectives to be achieved, (c) the behavior of teaching required so that the model can be implemented successfully, (d) the learning environment necessary for learning objectives that can be achieved.

Based on the understanding of learning model described above, which meant learning model in this study is a framework that is a portrait of a systematic procedure in organizing learning activities to achieve learning objectives and serve as a guide in planning and implementing learning activities. The main consideration in the preparation of the learning model based on learning objectives and learning theory selected. Learning objectives to be achieved is to facilitate conceptual change and retention chemistry student teachers. The theoretical basis that is used to develop the learning model is constructivist learning theories of Piaget and Vygotsky, information processing theory, dual code theory, and the theory of conceptual change.

Based on theoretical and empirical studies have been developed draft model of learning that includes learning the syntax of which consists of four phases: (1) orientation and identification, (2) exploration, (3) conceptualization and (4) application of concepts [11]. Syntax learning developed is the result of a development-oriented guided inquiry learning model with multiple representations. Therefore, learning model developed learning model called "Interpelasi" which is an acronym of "guided inquiry with multiple representations." Draft learning model developed subsequently tested for feasibility to ensure the quality of the model. Interpelasi learning model prototype quality criteria in the study of the criteria adopted [9] is validity, practicality, and effectivity. This paper will explain the practicality of Interpelasi learning model.
II. Method

This research is a development (Research and Development), which is a research oriented to the development of a product development process described accurately and the product obtained is evaluated. One of the products evaluated in this study is the practicality of Interpelasi learning model. The data collected is data about the implementation of Interpelasi learning model obtained through observations by the three observer as well as through learning software. The criteria to declare that the learning model developed is practically composed of five categories proposed by [12] is very high, high, medium, low, very low.

Techniques are being made to collect data on the implementation of Interpelasi learning model is to provide observation sheet to the three observers. The third person of the observers were asked to provide observations on the implementation of learning. In addition it also conducted verification of the cognitive activity of students through learning software.

III. Result

Practicality Interpelasi teaching model measured through an assessment of the enforceability of all lesson plan that contain elements of learning model that includes the syntax and the learning environment (activities of teachers and students). Implementation of learning with Interpelasi learning model conducted two meetings for any lesson plan. The first meeting was on the implementation of the syntax is the orientation and identification phase and exploration phase, then a second meeting conducted for the implementation of the syntax is the conceptualization phase and the application phase. The impact of its own instructional measured through tests to determine the conceptual understanding of conceptual change (shifting conceptions and misconceptions reduction), as well as understanding the concept of student retention. Observation of the implementation of the learning model by three observers who observe the course of learning. Percentage of implementation of the syntax for each learning lesson plans are developed based Interpelasi learning model listed in Figure 1.

![FIGURE 1. PERCENTAGE OF IMPLEMENTATION OF INTERPELASI LEARNING MODEL.](image)

Mark a line on the presentation of data as in Figure 1 is intended to facilitate the analysis study. Based on Figure 1 it can be given the following explanation:

a) Implementation of learning with the Interpelasi learning model on a limited trial has reached a very high category, because the percentage of implementation of the whole syntax is between (83.3 to 97.9)%. 

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b) Send the implementation of each phase in the Interpelasi learning model of learning I rise to the next lesson. This fact indicates that the tested model of learning that has been implemented properly and consistently to facilitate conceptual change and retention of students.

The results of further analysis of the physical and cognitive activity of students at every phase of the Interpelasi learning model verified through data on learning software as described below.

1. Implementation of Phase I (Orientation and Identification)

Implementation of the orientation and identification phase of learning software is recorded in a student's ability to write conception of the concepts learned. Of learning I - IV physical observation and recording of students in the cognitive learning software is presented in Figure 2.

![Figure 2. Percentage of Physical Observations and Cognitive Records of the Students Wrote Conception](image)

Based on Figure 2, the results of the analysis given that (a) physical observation of the activities of the students wrote on the conception of learning I and II have the same percentage and subsequently increased on learning III and IV. Improvements in this aspect verified through records cognitive learning software and the results are within the same category which is very high. (b) The activities of the students wrote conception based on physical observation and recording software cognitive learning of students in the learning I - IV meets the criteria the implementation of the model. This fact shows that the activities of the student write his conception in the orientation and identification phase can be performed well in learning.

2. Implementation of Phase II (Exploration)

Student activities during the exploration phase which is recorded in the learning software is to write the results of exploration concept which is done through text books, websites, and observations. Of learning I - IV physical observation and recording of student cognitive write exploration results presented in Figure 3.
Based on Figure 3 can be given that the results of the analysis of physical observation of the activities of the students wrote down the results of exploration concept through textbooks, websites, and observations have been carried out with very high category and has increased from 83.3% to 91.7%. This fact is reinforced by the data recording in the student cognitive learning software which shows the results of the same category. This indicates that the students have been able to utilize textbooks, websites, and observations in exploring the concept.

3. **Implementation of Phase III (Conceptualization)**

   Implementation of the conceptualization phase *Interpelasi* learning model recorded in learning software is the ability of students to write the results of conceptualization. Of learning I - IV physical observation and recording of student cognitive presented in Figure 4.

   Based on Figure 4 then given the results of the analysis as follows: (a) The activities of the students wrote the results of conceptualization assessed based on physical observations increased from the first to the next learning with performance of 83.3% to 91.7%. Once verified through the records of cognitive performance also showed the same category that are in very high category. This fact indicates that the student is able to conduct the conceptualization of the concepts learned.

4. **Implementation of Phase IV (Application)**

   Implementation of the application phase based on the observation of physical and cognitive recorded students apply concepts in learning software is presented in Figure 5.
Based on Figure 5 then given the results of the analysis as follows: (a) The results of physical examination of the activities of the students to apply the concept of stability began learning experience I - III with 91.7% performance increase to 100% at study IV. The high percentage of achievement in this aspect is also supported by the data recording in the student cognitive learning software. These facts indicate that the students have been able to apply the concepts learned; (b) In general, applying the concept of student activity based on observations of physical and cognitive recording of students in the learning software of learning I - IV has been accomplished with very high category. This fact suggests that applying the concept of student activity at the application phase can be performed well in learning.

IV. DISCUSSION

According [9] that the practicality of a learning model with regard to the statement of experts that the model can be developed and easily applied in the field. Proof of this is done through a process of trial and subsequent learning model implemented in the field. Based on the analysis of data on the implementation of the observation producing limited trial, which is seen from the implementation of the lesson plan developed based Interpelasi learning model shows that each phase of the syntax interpelasi learning model can be implemented in learning with a high level of execution. Implementation of this high indicates that elements interpelasi learning model that includes syntax, and the learning environment has been run in accordance with the principle of Interpelasi learning model. In the interpelasi learning model, learning is focused on the roles and relationships between teacher and students and students with other students as well as the principles relating to how faculty attention and treat students included in responding to questions, answers, comments or anything done by the students.

Implementation syntax and high learning environment also provides information that lecturers in implementing the interpelasi learning model has been able to create a conducive learning environment. The learning environment is characterized by democratic processes and active participation of students in learning to achieve mastery of concepts [3]. Conducive learning environment and democratic interpelasi learning model characterized by the interaction between students and student interaction - teachers. Interaction between students and student - teacher was created in an atmosphere of both group discussions and classroom discussion. It is appropriate view [3] which states that the atmosphere of the discussion in addition to supporting the growth of cognitive learning, the discussion could also create a positive social environment.

As described earlier, the syntax interpelasi learning model consists of four phases: (1) orientation and identification, (2) exploration, (3) conceptualization, and (4) application. The implementation of the fourth phase of this learning model described in this section. Implementation of the orientation and identification phase of the interpelasi learning model can be implemented with very high category. This happens because at
this phase the students are given the motivation by showing a phenomenon that attracted the attention of students to learn concepts. Their motivation of students is very helpful in directing the student to write his conception by answering the questions contained in the worksheet on individual learning software. According to [13] that is formed by the knowledge that children are learning so that learning should be more emphasis on the activity of the individual in the form of knowledge. Furthermore, [7] suggests that one can actively reorganizing the knowledge that has been stored in the cognitive structure through the process of assimilation and accommodation. This accommodation is likely to be instrumental in changing misconceptions. Reference [10] also argued that changing the misconceptions students can do with conceptual conflict through the provision of an anomaly or events that are contrary to the mind of students. According to [7] cognitive conflict is generated when the students are not satisfied with the existing conception. This approach generally involves early identification of students' knowledge and subsequently led to the conflict so that students can change the preconceptions held with scientific conception.

Based on the results of the assessment and verification result recording observer cognitive students in learning software shows that individual students can write his conception of the concepts being studied so that it can be concluded that the orientation and identification phase of the Interpelasi learning model can be done well.

Implementation of the exploration phase in the Interpelasi learning model can be accomplished with very high category. This occurs because the student Interpelasi learning model is facilitated with a variety of learning resources, namely textbooks, websites and producing direct observation through group learning activities to process information and reconstruct the concept. According to [16] that the information is processed very carefully through a variety of sources and be linked with existing knowledge, be part of long-term memory and enabled to return to working memory. Furthermore [4] states that the planned learning through group work can guarantee becomes effective learning activities. In addition Vigotsky [16] states that students working within the zone of proximal development while engaged in tasks that can’t be done alone, but can do it with the help of (scaffolding) adults or peers. Social interaction has spurred the formation of ideas. Further Paivio [14] stating that the information is presented visually and verbally remembered better than information presented only one way. By utilizing the visual system (illustrations or simple drawings) to process information verbally, one can reduce the loading effect that occurs in the working memory [17].

Based on the results of the assessment observer and verification result recording of cognitive students in learning software showed that students in the group can explore concepts to interconnect multiple representations of chemistry through a variety of sources, namely textbooks, websites, and other producers of direct observation so that it can be concluded that the implementation of the exploration phase in the Interpelasi learning model can be done well.

Implementation of the conceptualization phase of the Interpelasi learning model can be accomplished with very high category. This happens because students are actively trying to restructure the concepts learned through class discussion. According to Piaget [15] that with each listen to the opinions of his friend, a student can compare ideas and knowledge that has been put together with thought and knowledge of others. Individual students feel challenged and actively to further develop thinking and his own knowledge. Reference [7] also argued that the learner can actively reorganizing the knowledge that has been stored in the cognitive structure through the discovery process concepts. Furthermore [5] states that in order to achieve an understanding of a concept, learners need to actively restructure the information learned. Efforts to restructure the new knowledge, learners must integrate it with prior knowledge, identify and resolve the contradiction and make generalizations. Based on the results of the assessment and verification result recording observer cognitive students in learning software indicates that a student can make the conceptualization and change misconceptions held into scientific conception so that it can be concluded that the conceptualization phase in the Interpelasi learning model can be done well.

Implementation phase in the Interpelasi learning model application can be accomplished with very high category. This happens because in the learning activities of students has made the conceptualization of the concepts learned and is able to change the previously held misconceptions. According to [14] that students
truly understand and can apply their knowledge when given a problem, find everything for himself and trying desperately to ideas. If attention to the statement, the students should be given the opportunity to implement his own ideas. Furthermore [4] found that generalizations that have been raised into meaningful, then learners should be able to apply it to a problem in the new situation. Reference [16] also stated that short-term memory capacity in working memory lasts only a few seconds, unless performed by repeating (rehearse) the information or process it in any other way. Based on the results of the assessment and verification result recording observer cognitive students in learning software shows that students can apply the concepts learned so that it can be concluded that the application phase in the Interpelasi learning model can be done well.

Based on expert judgment on the Interpelasi learning model and appraisal observer and records of cognitive students in learning software for the entire phase Interpelasi learning model indicates that the syntax of the Interpelasi learning model may be carried out in the field so it can be concluded that the Interpelasi learning model is practical and has met the criteria for both a quality learning model as stated by [9] is practicality.

V. CONCLUSION

The Interpelasi learning model has been qualified practicality are the phases of Interpelasi learning model that has been operationalized in the lesson plan and worksheet can be implemented as a whole by the teacher. Percentage of implementation of each phase has experienced an increase began learning start to finish with high and very high categories. Implementation of learning is also supported by the record results in the student cognitive learning software with results not much different from a producer of observation by the observer.

REFERENCES

THE INTEGRATION OF MOBILE LEARNING AND LOCAL WISDOM TO ENHANCE STUDENTS’ PROBLEM SOLVING ABILITY

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Abstract—The purpose of this study is to use mobile learning with local wisdom content in order to enhance the problem solving. The used method in this research is literature review. Students sometimes misunderstand about the concept of physics that insist them to have problem solving competence. Physics is a part of life, because it is embed on the universe phenomenon and the environment while supporting today’s technology advancement. But sometimes, many student difficult to connecting physics material with daily phenomenon. One of ways to enrich the instruction is by showing local wisdom that is a form of real learning and also assisted by mobile learning technology development. Instructional media on mobile learning become a new alternative for enjoyable and interesting learning. Thus, it also insists educator practitioners for changing. Mobile learning can be used to encourage teaching and learning process. The hope benefits from this research is to give deep understanding for teachers in order to optimize the learners’ potential trough learning media which integrates mobile learning and local wisdom. The result of this research gives an overview that integrate mobile learning and local wisdom is one way of helping improve students’ problem solving ability.

Keywords: Mobile Learning, Local Wisdom, Problem Solving

I. INTRODUCTION

Physics is a part of life, because it is attached with the phenomenon of the universe and life environment and support the advancement of technology at this time. Most students tend to regard science as a boring lesson that demands they accumulate facts without engaging the imagination and creativity [1]. The participants looked at the subjects of physics affect the understanding and learning of the subject [2]. In studying physics, solving important problems in learning strategies that aim to increase students' knowledge of physics and align its structure by way of representation of experts [3].

Mistakes in understanding physics concepts that often occurs on the learner demand learners to have the ability to solve problems (problem-solving). Among the principal problem-solving ability is the ability to categorize, verbal skills, self-diagnosis, the ability to translate the diagram, the ability to translate graphs, mathematical skills or application symbol, vector describes the ability and the ability of a good analogy [4]. Some of the reasons why the concept of representation as well as the ability to construct, interpret and transform between different representations of a positive can be instrumental in learning physics [3].

One way to create rich learning representation is to expose the students with learning that is real or real everyday life both in terms of material or exposure problems or problems given [5] survey results show 17 students consider physics as difficult subject and 18 other consider that physics consist of too many formulas and memorizing [6]. This causes less enthusiastic students towards Physics lesson [7]. However, another fact mentioned that the difficulties experienced by students more because of the unwillingness of students to study physics [2].
In everyday life we can observe many local wisdom in society that can be used to enrich learning about multirepresentation. School-based education and should not overlook the importance of the knowledge of local wisdom [8] the draft curriculum with local wisdom and technology can build new knowledge [9].

One study conclude that teaching traditionally (lectures) is not effective in helping problem solving, therefore we need the latest innovations [10]. The atmosphere and learning environment that is conducive to the learning of science it is diverse contexts and learners will be more appropriate by optimizing local wisdom [11] and can raise the admiration of local cultures that exist in their environment[12].Integrating local wisdom in learning proved that traditional learning with modern learning can be combined. This is evidenced by the use of laboratory equipment as a replacement computer simulations in learning. Android is one of the m-learning system that has been used by many people, especially young children or children at school age.

To realize the wisdom of local-based learning, required the use of an appropriate medium for displaying such verbal representations, diagrams, images, graphics in the form of animation or simulation of a clear and interesting for the students can understand visually. There are currently a variety of learning media accessible for mobile, such as personal computing, communications, internet access and others can all be accessed via mobile devices. This led to the use of mobile devices is a common thing for students of junior and senior high school [13]; [14]; [15]. On the other hand teachers are still reluctant to use this technology in learning and some consider it interferes with learning students, while conversely, the teacher instead should use technology to create an effective learning environment, fun and challenging for students [13].

Android application development on the device needs to be done to improve the motivation of learning outcomes and learners. As well as from the results of one study that the use of the media can clarify the information submitted [16]. Android and Windows-based applications in physics learning easier for students to explore and develop their knowledge of physics concepts [17]. The Android operating system has several advantages over other operating systems, such as the distribution of applications more flexible and more inclusive, if students do not have an android device then they can either use the application through a computer with android emulator [14].

Development of instructional media on android device can become a new alternative in the learning. The use of media-based learning android is one application of the learning styles of the 21st century [18]. The smartphone, such as android device, can be used to support the learning process by taking into account the review of the device as a medium of instruction [19]. Almost all students have and bring android wherever they go. It can be used as a medium of learning through the application on android devices [20]. Android functions that were previously only as entertainment has now evolved into media that can help students in learning [21]. Therefore, it is important to use the media assisted learning android help explain complex concepts in physics.

II. METHODS

This research is a study of the literature of various scientific publications that contain the integration of mobile learning and local wisdom to enhance students problem solving ability. Such literature derived from national and international publications on integration of local wisdom to enhance students problem solving ability. Sections covered include the definition of local wisdom, mobile learning and problem solving skills.

III. RESULT AND DISCUSSIONS

A. Local Wisdom

Local wisdom as a derivative or the oldest indigenous heritage against the next generation, where the local wisdom are accumulated from social experience [22] [23]. Local wisdom in a foreign language is often understood as local policies (local wisdom), local knowledge (local knowledge) or local intelligence (local genius). In General, local wisdom is understood as area wise ideas, full of wisdom, good grades, and embedded followed by people [24].

Local wisdom which is often interpreted as local knowledge or local talent, was used as the point of view of life, knowledge and a variety of activities that are managed by the local community in responding to a wide range of issues related to their everyday life [25]. Another sense conveyed that local wisdom is a term
frequently used by scholars to represent value system and norm organized, held, understood, and applied by the local society based on their understanding and experience in interrelating and interacting with the environment [26].

Some of the characteristics of local wisdom as follows: (1) local wisdom must combine knowledge of virtue that teaches people about the ethical and moral values; (2) local wisdom must teach people to love nature, not to destroy it; and (3) local wisdom has to come from older members of the community [22]; [27]. There are 8 basic knowledge of local wisdom built namely (1) the knowledge of the cultural and religious beliefs, traditions, rituals and customs; (2) knowledge of history; (3) knowledge of the arts and local crafts; (4) knowledge of basic economics; (5) knowledge of traditional sports; (6) knowledge of the wisdom of the community related food processing; (7) the knowledge of local wisdom related health care; and (8) the knowledge of medicinal plants and traditional [28].

The potential of local wisdom can be used as the basis for learning science. The efforts of local wisdom manifest as capital in learning science is done through a variety of conditions and strategies. One study suggests that by studying and analyzing the culture of Indonesia, we will find many of the concepts of local wisdom which is still in force in the community and can be used to support learning [29]. According to that result, by studying and analyzing the overall aspects of the culture of Indonesia, we can find the concept of local wisdom that has been practiced in the everyday life of society Indonesia to maintain pluralism in Indonesia.

Local wisdom used as a basis for learning contextual learning device, especially for Indonesia as a country that compound and rich by local wisdom. In addition, by using local wisdom, students get the better knowledge about the richness of the Indonesian cultures. In Java, for example, there are a variety of local wisdom that can be used namely Kapal Othok-Othok, Jemparingan, Andong, Rebab, Siter and Kincir Air. On the local wisdom there are concepts of physics that can be reviewed later served as contextual learning. Concepts of physics local wisdom in Java is summarized in Table 1.

<table>
<thead>
<tr>
<th>No</th>
<th>Local Wisdom</th>
<th>Physics concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>KapalOthok-Othok</td>
<td>1. Newton Law’s</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Archimedes Law’s</td>
</tr>
<tr>
<td>2</td>
<td>Jemparingan</td>
<td>1. Parabolic motion vector analysis</td>
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<td></td>
<td></td>
<td>2. Pressure on solids</td>
</tr>
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<td></td>
<td></td>
<td>3. Elasticity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Energy in the spring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Impulse and momentum</td>
</tr>
<tr>
<td>3</td>
<td>Andong</td>
<td>1. The relationship of the wheels</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Torque</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. The moment of inertia</td>
</tr>
<tr>
<td>4</td>
<td>Rebab</td>
<td>1. Friction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Sound Wave</td>
</tr>
<tr>
<td>5</td>
<td>Siter</td>
<td>1. Sound Wave</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Harmonic vibration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Elasticity</td>
</tr>
<tr>
<td>6</td>
<td>Kincir Air</td>
<td>1. Circular motion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Relationship wheels</td>
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<tr>
<td></td>
<td></td>
<td>3. Dynamics Fluid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Mechanical energy</td>
</tr>
</tbody>
</table>

B. Media Assisted Learning Android

One type of m-learning learning used in smartphones. The use of smartphones is usually coupled with the use of android applications. The use of media-based learning android is one application of the learning style of the 21st century [18]. Smartphones, such as the android devices, can be used to support the learning process with attention to the review of the device as a media learning [19].

Smartphones with Android yet underutilized in the world of education. Interview conducted on some students showed smartphones that are owned not only functioned as a tool in learning. Owned smartphones
only used for things that are familiar with their everyday life [30]. Android functions only as entertainment is now developing into a medium of learning that can help students in learning [21].

C. Representation

The ability of solving problems (problem solving) is the main part in learning physics [4]. Problem solving refers to the effort required in achieving a goal or find solution when there is no automated solutions that are available [31]. Troubleshooting can be inferred is the work done through the cognitive process to achieve a goal or resolution of a problem when there is no other appropriate way with problems.

In the problem solving ability is divided into several groups. Include sub problem-solving abilities, namely: the ability of problem solving on the expert and novice, worked example, the representation of mathematics in physics and evaluating the effectiveness of strategies for learning by problem-solving methods. On the sub chapter problem solving capabilities of expert and novice discuss capture power difference or problem solving process from the expert and the novice. On the sub chapter work example discusses how students use the previous solutions to solve new problems. On mathematical physics sub chapter discussed the use of symbols in the equation to describe physical quantities, vector, arithmetic, algebra, geometry, calculus and the reason. On the sub chapter representation discussed viewpoints of students to illustrate information in solving problems. Commonly used representation of students:“free-body diagrams, field line diagrams, or bar graphs, concept maps, graphs and equations [4]. Each type of research is differentiated into a number of points. For example, in the representation. Some of that representation are argument, diagrammatic, mathematical/symbolic and graphical [32].

IV. CONCLUSION

Local wisdom can be interpreted as local knowledge or local talent, which is used as a point of view of life, knowledge and a wide range of activities. That knowledge run by local people in answering a wide range of issues related to their daily lives. The potential of local wisdom can be used as a basis in the learning of science particularly physics lessons. This was done so that the learning process becomes more meaningful and can improve the problem solving ability from learners. Enter Asian economic community (MEA) education should also be aligned with the development of technology. Therefore, mobile learning (android) sites related to local wisdom is helpful in the educational world.

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The Implementation Of Sets Approach To Increase High Order Thinking Skill (HOTS) In Learning Biology

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Abstract—High Order Thinking Skill (HOTS) became one of an ability that should be achieved by the Students. In training and achieving HOTS abilities, the Students are demanded to construct their own abilities. SETS is an approach that is used for building students’ mindset globally and acting locally or globally without separating four important element in achieving learning goals; that is elements of science, environmental, technology, and social. In SETS approach, the student can develop a skill in identifying potential problem in collecting the data, considering the solution, and consequence based on certain decision which is suitable with the ability of thinking and the logical of students. This appropriate with one of High Order Thinking Skills (HOTS) characteristic that is strong with its analysis. The SETS approach with HOTS have relevancy based on their own criteria and that are focused on some aspects; 1. Develop cognitive dimensions of the student in analyzing steps which is implemented in every activity not only in HOTS but also SETS approach. 2. Utilization of the element of technology in science elements that is closely its activities with potential environmental. 3. Growing the critical thinking abilities and problem solving in pragmatist activities that are appropriate with the problem that is face in students’ environment.

Key word : HOTS, SETS approach

I. INTRODUCTION

Science, Environment, Technology, and Society (SETS) has long term in Indonesian as Sains, Lingkungan, Teknologi and Masyarakat. SETS learning center is to connect between science concept to environment, technology and society. Learners are grown awareness about the correlation between elements of SETS and learners are demanded to apply the principles of science to produce a simple technology, followed by the development of High Order Thinking Skills (HOTS) against possible negative impacts of product technology on the environment and society.

HOTS are often described as higher thinking level skills in a variety of thinking skills of framework. In this case, the term of HOTs is usually contrasted with LOTS HOTs (lower order thinking skills). Cognitive process analysis (analysis), synthesis (synthesis), and evaluation (evaluation) in Bloom's taxonomy (Bloom, et. al., 1956, Q18) as HOTs, while knowledge (knowledge), understanding (comprehension) and application (application) as LOTS. This is supported by Senk, et al (1997) in explaining the characteristics of high order thinking skills as: "solving tasks where no algorithm has been taught, where justification or explanations are required, and where more than one solution may be possible." Which means that high order thinking skills is the ability to complete tasks in which no algorithm has been taught, which requires justification or explanation and may have more than one possible solution.

Some References state that "Higher order thinking involves breaking down complex material into parts, detecting relationships, combining new and familiar information creatively within limits set by the context, combining and using all previous levels in evaluating or making judgments". Thus, higher order thinking includes splitting the material into parts, detecting relationships, combining new information and existing creatively with the rules of limitation context, combining and use all the previous levels to evaluate or to make decisions. That is, high-order thinking skills come with the real three highest in Bloom's taxonomy. To understand this side, learners need to understand the material before combining it with further material, and resolve non-routine.
As stated by Krathwohl (2002), a revision of Bloom's Taxonomy: an overview - Theory Into Practice which states that the indicators to measure the ability of a high order thinking skills includes: (1) Analyzing • Analyze incoming information and divide or structuring the information into smaller sections to identify patterns or connections • Being able to recognize and differentiate the factors that cause of complicated scenario. • Identifying / formulating questions (2) Evaluating • Provide an assessment of solutions, ideas and methodologies using matching criteria or standards to ensure the effectiveness or value of it’s’ benefit. • Making a hypothesis, criticizing and testing • Accepting or rejecting a statement based on predefined criteria (3) to be creative • Make a generalization of an idea or the perspective of something • Designing a way to solve the problem • Organizing elements or parts into a new structure that has never existed previously.

Higher order thinking is complex thinking process that can be categories into: problem solving, decision making, creative thinking and critical thinking. Critical thinking can be used to analyze the arguments and bring insight to each of meanings and interpretations; developing a cohesive pattern and logical reasoning; understand the underlying assumptions and biases of each position; giving a presentation model that is reliable, quick and convincing (Ennis, 1991). This mind think emphasizes the aspect of comprehension, analysis (Schlect, 1989), and evaluation (Gerhard, 1971; Schlect, 1989; Ennis, 1991). High order thinking skills according to Bloom's Revised Taxonomy covers the skills to analyze, to evaluate, and to create (King, Goodson & Soul, 2009).

Learning biology has its own characteristics compared with other natural sciences. Learning biology means as the effort to know real life of the environment is attempting to identify as an individual and social beings. Therefore, by learning biology is expected to be useful to increase the quality and survival of humans and the environment. The meaning of IPA as the result of human activities in the form of knowledge, ideas and concepts are organized on the natural surroundings. Biology is a vehicle to improve knowledge, skills, attitudes, values, and responsibilities as a citizen who is responsible to the environment, society, nation and state that faith and fear of Allah SWT. Biology deals with how to find out about a nature systematically. So that learning biology is not only mastery of clusters of knowledge in the form of facts, concepts, or principles, but also a process of discovery. Learning biology is expected to become a vehicle for learners to learn about themselves and the environment, as well as prospects for further development in applying in our daily activities. the advantages of learning biology by using SETS approach include:

1. Learners’ experience and learning activities will always be relevant to the level of learners’ development.
2. Selecting activities based on learners’ wishes.
3. Learning activities will be more meaningful for learners and the results will be last longer.
4. SETS approach develops learners’ thinking skills.
5. Presenting pragmatic activities based on the problems often faced in the environment of the learners.
6. Developing learners’ social skills such as cooperation, tolerance, communication and respect for the ideas of others.

Those explanations are described generally, while the advantages in particular compared to other approaches, the SETS approach directs learners to associate the material with daily life and produce into a simple form technology and consider to the positive and negative impacts.

II. RESEARCH METHOD

The method used in this paper is the method of literature. The literature used include books, journals, and articles. The paper is expected to be used as a resource for other writers, especially for studies related to The Implementation Of Sets Approach To Increase High Order Thinking Skill (HOTS) In Learning Biology.

III. DISCUSSION

Approach of Environment Science Technology and Society (SETS) or Environmental Science Technology and Society is an integrated approach among science, technology, and issues in society. The aim of STM approach is to produce students who had of knowledge, therefore learners are able to make crucial decisions about the problems in society and take an action with the decision that has been taken.

SETS approach/Salingtemas was taken from the concept of education STM (Science, Technology, and Society), environmental education (Environmental Education/EE ), and STL (Science, Technology, Literacy). In approach of Salingtemas or SETS (Science, Environmental, Technology and Society) or STL STM education concepts and EE is viewed as a unit that cannot be separated.

Education practitioners express terms that are similar to the actual salingtemas have the same core, as the term Science, Environment, Technology, and Society (SETS); Science, Technology, and Society (STS) or can be interpreted into Science, Technology, Society (STM); and Science, Environment, Technology (SET).

Picture 1. Correlation among science, environment, technology and society

Summary of SETS carries the message that in order to use science (S - first ) into the form of technology (T) in fulfilling society needs. (S - Second) requires thinking about the implications on the environment (E) physically and mentally. Salingtemas approach basically expected that students are able to know every element salingtemas and understand the implications of the relationship among elements. Besides, Salingtemas will guide students to think globally/whole and act to solve environmental problems, both the local environment and environmental relationship with everything in the society and participate in solving international problems based on its capacity.

B. Sets Approach To Improve High Order Thinking Skill (HOTS)

In the SETS approach, learners are not only learn the concepts of science, but also introduced the aspect of technology, and the role of technology in society. Learning using SETS should be able to make learners who learn to understand the significance of each element in the SETS. Relationship between science, environment, technology, and society cannot be separated each others. It can be assessed the benefits and losses incurred. As stated by Yager, SETS learning has some characteristics:

1. Starting from the identification of local problems
2. Use of local resources
3. The participation of students active in finding information that can be applied to solve problems in daily life.
4. The emphasis on process skills that can be used learners in solving problem.
5. The opportunity for students to gain experience of solving problems that have been identified.

Based on those characteristics, the teacher should be able to guide students to think actively in efforts to solve local problem that comes from learners experience in daily activities. SETS application in learning biology by teachers should be variations, tailored to the level of proficiency to be achieved in learning. Each learner has an opportunity to solve different problems.
Operationally, National Science Teacher Association set the stage SETS science learning approach as follows:

1. **Invitation phase**
   - At this stage, teacher gives the issue / new problem which growing in the surrounding society that could be understood by learners and can stimulate learners to solve it. Teachers can also catch learners’ opinion while connected with the material to be covered.

2. **The exploratory phase**
   - Learners try to understand about a problem that is given by teachers actively by themselves.

3. **Solution phase**
   - Learners analyze and discuss how to solve the problem.

4. **The application stage**
   - Learners are given the opportunity to use a concept that has been obtained. In this case, the students held a real action to tackle problems arising in invitational stage.

5. **Stabilization concept phase**

6. **Teachers provide feedback / reinforcement of the concepts acquired learners.** Thus SETS approach can help learners know development of science, technology and its impact in environment and society.

SETS approach is expected to condition of the learners in order to apply the principles of science to generate ideas and their work to reduce or prevent the possibility of the negative impacts of the product on the communities and the environment. Sutarno (Isti, et al., 2013: 58) adds that SETS approach aims to make the students know how to solve problems that arise in the society. Learning by using SETS approach can make students understand the development of science and technology is expected to provide solutions that occur in the environment and society.

If learners are always accustomed to think positively and negatively among SETS elements, then learners will always try to analyze the condition and synthesize something new. SETS education essentially will guide learners to be able to think globally and act locally and globally in solving the problems faced in daily life. Solving is the ability to think critically, the ability of analysis-synthesis, and evaluation (Bloom in Yatim, 2009: 285).

**C. Benefits**

SETS approach can overcome the weaknesses of the system classical education where the learners are motivated to resolve the subject matter, without clearly known implementation of learners towards the absorption of the subject matter (Is the subject matter can be controlled in whole or in part, and the basic competencies of what has been achieved). So, SETS approach can anticipate some fundamental for learners, including:

1. **Avoiding 'oriented material' in education without knowing the problems in society locally, nationally, and internationally.**

2. **Have adequate provisions for learners to welcome globalization era (ASEAN Economic Community 2015)**

3. **Learners are able to address and resolve any issues related to the preservation of the earth, social issues, global issues, such as pollution problems, unemployment, social unrest, impact of technology and others to eventually boils down to save the earth.**

4. **Equip learners with the ability to solve problems by reasoning science, environment, and technology, social integration, both within and outside the classroom.**

SETS Approach covers topics or concepts related to science, technology, environment and things that expected to hit the public. The objects of education are studied in turn are expected to understand with good correlation with the four main elements SETS.

**IV. CONCLUSION**
SETS approach seeks to provide an understanding the role of the environment on science, technology, society. Including the role of technology in adaptation science, benefits to the community and impacts caused to the environment. SETS approach reinforces students to think about positive and negative among elements of SETS, and then students will always try to analyze condition and synthesize something new. SETS approach will ultimately guide students to be able to think globally and act locally and globally in solving problems faced everyday, which is one of high order thinking skill.

REFERENCE


DEVELOPMENT OF CONCEPTUAL ATTAINMENT
STUDENT WORKSHEET TO IMPROVE COGNITIVE
AND PSYCHOMOTOR IN PHYSICS INSTRUCTION

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Abstract—This research aims were to: (1) produce Conceptual Attainment student worksheet, (2) know student cognitive improvement and (3) know psychomotor accomplishment. This was a development research by using 4-D models (define, design, develop, and disseminate). The development product was tested in grade XI SMA Negeri 1 Magelang, 10 students for limited test and 20 students for field test. The research results: (1) produced student worksheet based on validator’s score in language structure and design PA 96.97%, appropriate learning with Conceptual Attainment method PA 95.24%, both aspects got good category. 80.9% student in limited test and 88.7% student in field test agreed to the worksheet, (2) Student cognitive improvement based on normalized gain (g) was 0.54 for limited test and 0.57 for field test, both aspects got medium category, and (3) psychomotor accomplishment got percentage 84.4% for limited test and 87.8% for field test.

Keywords: Student Worksheet, Conceptual Attainment, Cognitive, Psychomotor

I. INTRODUCTION

Mastering and developing technology in 21st Century always be a competition between countries. Therefore Indonesia has to prepare human resources who capable in it. Good quality education mainly in science (Physics) influences to the development of technology. But science literacy result of Indonesian students in 2012 got 64 rank from 65 countries, it was based on PISA (Program for International Student Assessment) [1]. The result proved that science literacy including Physics concept understanding is still weak among Indonesian students.

One of idea to improve Physics concept understanding is by improving cognitive and psychomotor ability. It because to get Physics concept understanding, students should not only memorize the concept and theory but also do real activity using experimental method. So this research would develop student worksheet to improve not only cognitive ability but also psychomotor in physics instruction. It was expected to improve Physics concept understanding.

This research used Torque and Equilibrium subjects in lesson process. Because there’re many application in daily life but rarely presented in experimental activity at schools. The subjects usually given by mathematical equation which made students had to memorize formula and apply for solving problems. Therefore, this research developed Conceptual Attainment student worksheet to improve cognitive and psychomotor.

II. RESEARCH METHOD

This was a development research using 4-D Models which developed by Thiagarajan and Semmel [2]. Developed product in this research was Conceptual Attainment student worksheet to improve cognitive and psychomotor in physics instruction.

This research was conducted at SMA Negeri 1 Magelang on January 2016. The research subjects were students of grade XI that involved 10 students for limited test and 20 students for field test.

4-D Models steps consisted of (1) define, (2) design, (3) develop, and (4) disseminate. Defineaim was to decide what be needed in learning. This consisted of five basic steps, first analysis, student analysis,
assignment analysis, concept analysis, and learning aim specification. First analysis was done by finding the basic problem of physics learning which needed a new innovative solution. Student analysis was conducted by analyze student characteristics which concluded thinking skill level, student activity in classroom, and response to the lesson that given by teacher. Assignment analysis was intended to determine learning contents. Concept analysis was done by identifying main concepts which be taught and learning aim specification by formulating the learning aims based on core competences, basic competences, and indicator. Design step consisted of arranging research instrument, choosing media, choosing format, and making first design of the student worksheet. Develop step was conducted to produce revision worksheet based on comments, suggestions, and scoring from lecturer, teacher, limited test, and field test. Disseminate step was done by sharing the development product to other teachers and other schools.

Research instruments comprised of learning instrument and collecting instrument. Learning instrument involved lesson plan and Conceptual Attainment student worksheet. Data collecting instrument consisted of learning process observation sheets, validation questionnaire, student response questionnaire, pretest posttest, and psychomotor observation sheets.

Learning media feasibility from lecturer and teacher scoring converted to five grade scales [3] as seen at Table1.

<table>
<thead>
<tr>
<th>Quantitative Score Range</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_i + 1.8sb_i &lt; X$</td>
<td>Best</td>
</tr>
<tr>
<td>$X_i + 0.6sb_i \leq X_i + 1.8sb_i$</td>
<td>Good</td>
</tr>
<tr>
<td>$X_i - 0.6sb_i \leq X_i + 0.6sb_i$</td>
<td>Medium</td>
</tr>
<tr>
<td>$X_i - 1.8sb_i \leq X_i - 0.6sb_i$</td>
<td>Less</td>
</tr>
<tr>
<td>$X \leq X_i - 1.8sb_i$</td>
<td>Least</td>
</tr>
</tbody>
</table>

Instrument reliability used Percentage of Agreement: $PA = \left(1 - \frac{A-B}{A+B}\right) \times 100\%$, $A$ is the highest score and $B$ is the lowest score. Good instrument happen when reliability coefficient more than or equal to 0.75 or 75% [4].

Cognitive improvement was analyzed using normalized gain method: $(g) = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}}$.

Then the result was converted into gain criteria [5] as seen at Table 2.

<table>
<thead>
<tr>
<th>Standard Gain Score</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.70 &lt; (g)</td>
<td>High</td>
</tr>
<tr>
<td>0.30 \leq (g) \leq 0.70</td>
<td>Medium</td>
</tr>
<tr>
<td>(g) \leq 0.30</td>
<td>Low</td>
</tr>
</tbody>
</table>

Psychomotor ability was known from psychomotor observation sheets. It had done by observer. Each group in limited or field test observed by two observers. The assessment results from each observer were calculated to find average score. Then psychomotor accomplishment in percent (%) was calculated to know the result of each aspect.

Student questionnaire consisted of positive and negative statement in each aspect. It was analyzed by changing positive and negative statement into 1-4 scale, for positive statement: strongly disagree = 1, disagree = 2, agree = 3, strongly agree = 4, and for negative statement: strongly disagree = 4, disagree = 3, agree = 2,
strongly agree = 1. Then unreliable scales were discarded and percentage of reliable scales were calculated. Diagram pie of reliable scales percentage was used to know the student respond propensity.

III. RESULT AND DISCUSSION

Conceptual Attainment student worksheet was used to improve not only cognitive ability but also psychomotor in physics instruction. It was expected to improve Physics concept understanding. This was a development research by using 4-D Models that concluded define, design, develop, and disseminate. Define aim was to decide what be needed in learning. Design aim was to prepare learning media. Develop was to produce revision worksheet based on comments, suggestions, and scoring from lecturer, teacher, limited test, and field test. Disseminate was step to share the development product to bigger group than field test.

Revision product from lecturer and teacher validation was given to students in limited and field test. Each group test consisted of two meetings, first meeting students solved some pretest problems and did experiment 1 and 2 about Torque. Second meeting students did experiment about Equilibrium and solved some posttest problems. Cognitive improvement from limited and field test could be known from the average gain between pretest and posttest. Psychomotor ability was known from percentage of psychomotor accomplishment in every aspects. Student response propensity to the developed worksheet was served as pie diagram to know clearly about percentage of strongly agree, agree, disagree, and strongly disagree proportion. Final product revision as the result of comments, suggestions, and scoring from lecturer, teacher, limited test, and field test was shared to other teachers and other schools.

A. Worksheet Validation Result

The aim was to know the worksheet feasibility. Quantitative score as the result of validation then converted into qualitative category for each aspects. Instrument reliability was known from the Percentage of Agreement which can be seen at Table 3.

<table>
<thead>
<tr>
<th>Aspects</th>
<th>Score</th>
<th>Percentage Agreement (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language structure and design</td>
<td>32 (best)</td>
<td>34 (best)</td>
</tr>
<tr>
<td>Appropriate learning with Conceptual Attainment method</td>
<td>11 (best)</td>
<td>10 (good)</td>
</tr>
</tbody>
</table>

Because all the aspects were more than 75%, so the worksheet included to be a good instrument and proper to be used based on lecturer and teacher score.

B. Limited Test Result

- Cognitive Assessment Result

Cognitive assessment result of limited test can be seen at Table 4.

<table>
<thead>
<tr>
<th>Pretest Score</th>
<th>Posttest Score</th>
<th>Average Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>Standard Deviation</td>
<td>Average</td>
</tr>
<tr>
<td>37</td>
<td>10</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on calculation, average gain for limited test was 0.54 or in medium category. If maximal cognitive improvement is 100%, so it had been significant because more than 50%.

- Psychomotor Result

Student psychomotor result based on the observation shown as diagram on Figure 1.
Psychomotor accomplishment percentage had shown minimal result of 82.5% for setting experiment tools aspect and maximum result of 86.3% for doing Torque experiment 1. The average of accomplishment percentage was 84.4%. It meant that Conceptual Attainment worksheet in limited test not only made students understand about Physics concept but also gave good psychomotor ability.

- **Student Questionnaire Result**
  
  Student respond propensity to all worksheet aspects can be seen at pie diagram on Figure 2.

  ![Figure 2. Student Questionnaire Result](image)

  Percentage of students who strongly agree to worksheet in limited test was 4.5%, agree 80.9%, disagree 14.6%, and strongly disagree 0%. Student respond propensity to developed worksheet was agree with percentage 80.9%, which meant that Conceptual Attainment worksheet was proper to be used based on student questionnaire result in limited test.

**C. Field Test Result**

- **Cognitive Assessment Result**
  
  Cognitive assessment result of field test can be seen at Table 5.

<table>
<thead>
<tr>
<th>Pretest Score</th>
<th>Posttest Score</th>
<th>Average Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>Standard Deviation</td>
<td>Average</td>
</tr>
<tr>
<td>49</td>
<td>13.41</td>
<td>77</td>
</tr>
</tbody>
</table>

Based on calculation, average gain for field test was 0.57 or in medium category. It meant that Conceptual Attainment worksheet in field test could be used to improve cognitive ability although it had not improved into high category yet.

- **Psychomotor Result**
  
  Student psychomotor result based on the observation shown as diagram on Figure 3.
Psychomotor accomplishment percentage had shown minimal result of 83.8% for doing Torque experiment 1 aspect and maximum result of 90.6% for setting experiment tools. The average of accomplishment percentage was 87.8%. It meant that Conceptual Attainment worksheet in field test not only made students understand about Physics concept but also gave good psychomotor ability.

- Student Questionnaire Result
  Student respond propensity to all worksheet aspects can be known at pie diagram on Figure 4.

Percentage of students who strongly agree to worksheet in field test was 6.7%, agree 88.7%, disagree 4.6%, and strongly disagree 0%. Student respond propensity to developed worksheet was agree with percentage 88.7%, which meant that Conceptual Attainment worksheet was proper to be used based on student questionnaire result in field test.

IV. CONCLUSION

The result of this research was: (1) produced student worksheet based on validator’s score in language structure and design PA 96.97%, appropriate learning with Conceptual Attainment method PA 95.24%, both aspects got good category. 80.9% student in limited test and 88.7% student in field test agreed to the worksheet. (2) Student cognitive improvement based on normalized gain \( g \) was 0.54 for limited test and 0.57 for field test, both aspects got medium category, and (3) psychomotor accomplishment got percentage 84.4% for limited test and 87.8% for field test.

ACKNOWLEDGMENT

This paper is part of development research of conceptual attainment student worksheet to improve cognitive and psychomotor in physics instruction. Thanks to Mr. Yusman Wiyatmo, M.Si for the guidance and all people for helping and supporting to finish this paper.
REFERENCES


ENVIROMENTAL EDUCATION THROUGH BIOLOGY LEARNING FOR ECOSYSTEM SUSTAINABILITY

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Abstract—This study aims to provide an overview about environmental education through biology learning for ecosystem sustainability. As we know, the global environment is growing concern. Environmental damage caused by uncontrolled human activities cause negative effects on ecosystems and their components. Based on this conditions, environmental awareness by all society elements is needs to decrease the environmental damage. Environmental awareness can be realized by various efforts, such as environmental education at schools. Environmental education at schools being important because by environmental education from an early age, the young generation will be taught and practice how to use, manage and preserve environment. It is expected to balance the ecosystems which certainly will impact all of life form on earth. Environmental education at schools can be integrated with learning materials like biology. Biology as a branch of science that studies everything about living things can facilitate students to learning biology and linking it with environmental education. Through environmental education which is linked with biology learning, it is expected to increase student environmental awareness with participate actively to protect and manage the environment for ecosystem sustainability in the future.

Keywords: Biology Learning, Ecosystem Sustainability, Environmental Education

I. INTRODUCTION

Environmental damage which happening today is not a new thing. The environmental damage becomes very close to human life. The results of environmental damage have been happening. Various efforts to reduce and mitigate the environmental damage also have been doing continously. But until now environmental damage still occurs. This is because only partially people who care and participate actively in efforts to reduce and mitigate the environmental damage.

The root causes of environmental cases within the global scope is perspective and behavior toward the environment. The wrong perspective will produces wrong behavior. While low environmental awareness will result the disruption of ecosystem balance, causes more environmental damage and environmental crisis. An environmental crisis which is occurred only can overcame by changing the fundamental and radical outlook also society mindsets of environment [1]. Direct action and technical environmental protection with the help of science and technology wasn’t an appropriate solution. This solution requires methods to changing behavior and lifestyles which friendly to environment. The behaviour and lifestyles which friendly to environment can be done through education by embed character to concerned with the environmental education at schools.

The efforts to control environmental damage can not be done only by partially people, but it needs to be done with the cooperation by all of society elements. One of efforts to control environmental damage is through environmental education. Through environmental education, it is expected to grow up awareness of the importance of protecting the environment for ecosystem sustainability. Environmental education is a process of education (cognitive and affective), which aims to create understanding (awareness), attitude, and behavior (personality) of students and society to have environmental awareness. The approach and appropriate methods are necessary to achieve the environmental education in schools goals. Teachers and the learning process at
school in environmental education are the important role, because all of components in environmental education should be interacting and working together to achieve the goals.

Environmental education can be implemented into education in formal system and non-formal system. In the formal system of education, schools play an important role in implementing environmental education. The values and social norms are internalized by the environment early knowledge can foster an environmental awareness [2]. Environmental education approaches are aiming to the make young people more awareness of environmental, and also become more aware with environment around they live [3]. Therefore, environmental education is absolutely necessary in all society elements, especially to students at the school. This is accordance with [4] that through environmental education, students are expected to acquire knowledge about the environment so that there will be awareness of theirself and others about the importance of preserving the environment and ultimately a positive action to the environment. Environmental education at schools can be done with insert it into school curriculum by integrating with teaching materials like biology. In the non-formal system of education, environmental education can be implemented in the community. For example through voluntary to clean the environment, reforestation, family medicinal plant, counseling relating to the protecting and preserving the environment, and so on.

Biology as a branch of science that studies everything about living things is very suitable if integrated with environmental education. In biological sciences, environment becomes an unlimited source of knowledges. Various studies and research do in environment. Therefore, it would be very good when biology learning integrated with knowledge about environmental preservation and ecosystems management for sustainable. It is because human beings responsible for the ecological sustainability. Furthermore, Saragih [4] explains that through studying environmental education, students will be more integrated with nature and understand the natural functions also how to preserve environmental balance.

II. DISCUSSION

A. Environmental Education

Larinjani explain environmental education as the study of nature, natural resources, the interrelationship with human activities, disturbances to the environment and the attempt to improve the environment [5]. In order to protect and conserve the environment, environment education emphasis given in both formal and non formal system of education. In formal system of education, environmental education concept integrating into the existing curriculum, developing new strategies, and preparing instructional material for effective implementation of environmental education. It is accordance with [6] that when the curriculum organized with around significant issues and problems, it facilities relevant and holistic learning, so learners will develop the critical thinking skills which are important in environmental education.

In NSW Department of Education and Training Curriculum Support Directorate explained when included environmental education into school curriculum, student will learn about the environment, learning to behave caring and concerned about the environment, adopting the behavior and practice how to protect the environment, also understand the principles of ecology for sustainability [7].

The insertion of environmental education into school curriculum can be done in various ways, such as: (1) environment education can be included into the school curriculum as an independent subject; (2) environment education can be treated as a cross-circular issue permeating the whole curriculum hence integrated into existing subjects; and (3) environment education can be taught as theme organized around significant issues and problems[6]. Research result by [8] show that learning environmental education is taught to students either by integrating into the curriculum as well as separately with and be subject itself, as well as taught by various methods such as the findings of researchers at the top, will provide knowledge, motivating students, form a responsible environmental behavior of students and is expected to be cultivate green school.

B. Ecosystem Sustainability

The humans survival and other living things depend on the preservation of the ecosystem [9]. Human as ecological thing beings depend on ecosystem and as a determinant key of ecosystem and all its components
sustainability [10]. Therefore, the management of natural resources need to managed for the maintain of ecosystem balance.

Environmental change needed for ecological sustainability will be influenced by a new, more environmentally aware generation, a generation which is motivated by an environment ethic of care [3]. Based on this theory, it is clear that humans depend on ecosystems and positive environmental change required for ecological sustainability. This is accordance with Secretariat of the Convention on Biological Diversity explain that ecosystem must be managed within the limits of their functioning in considering the likehood or ease of attaining the management objectives, attention should be given to the environmental conditions that limit natural productivity, ecosystem structure, functioning and diversity [16].

C. Environmental Education Through Biology Learning

One factor to succes an environmental education at schools is the use of environmental education in their curriculum [12]. Although integration environmental education into the curriculum is a pro concept, the integration of environmental education into teaching depend very much on the teacher’s understanding of the concept and their ability to link environmental education content with subject matter content [6]. The integrating environmental education into school life requires a coherent approach on various fronts for there to be progress towards sustainable development in the school itself [13]. Through integrating environmental education in subjects material at school into learning process, it’s expected that environmental education can provide the awareness, active participation and knowledge about environment protecting and preserving by students [14].

Biology is the branch of science that studies everything about living things. Biology provides a variety of learning experiences to understand science concepts and processes that associated with everything about living things. Biology subjects material enables teachers to link theory with practice constructive knowledge of students about the environment so that biology learning objective achieved [15]. In learning science, students should ideally not only learn the product, but also learn aspects of the process, attitudes and technology so that students can understand the science as a holistic [16]. Implementation of environmental education in biology learning can be done by integrating the materials that can be inserted with knowledge of the environment, by linking it to everyday life.

The factors that affecting the integration of environmental education into curriculum and learning process in school is a teacher's own self [6]. In integrating an approach to learning, teachers have a disciplinary backgrounds with different motivations, different concept of environmental education, different priorities, and teachers do not know what should be inserted. This happens because the teachers are not included in the insertion of things that are not mentioned explicitly in the syllabus of learning. This is one reason for the lack of knowledge and skill/proficiency in environmental education. The implementation strategy in the learning environment by [17] namely through the integration of the environment into the curriculum by focusing on environmental awareness of the school and serve as a model/example for students is an effective way to promote the importance of environmental value.

Based on the ideas of the author, there are still many people unconcious the importance of environment. This is happen causes by low environmental awareness by the society. To build a society that has an environmental awareness need an environmental education both in formal system of education and non-formal system of education. With the implementation of environmental education at schools can form an understanding (awareness), attitude and behavior (personality) of students and society to behave environmental awareness. Due to environmental education have components that are interrelated to achieve objectives, the presence of the teacher's role.

As a profesional educators, biology teachers have an important role to educate, teach and guide the students during the learning process. During the learning process, the role of biology teacher is facilitating students to understand the biological concept, master the subject matter, find and construct a new knowledge, and so on. Learning biology emphasizes the achievement of product and process in a balanced manner. Biological products in the form of facts, concepts, theories, and laws while in terms of biological processes is skill used to uncover objects and occurrence of symptoms. Further skills include: skills to observing with the senses,
classify or categorize, applying the concepts or principles, using the tools and materials, communicate, hypothesize, experiment, and ask questions. Thus, in finding a product or facts in biology learning requires scientific measures.

III. CONCLUSION AND SUGGESTION

A. Conclusion

Environmental education as one of effort to reduce environmental damage can be implemented in formal system and non-formal system of education. In formal system of education, environmental education can be include in school curriculum and integrated in learning process, especially biology. Implementation of environmental education in biology learning can be done by integrating the materials that can be inserted with knowledge of the environment, by linking it to everyday life. In non-formal system of education, environmental education can be implemented in the community like voluntary to clean the environment, reforestation, family medicinal plant, counseling relating to the protecting and preserving the environment, and so on. Factors that affecting the integration of environmental education into curriculum and learning process in school is a teacher's own self. In integrating an approach to learning, teachers have a disciplinary backgrounds with different motivations, different concept of environmental education, different priorities, and teachers do not know what should be inserted.

B. Suggestion

Based on the overview, need a periodic training related to environmental education in learning process in formal system and non-formal system of education. This is so that the environmental education can be maximized and generate output an environmental awareness of all society elements for ecosystem sustainability.

REFERENCES

AN EVALUATION OF THE IMPLEMENTATION OF PROBLEM BASED LEARNING MODEL CURRICULUM 2013 IN SCIENCE LEARNING JUNIOR HIGH SCHOOL CLASS VII IN SLEMAN

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Abstract—This study aims to know the implementation of learning science in the implementation of the model of problem based learning curriculum 2013 in Sleman. This study is evaluating the use of evaluation model Countenance Stake. The population in this study are all Junior High School in Sleman district curriculum of 2013 in the academic year 2015/2016. Data was collected on 5 teachers that administer teaching science classes VII to each school pilot project and 246 students of class VII. The instruments used in data collection in the form of a teacher questionnaire, questionnaire of learners, and the observation sheet. The instrument first tested the validity of the analysis and testing v'aiken limited to the analysis of SPSS version 20 and Quest. Analysis of experimental data with descriptive qualitative-quantitative technique. The quantitative data with z-score test and t-score test. According to the analysis of qualitative data Miler &Huberman. The results showed that, the implementation of Problem Based learning models applied in the process of science teaching seventh grade junior high schools in Sleman district has been running quite effective based on the analysis results the average T-score that is worth 51.87. The results of the average value of the t-score is derived from the analysis of the teacher questionnaire sheet with a value of 54.17 t-score, a questionnaire sheet analysis results of learners with a t-score of 51.43, and the analysis results sheets observations and the t-score 50.29.

Keywords: Evaluation, Model of Problem based Learning, Curriculum 2013, Science Learning

I. INTRODUCTION

Curriculum implementation in 2013 recommended to use a learning model. The learning model suggested in 2013 that the model curriculum Inquiry learning, Discovery learning, Project Based Learning and Problem Based Learning. In accordance with Act No. 20 of 2003 on the national education system, Article 1 states that education is a conscious and deliberate effort to create an atmosphere of learning and the learning process so that learners are actively developing the potential for him to have the spiritual power of religion, self-control, personality, intelligence, noble character, and skills needed him, society, nation and country.

According to Government Regulation No. 32 of 2013 on national education standards that the process of learning in the educational unit organized in an interactive, inspiring, fun, challenging, motivating participants learners to actively participate and provide enough space for the initiative, creativity, and independence according to their talents, interests, and physical and psychological development of learners. For that every academic learning planning, implementation of the learning process and learning assessment to improve the efficiency and effectiveness of the achievement of competencies of graduates. This means that lesson
activities are expected to carry out learning challenging, fun, motivating the students to participate actively, and able to work in groups or independently.

Lessons can be challenging, fun, motivating the students to participate actively, and able to work in groups or independently is in accordance with the characteristics of the model Problem Based Learning (PBL). PBL is a learning model that focuses on the activities of identification, analysis, and discussion of problems in small groups with a problem as a stimulus for learning. In addition, the model of Problem Based Learning will provide facilities for learners to construct knowledge in groups or independently. The learning activities make students more motivated to learn. The essence of Problem Based Learning is the existence of a real problems that must be completed by learners. This problem will make learning becomes meaningful, because students learn to solve problems will be trying to link the knowledge obtained previously with no problems.

II. DISCUSSION

A. Curriculum 2013

Curriculum 2013 is a follow up of a competency-based curriculum (KBK) were never tested in 2004. The CBC used as a reference and guide for the implementation of education to develop different spheres of education (knowledge, skills, and attitudes) in all levels and access to education, particularly in line school education. In essence, competence is the combination of knowledge, skills, values and attitudes are reflected in the habit of thinking and acting [1].

Curriculum 2013 is a new curriculum that was initiated by the Ministry of Education and Culture of the Republic of Indonesia to replace the Education Unit Level education. Curriculum 2013 is a curriculum that promotes understanding, skill, and character education, students are required to understand the material, active in discussions and presentations and have manners discipline. Curriculum Development in 2013 made to face many problems and challenges of the future are becoming increasingly complicated and complex. Therefore, the curriculum goal in 2013 is to prepare the Indonesian people to have the ability to live as a person and a citizen of productive, creative, innovative and effective and able to contribute to society, nation, state and world civilization. The learning activities in the curriculum in 2013 geared to empower all the potential of the learners so that they could have expected competencies through an effort to foster and develop the knowledge, attitudes, and skills [2].

Character learning science in K-13 science must be integrated with the approach used is a scientific approach. Learning models can be modified according to the model chosen by steps or a separate syntax. Learning science in K-13 learning create aspire learners who think scientis (analytical) ie thinking skills to solve a problem.

B. Problem Based Learning

Problem Based Learning (PBL) is defined as the overall thinking of learning to bring a settlement issues; biosynthesized starting from early learning and organized in a problem situation. For the first time, PBL is implemented in 1950 at the Medical School of Case W. University in America. Then, at the end of 1960, the concept of PBL is started to be implemented at the Medical School of the McMaster University in Canada. The studies focused on PBL models in primary education, secondary, and higher have been conducted since 1980 [3].

This learning model to train and develop the ability to solve problems oriented on authentic problems from the actual life of the students, to stimulate high-level thinking skills. Conditions that remain to be maintained is a conducive atmosphere, open, negotiation, and democratic [4]. Furthermore PBL is a learning atmosphere that is directed by a daily problem [4]. Reference [5] PBL is a method of learning centered on learners, learners progressively given more and more responsibility for their own learning and become more independent.

PBL essence be presenting a variety of circumstances problematic authentic and meaningful to learners, which can serve as a springboard for investigation and research [6]. PBL is consistent with the view of learning philosophy now, mainly constructivism. Constructivist theories of learning, which emphasizes the need for students to investigate environmental and instruction personal knowledge, provide a theoretical basis
for PBL. This is consistent with the statement of [7]. PBL is a model that is centered on the learner by following the principles of constructivist learning theory. Some of the constructivist theory is Piaget's theory of cognitive and Vygotsky with the concept of zone of proximal development. PBL models can be used as an alternative to improve problem-solving skills and creativity of learners, so it can be used as input for the school to be developed as a model for effective learning [8]. Furthermore, to carry out the study with appropriate learning strategy PBL syntax, there are five stages of learning according to Arends as follows [7].

TABLE 1. STAGES OF LEARNING WITH PBL STRATEGY

<table>
<thead>
<tr>
<th>No</th>
<th>Phase</th>
<th>Teacher Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Provide an orientation about the problems faced by the students</td>
<td>The teacher discusses learning goals, describe various important logistical needs, and motivate learners to engage actively in activities and problem solving.</td>
</tr>
<tr>
<td>2</td>
<td>Organize students to conduct research and investigations.</td>
<td>Teachers help learners to describe and organize learning tasks related to the problems faced.</td>
</tr>
<tr>
<td>3</td>
<td>Helping learners investigations independently and in groups.</td>
<td>Teachers encourage students to get the right information, accurate, and conducting experiments and searching for explanations and solutions.</td>
</tr>
<tr>
<td>4</td>
<td>Develop and present the results of participants' work and exhibitions.</td>
<td>Teachers assist students in planning and preparing the appropriate work such as reports, video recordings, and models, as well as helping them to pass it on to others.</td>
</tr>
<tr>
<td>5</td>
<td>Analyze and evaluate the process in order to cope or find solutions masalah.</td>
<td>Teachers help learners to reflect on the results of the investigation and the processes they use.</td>
</tr>
</tbody>
</table>

C. Science learning

Science learning is an integrative approach that his review is all the fields of study in science to solve problems. Learning science by [8], is the process of interaction between learners and teachers, learning resources, learning media and learning environment to achieve learning science competencies that have been set. Aspects learned from IPA tentative (subject to change); empirically based (based on and / or derived from observations of nature); subjective (theory); partly a product of inference, imagination, and creativity of human beings (involving explanation of the invention); and social and cultural embedded [9]. The main purpose of learning science is to generate interest learners to stimulate thought and directing students to learn the material more deeply IPA [10].

D. Evaluation

Many definitions of evaluation can be obtained from books written by experts, among others, the definition of which was written by Ralph Tyler, the evaluation process is to determine the extent to which educational goals can be achieved. Reference [11] found "as the systemic investigation evaluation of the worth or merit of on object". The above statement implies that the evaluation system as investigative value or worth of an object.

Evaluation can be defined as an assessment of the achievement of objectives through the collection and analysis of data that is useful for making a decision on a program. Evaluation by Djemari Mardapi is one of the series of activities to improve the quality, performance or productivity of an institution in implementing the program [12]. Furthermore Eko Putro Widoyoko explains that the evaluation is the provision of information that can be used as consideration in making a decision [13]. Through the information will be obtained information about what has been achieved and which have not, then this information is used to repair a program.

The purpose of evaluation is to collect the data, translates the data into information, and use that information to make a decision [13]. Another opinion is explained by Stufflebeam & Shinkfield states that "the most important purpose of evaluation is not Prove, but to improve". That is the purpose of evaluation is to improve, not prove [14]. Objective evaluation according to Weiss that "the purpose of evaluation research is to measure the effect of a program again the goals it set out Accomplish as a means of contributing to the subsequent decision making about the program and improving future programming" [15]. The formula provides four goals emphasized, namely, 1) refers to the use of research methods, 2) emphasis on the results
of a program, 3) the use of criteria to judge, and 4) contribution to decision making and program improvement in the future. Objective evaluation according to Fitzpatrick says "the primary purpose of evaluation is to render judgment about the value of whatever is being Evaluate" [11]. Objective evaluation according to the Fitzpatrick is to give due consideration to the value of anything related to the evaluation, in order to obtain a recommendation as the final outcome of the evaluation study.

Table 2. Results Analysis of Implementation Questionnaire and Observation Sheet

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Teacher Questionnaire Sheets</th>
<th>Learners Questionnaire Sheet</th>
<th>Observation Sheet</th>
<th>The average t-score</th>
<th>Category</th>
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<tr>
<td>1</td>
<td>53.35</td>
<td>57.69</td>
<td>57.84</td>
<td>56.31</td>
<td>Effective</td>
</tr>
<tr>
<td>2</td>
<td>47.17</td>
<td>39.42</td>
<td>24.06</td>
<td>35.60</td>
<td>Less effective</td>
</tr>
<tr>
<td>3</td>
<td>59.53</td>
<td>58.23</td>
<td>24.06</td>
<td>44.42</td>
<td>Less effective</td>
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<tr>
<td>4</td>
<td>59.53</td>
<td>49.81</td>
<td>57.84</td>
<td>56.40</td>
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<tr>
<td>5</td>
<td>53.35</td>
<td>50.35</td>
<td>49.39</td>
<td>50.95</td>
<td>Quite effective</td>
</tr>
<tr>
<td>6</td>
<td>65.71</td>
<td>49.63</td>
<td>49.39</td>
<td>54.89</td>
<td>Quite effective</td>
</tr>
<tr>
<td>7</td>
<td>53.35</td>
<td>64.32</td>
<td>49.39</td>
<td>54.44</td>
<td>Quite effective</td>
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<tr>
<td>8</td>
<td>53.35</td>
<td>55.90</td>
<td>32.50</td>
<td>45.30</td>
<td>Quite effective</td>
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<tr>
<td>9</td>
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<td>46.38</td>
<td>49.39</td>
<td>50.01</td>
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</tr>
<tr>
<td>10</td>
<td>47.17</td>
<td>36.91</td>
<td>49.39</td>
<td>45.53</td>
<td>Quite effective</td>
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<tr>
<td>11</td>
<td>47.17</td>
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<td>57.84</td>
<td>53.17</td>
<td>Quite effective</td>
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<tr>
<td>12</td>
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<td>40.95</td>
<td>49.85</td>
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</tr>
<tr>
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<td>53.35</td>
<td>48.50</td>
<td>46.58</td>
<td>49.31</td>
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<tr>
<td>14</td>
<td>53.35</td>
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<td>15</td>
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<td>58.63</td>
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<td>16</td>
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<td>57.29</td>
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<tr>
<td>17</td>
<td>57.06</td>
<td>50.70</td>
<td>42.64</td>
<td>49.46</td>
<td>Quite effective</td>
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<tr>
<td>18</td>
<td>53.35</td>
<td>58.05</td>
<td>49.39</td>
<td>52.88</td>
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</tr>
<tr>
<td>19</td>
<td>59.53</td>
<td>50.88</td>
<td>57.84</td>
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<tr>
<td>20</td>
<td>53.35</td>
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<td>22</td>
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<tr>
<td>24</td>
<td>40.99</td>
<td>42.64</td>
<td>57.84</td>
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<tr>
<td>25</td>
<td>53.35</td>
<td>49.81</td>
<td>57.84</td>
<td>54.34</td>
<td>Quite effective</td>
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<tr>
<td>26</td>
<td>53.35</td>
<td>59.66</td>
<td>57.84</td>
<td>56.80</td>
<td>Effective</td>
</tr>
<tr>
<td>27</td>
<td>53.35</td>
<td>51.78</td>
<td>57.84</td>
<td>54.83</td>
<td>Quite effective</td>
</tr>
</tbody>
</table>

E. An Evaluation of the Implementation of Problem Based Learning Model Curriculum 2013 in Science Learning

Research was conducted from 18 April to 20 June 2016 at 5 junior in Sleman that uses K-13 produced some data. The data obtained from the questionnaire sheet and observation sheet. Sheets of this questionnaire given to teachers and learners, while the observation sheet used researchers to observe the learning process conducted by a science teacher.

Evaluation model used is Countenance Stake. Stake evaluation model is the analysis of the evaluation process that focuses on two types of operations are descriptions and judgment and distinguish three phases in the evaluation of the program, namely: 1) preparation (antecedents) in this study is the lesson planning; 2) the transaction is the implementation of learning; and 3) the outcome of this program is the study of students. Stake evaluation model selected with the consideration that the research to be conducted focused on evaluating the implementation of the model of Problem Based Learning (PBL) held SMP in Sleman that uses K-13.

The results of data analysis model execution PBL obtained from questionnaires and observation sheets sheet given to the respondents, a science teacher and students grade 7, while the observation sheet used mainly to observe the process of learning that teachers do. The results of the implementation of the questionnaire data analysis and observation sheet can be seen in table 2.
Based on Table 2 shows that teachers often prepare students before the learning begins, divide the students into groups, using a source of learning, using the approach of scientific, check for understanding students, facilitating learners to perform 5M, concluded the subject matter, and conduct follow-up activities. Value T-score above indicators have effective category, because the price of the t-score > 55. Indicators that are less effective in the indicator 2 and 3 of the teachers in preparing lesson by explaining the PBL activities to be carried out and provide motivation by linking the material in the events in daily life-day. Other indicators in detail has a category quite effective. The results of the analysis categories are arranged in the distribution graph in Figure 1.

![Graph Category Frequency Execution](image)

Based on Figure 2 supports the results of the analysis of each indicator of the aspects of the implementation of the results is quite effective category has the highest percentage value that is 62.96%. Category underneath is effective with a percentage of 29.63%. It is concluded that the implementation of learning science with the model PBL works quite effectively.

III. CONCLUSION AND SUGGESTION

A. Conclusion

Implementation of PBL models applied in the process of learning science class 7 in Sleman are in accordance with the learning strategy and model of PBL, but teachers can not perform all the steps of learning in PBL models by reason of the time that had been prepared was not enough to carry it all. This is seen by the results of the analysis of the average T-score that is worth 51.87, which means into the category quite effective. The results of the average value of the t-score is derived from the analysis of the teacher questionnaire sheet with t-score value of 54.17, has questionnaire sheet analysis of learners with a t-score of 51.43, and the analysis results sheets observations and the t-score 50.29.

B. Suggestion

The Government needs to conduct training on the implementation of learning model that correctly and in accordance with the subject matter itself, so it will give good learning outcomes anyway.

REFERENCES


MULTIPLE REPRESENTATION FOR PHYSICS EDUCATION:
BENEFIT AND CHALLENGE

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Abstract—Multiple representation is an important theme in physics education. It was shown that many physics education research discussed about that theme. Multiple representation emphasizes the student's ability to solve problems in various ways such as representation diagrams, representation graphic, representation verbal and representation mathematical. This document introduces the subject of multiple representation in physics education. The main purpose of this paper is to describe multiple representation, benefits, challenges, and it's barriers to support teaching and learning physics. Collecting data obtained from google scholar from July 2015 to June 2016. Areas will be addresses in this paper include: an analysis of multiple representation in physics education; value and benefit of multiple representation in physics learning; challenges and barriers of multiple representation in physics learning. Result concluded that multiple representation could used physics education to enhance problem solving skill from student.

Keywords: Multiple Representation, Physics Education, Problem Solving

I. INTRODUCTION

Problem solving skill is the ability of the students in solving problems related to daily life. So, this skill can support physics learning [1]. Unfortunately, students consider the problem solving skill just as the effort in determining one or more unknown value in studying the physics [2]. In fact, students who lack the problem solving skills will have difficulty in understanding the physics learning [3]. One efforts to improve this skill is implementing the strategy of problem solving. This strategy consists the representation skill, the ability of mathematical manipulation, and finish the solutions [4]. The representation skill is the ability to change the problem from one representation form to other representations, whereas the ability of mathematical manipulation is the ability to make mathematical equations from the visual representation. The final solution contains the results of the settlement and the ability to make conclusions.

The representation skill is the main strategies in problem solving. Multiple representation is defined as a description of the same concept using the different way. Generally, the function of representation are grouped into three namely complementary information or support complementary cognitive processes, constraints possible (mis) interpretations and construct a deeper understanding of a situation [5]. In addition, the representation is also known as the center of cognitive flexibility theory [6]. That is because the students' ability to make representations determining cognitive outcome or conceptual understanding of the students. Thereby, representation can be interpreted as part of a problem-solving strategies to determine the quality of a person's cognitive and conceptual understanding.

The representation skill become a common theme in many of physics education research. Several studies describe this skill is useful in solving problems [7,8,9] and improve the performance of problem solving [9,11]. Therefore, this skill is widely used in learning physics. There are four types of representation that are widely used in physics which includes a diagram representation (the ability to create and label diagrams), verbal representation (the ability to explain concepts with own words), the mathematic representation (the ability to describe the results of visual representation into mathematic equation) and graphic representation (the ability to create and label a graph) [10]. Each child tend to prefer using a single representation in solving problems. Whereas the use of less-precise representation can inhibit students to understand the concepts and solve the problem [12].
This paper aims to analyze the impact of learning based multiple representations in physics education. It covered include descriptions of multiple representation, the benefit and the challenges in supporting the process of physics learning.

II. METHOD

The method of this research is the descriptive analysis of multiple representations in physics learning. The collected data are obtained from the google scholar engine with keyword: "multiple representation" +physics +education. It aims to eliminate the representation that is not included in the physics problem-solving strategies. Data analysis was performed on the journal published in July 2015 – June 2016. Based on the results analysis obtained 14 journals (journals research and review of the literature) about multiple representation in physics learning.

III. RESULT AND DISCUSSION

Based on the data obtained, then there are 14 journals of multiple representations in learning physics has details that 9 units (65%) of research journals and 5 (35%) of the journal literature. Results of the study also testified that almost all (93%) of research journals did not encounter any obstacles in applying multiple representations in learning physics. Unfortunately, the scope of material covered is still small. The scope of the material discussed, such as Newton's laws, waves, electricity, and magnetism. A description of analysis multiple representation presented in the following Table 1.

<table>
<thead>
<tr>
<th>Journal</th>
<th>Definition</th>
<th>Value and Benefit</th>
<th>Challenge and Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Savinainen &amp; A. Mäkynen &amp; P. Nieminen &amp; J. Viiri [13]</td>
<td>-</td>
<td>1. The systematic ID or diagram representation was improved students' understanding. 2. When students are skilled in making ID, they do not need to make diagram representations directly</td>
<td>1. Teachers need to be trained to use interactive diagrams before implementing it. 2. Teachers use textbooks based ID that include examples of its application</td>
</tr>
<tr>
<td>Parlindungan Sinaga [14]</td>
<td>-</td>
<td>1. Pre-service teachers who have multiple representation skills can make teaching materials properly 2. Multiple representation makes the concept in physics easier to understand.</td>
<td>1. Using various representation types can help students to understand physics subject easily. 2. Using representations adapted to physics concept. 3. Using mathematical representations must be integrated with other representations.</td>
</tr>
<tr>
<td>M.A Rau [15]</td>
<td>1. Internal representations are building blocks of mental models, which constitute students' content knowledge of a particular topic or domains. 2. Schnotz’s integrated model of text and picture comprehension (ITPC) is ability of the students to choose relevant information, organize information and integrate information from internal representations in order to become a mental model from the relevant knowledge.</td>
<td>1. Visual representations can help students learn, but they can also confuse students because students often have to learn new content from new visual representations they do not yet fully understand</td>
<td>1. To learn content knowledge from visual representations, students therefore need representational competencies: knowledge about how visual representations depict information about the content</td>
</tr>
<tr>
<td>W. Danielson Robert</td>
<td>1. When text and graphics</td>
<td>1. Graphics could benefit not only</td>
<td>1. text-graphic pairing should</td>
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421
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<tr>
<th>Journal</th>
<th>Definition</th>
<th>Value and Benefit</th>
<th>Challenge and Barrier</th>
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<tbody>
<tr>
<td>&amp; M. Sinatra, Gale [16]</td>
<td>are combined (multiple representation), learners tend to infer very different meanings than when these representations are presented independently.</td>
<td>learners’ comprehension of text, but their interest and engagement with the material as well. 1. process text- graphic pairings can draw relations between the text and the graphic then construct an integrated mental model.</td>
<td>use analogy or metaphor to provide a bridge between student prior knowledge and the content. 2. text-graphic pairings can draw a contrast between student misconception and scientific conception. 3. a graphic organizer or illustrations of paradoxes can promote concept acquisition and differentiation among concepts.</td>
</tr>
<tr>
<td>Wei-Kai Liou, Kaushal Kumar Bhagat, &amp; Chun-Yen Chang. [17]</td>
<td>1. Multiple representation is the depiction of any process using symbols, diagrams, numbers, tables, texts graphics, animations, etc., defined as two or more (Ainsworth 2006). 2. Prain and Waldrip (2006) defined multiple representation as the description of the same concept by using different modes; these include verbal, graphical and numerical modes, with repeated student exposures to the same concept.</td>
<td>1. Highly Interactive Cloud-Classroom system can promote active learning, which results in enhancing knowledge, comprehension and application skills of the learners. 2. Teachers can easily change the teacher’s roles from “sage on the stage’’ to “guide on the side,’’ allowing them to work with individuals or groups of students throughout the class.</td>
<td>-</td>
</tr>
<tr>
<td>Satyugjit Virk, Douglas Clark &amp; Pratim Sengupta. [18]</td>
<td>1. coordinating multiple external representations (MERs) can productively support learners in making sense of complex models and relationships (Ainsworth, 2006). 2. Model-based games are MERs type with new structures and forms of representations.</td>
<td>1. Many of the intermediate representations used in the recreational games 2. Research in multi representational gaming is sparse, and the proposed design considerations from research on MERs therefore provide a useful template for thinking about the design of educational games involving models and multiple representations.</td>
<td>1. MER design can be used and appropriated more effectively by teachers as part of their regular curricula. 2. The curricular integration of games in the K-12 science classroom was relied teachers provide multi representational infrastructure in digital games.</td>
</tr>
<tr>
<td>B.W.Miller, J.G. Cromley, &amp; N.S. Newcombe [19]</td>
<td>1. Visual representations are essential such as diagrammatic reasoning skills.</td>
<td>1. Many of the intermediate representations used in the recreational games 2. Research in multi representational gaming is sparse, and the proposed design considerations from research on MERs therefore provide a useful template for thinking about the design of educational games involving models and multiple representations.</td>
<td>1. COD instructions was targeted at improving diagrammatic reasoning specifically and not to increase the learning of science content directly.</td>
</tr>
<tr>
<td>C. Cottineau, E. Hatna, E. Arcute, &amp; M. Batty [20]</td>
<td>1. The coordination of representations has been shown to be important for learning physics.</td>
<td>1. Using spaced recall in introductory physics will place a stronger emphasis on practices shared by physics experts, such as symbolic mathematics, and translating between representations.</td>
<td>1. Even though students may very successfully recall material immediately after presentation or studying, this type of recall is not effective because it relies on the short-term memory. Spaced recall relies on the time between the recall sessions (days or weeks), which increases the cognitive difficulty for the student.</td>
</tr>
<tr>
<td>M.S. Aftanasar, &amp; N. Mohamad [21]</td>
<td>1. The representation skill is one technique that can be used in conceptual</td>
<td>1. Representation can specify a variety of ways to help understanding conceptual</td>
<td>1. Interviews can be conducted to determine students' conceptual understanding and obtain a</td>
</tr>
<tr>
<td>Journal</td>
<td>Definition</td>
<td>Value and Benefit</td>
<td>Challenge and Barrier</td>
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| T. M. S. Haratua & J. Sirait [22] | learning, in addition the use of technology and interactive in learning. | 1. Multiple representation can help them understand the concept and visualize the problem before going into the mathematic equations  
2. Students who drew picture or sketch and also motion diagram in the experiment group achieved higher score than students who did not.  
3. learning based representation can be used as an alternative to understanding the problem solving skill. | 1. This study has still been implemented for one topic, so it cannot generalize to all subject of physics. |
| M.A. Rau [23]                  |                                                                            | 1. Text and visual representation combined more effectively to improve student learning, than the activities only with text. | 1. visual representations hinges on their ability to form accurate internal representations of the representations’ referents and on their ability to integrate internal representations into a coherent mental model of the content—in other words, learning from visual representations requires representational competencies.  
2. visual representations can confuse students because they play a dual role in education: students have to learn about visual representations, that is, how they depict information and students have to learn new information from visual representations  
3. Making multimedia learning which can explain to students acquire representational competencies while also learning content knowledge  
4. Examine student representation skill based on representational competencies, specific knowledge and skills they involve, and the learning processes through which students acquire them |
| K.S. Tang [24]                 | 1. representations are seen as artefacts that symbolize an idea or concept in science and can take the form of written texts, analogies, diagrams, graphs, and simulations. | 1. using representations and multimodality in classroom talk is gaining more attention in science education research  
2. In the process of re-representation, it is useful to denote different stages of representation where learners typically go through in any instructional context. | 1. role of representation and its transformation process within the context of the classroom communicative approach (e.g. dialogic or authoritative), and conversely.  
2. science teachers a useful pedagogical tool to plan teaching sequences and choose appropriate... |
<table>
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<th>Value and Benefit</th>
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<tbody>
<tr>
<td>M. Tomara, &amp; D. Gouscos, [25]</td>
<td>1. AR representation can being a common experience to all learners involved, would be observable and manipulable from different perspectives through the learners’ personal ubiquitous interface of a mobile device or, in the near future, a wearable computer in the form of glasses or even contact lenses.</td>
<td>1. Augmented reality features that render it particularly suitable for the development of experiences that will allow learners to envision physical processes, to give up their prior ideas and embrace scientific knowledge.</td>
<td>1. AR experiences need to be designed and developed with the purpose of representing concepts and processes encountered in everyday life.</td>
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<td></td>
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<td></td>
<td>2. Environment should allow the learners to experiment with the elements provided (true and virtual), to formulate hypothesis and test their validity, to visualize and sense all related concepts, principles and quantities through multiple representations and eventually reform their prior conceptions.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>3. The teacher organize and configure a learning experience with respect to a particular learning subject and in order to implement specific educational goals, as well as to create realistic 3D phenomena representation models.</td>
</tr>
<tr>
<td>M. Gunel &amp; F. Yesildag-Hasancebi [26]</td>
<td>1. Due to the increasing importance of their role in the production and communication of science. 2. Understand their function in communication, and make transitions between different representation modes learn scientific concepts more easily and permanently</td>
<td>1. Modal representations are integrated into writing-to-learn activities, they serve as an alternative method of teaching and measurement of assessment for teachers as well as a learning tool that activates students’ cognitive abilities. 2. Their role in science education and writing-to-learn activities has been explored by considering their theoretical and pragmatic dimensions.</td>
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</table>

Detailed analysis conducted on definition of multiple representation, benefit from it, challenge and constraints in implementing it. There are 9 (64%) journals that do not provide an analysis of the definition of multiple representations. Results of some studies, it is known that multiple representation has several meanings as follows.

1. Internal representations are building blocks of mental models, which constitute students’ content knowledge of a particular topic or domains.
2. Schnotz’s integrated model of text and picture comprehension (ITPC) is ability of the students to choose relevant information, organize information and integrate information from internal representations in order to become a mental model from the relevant knowledge.
3. Visual representations are essential such as diagrammatic reasoning skills.
4. The coordination of representations has been shown to be important for learning physics.
5. The representation skill is one technique that can be used in conceptual learning, in addition the use of technology and interactive in learning.
6. Representations are seen as artefacts that symbolize an idea or concept in science and can take the form of written texts, analogies, diagrams, graphs, and simulations.
7. AR representation can be a common experience to all learners involved, would be can observe and manipulate from different perspectives through the learners’ personal ubiquitous interface of a mobile device or, in the near future, a wearable computer in the form of glasses or even contact lenses.

Thus, multiple representation is a mental model or technique that can be used in conceptual learning to symbolize an idea or concept in science and can take the form of written texts, analogies, diagrams, graphs, and simulations with a way choose relevant information, organize information and integrate information from internal representations. In simple terms, multiple representation interpreted as a method or technique to change ideas or concepts in physics with different presentation form. Definition of multiple representations in learning physics unchanged since the 19th century. So, the use of multiple presentations in learning is still relevant and in accordance with the theories ever proposed previous century.

The application of multiple representations in learning physics have quite positive impact. Based on publications in google scholar over the range in July 2015-June 2016, it is known that the use of multiple representations of learning profitable if applied in teaching. There is no journal stating the use of multiple representations will be difficult for student in learning. Some of the benefits are as follows.

1. For student, it can improve students’ understanding, makes the concept in physics easier to understand, can help students learn, construct an integrated mental model, can promote active learning (which results in enhancing knowledge, comprehension and application skills of student), visualize the problem before going into the mathematic equations, achieved higher score, an alternative to understanding the problem solving skill, interest and engagement with the material learning.

2. For teacher, it can improve skill to make teaching materials, improve teacher role in class, and create alternative design of physics learning.

Based on the journals analyzed, it is known that the implementation of learning using multiple representations provide some challenges and obstacles. Some of the challenges caused by the development of science and technology. In detail the challenges derived from the application of learning physics in the 21st century is among them as follows.

1. Teachers need to be trained to use interactive diagrams before implementing it.
2. Teachers use textbooks based ID that include examples of its application.
3. Using mathematical representations must be integrated with other representations.
4. To learn content knowledge from visual representations, students therefore need representational competencies: knowledge about how visual representations depict information about the content
5. Text-graphic pairing should use analogy or metaphor to provide a bridge between student prior knowledge and the content.
6. Text-graphic pairings can draw a contrast between student misconception and scientific conception.
7. A graphic organizer or illustrations of paradoxes can promote concept acquisition and differentiation among concepts.
8. The curricular integration of games in the K-12 science classroom was relied teachers provide multi-representational infrastructure in digital games.
9. Making multimedia learning which can explain to students acquire representational competencies while also learning content knowledge
10. AR experiences need to be designed and developed with the purpose of representing concepts and processes encountered in everyday life.
11. Environment should allow the learners to experiment with the elements provided (true and virtual), to formulate hypothesis and test their validity, to visualize and sense all related concepts, principles and quantities through multiple representations and eventually reform their prior conceptions.
12. The teacher organizes and configures a learning experience with respect to a particular learning subject and in order to implement specific educational goals, as well as to create realistic 3D phenomena representation models.

Challenges derived from implementation of multiple representation caused by the readiness of teachers in implementing learning using multiple representation. Not found the constraints stemming from the process of
learning or learners. Therefore, a solution that can be done is to provide training to teachers in implementing the learning using multiple representation.

IV. CONCLUSION

Multiple representation could use physics education to enhance problem solving skill from student. However, multiple representation has advantages when applied in learning physics. The role of teachers in implementing multiple representations in learning physics is very important. As a result, teachers need to have a solid understanding in making representations. With the development of technology, appeared many challenges in developing representation that is integrated with the science and technology such as the use of AR.

REFERENCES


Isolating and Testing of *Jatropha multifida* Extract toward Leukocytes as Chemistry Learning Module

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**Abstract**—*Jatropha multifida* Linne, known as the plant Betadin by the Bengkulunese, has been used as new wound healer. The objectives of the study are 1) Isolating secondary metabolites and investigate the effect of the *J. multifida* L. extract toward the number of leukocytes in male mice. 2) Improving student learning outcomes using learning modules developed from laboratory research materials. Isolation of secondary metabolites was done by maceration and fractionation, followed by separation and purification on TLC and columned chromatography. The isolation was then identified by FTIR and ¹H NMR spectrophotometer. A total of 25 mice males were divided into 5 groups. P₀ (positive control) were treated orally with sesame oil, P₁ (negative control) were given imunos with dose of 0.01 g / kg bw, P₂ were given imunos and prednikson (0.01 g / kg bw), P₃, P₄ and P₅ were given imunos and *J. multifida* extract with the dose of 0.028 g / kg bw, 0.056 g / kg bw and 0.084 g / kg bw. Number of leukocytes after treatment was calculated using a hemocytometer. The result of the study is used as a learning source using R&D approach and then packed in a module. Based on FTIR and ¹H NMR spectra, the products of the isolation was flavonol glycosides. *J. multifida* L. extract with dose of 0.028 g / kg bw is proved to lower the number of leukocytes in mice. The module, developed from laboratory research material, may result in an improved and exceed the minimum passing grade learning outcomes.

**Keywords**: *Jatropha multifida* L., Secondary Metabolites, Leukocytes, Imunos, Module

I. INTRODUCTION

The modern treatment in Indonesia has not reached all levels of society, some people still tend to use medicinal plants in tackling health problems. Therefore, medicinal plants can be used as an alternative program to meet the basic needs of the public health service. Empowerment of medicinal plants, in fact are able to reach a wider and equitable society. Since the knowledge and utilization of medicinal plants is obtained from the ancestors, therefore, the empowerment of medicinal plants in Indonesia can be preserved as national heritage.

The use of plants as alternative medicine in maintaining good health at the moment is increasing. The utilization of medical plants needs to be scooped out, tested, and developed through scientific researches and assessments along with advanced technology. Advanced technology may support the existence and role of medical plants in meeting the basic health needs of the society.

Empirically experienced, *Jatropha multifida* L. was widely used by Bengkulunese as a new wound healing, therefore this plant is known as *’betadin’* plants. *J. multifida* has been studied and it has an effective equality of 10% of povidone iodine in wound healing [1]. *J. multifida*, also able to clot blood in average time of 2.72 seconds with the concentration of 70% [2]. The ethanol extract stem of *J. Multifida* is able inhibit the growth of *Salmonella typhi* [3]. Preclinical research proves that the stem extract of *J. multifida* is useful for
increasing the platelet count in normal mice [4][5]. Stem extract of J. multifida has no teratogen effect, which means not allowing the potency of defects in the fetal mice [6].

In this study, the secondary metabolite compound in J. multifida extract was isolated by maceration and extraction, followed by purification using TLC and column chromatography. In order to look for opportunities to be used as a medicine of leukocyte-lowering or infections, J. multifida stem extract is tested preclinically to reduce the number of leukocytes mice in leukocytic condition; when the condition of the number of leukocytes in mice is in rise. The result of laboratory research was developed as a learning resource in learning chemistry of natural products and was packaged in the form of modules.

II. MATERIALS AND METHOD

This laboratory research is intended to isolate the secondary metabolites and to test the effect of J. multifida extract in reducing the number of leukocytes in mice. Next, the results of laboratory studies were developed into learning modules that are used in learning chemistry of natural materials classes. The main tools that were used were chromatography column, rotary evaporator, FTIR (IR Prestige-21 Shimadzu) and 1H-NMR (JNM ECA-500)

A. Isolation of Secondary Metabolites

Isolation of secondary metabolite was started with phytochemical test to determine the content of flavonoids, saponins, tannins, alkaloids, steroids and terpenoids in J. multifida L [7] [8]. Extraction of J. multifida L was done by maceration with technical ethanol of 96% for 7 days, the filtrate obtained was fractionated in a separating funnel using n-hexane and ethyl acetate. The phytochemical tests of fractions obtained were repeated to find out the secondary metabolite of each fraction which then each was evaporated using rotatory evaporator.

1) Selection of Eluent by TLC

The sample used in the separation and purification of secondary metabolites of J. multifida L. extract was the fraction of ethyl acetate, prior to separation by column chromatography, which first was performed eluent election using TLC. Eluent that separatesthe highest number of spots with the widest separation distances between one and others was then used as the basis for selection of the eluent for purification [9].

2) Separation of Secondary Metabolites by Column Chromatography

Before using silica gel as adsorbent, it was activated using n-hexane, the samples (fraction of ethyl acetate) were eluted using the eluent mixture n-hexane and ethyl acetate in the ratio (10: 0; 8: 2; 6: 4; 4: 6; 2: 8; 0:10) in a prepared column. Each eluate was then collected in a vial tube until all the extract is separated. Each fraction was analyzed by TLC, the fractions that have same spot were combined into one and then phytochemical test was performed again [10].

3) Identification of Secondary Metabolites

The compound of the result of isolation products on the chromatographic column was identified using a spectrophotometer FTIR and 1H-NMR

B. Activity Test of J. multifida L extract toward Leukocytes of Mice

Male mice were imported from IPB Bogor. Mice were adapted in a cage with lighting of 12 hours (06:00 to 6:00 p.m.), at the room temperature ranges from 23.6 °C -26 °C

1) Conversion Dose

a) The dose of J. multifida L. extract in this study was adjusted for research of platelets. The dose of J. multifida L. extract that given to the mice was 0.028 g / kgbw, 0.056 g / kgbw b, and 0.084 g / kgbw [11]. By converting the average weight of mice was 30 g, so then the extract J. multifida L. given to the mice in a sequence were 0.84 mg, 1.68 mg, and 2.52 mg.

b) The dose Imunos and Prednikson in this study were adjusted for Imunos and Prednikson consumption by adults at a dose of 0:01 g / kgbw; to mice with an average weight 30 g, dosages imunos and prednikson used was 0.3 mg respectively.

2) Provision of treatment
Male mice were healthy weighing from 20-50 g, ageing from 7-12 weeks, during the maintenance, the change of the weight was not exceeded higher than 10% and visually indicates normal behavior. A total of 25 mice were divided into five groups, namely P0 (positive control) was given orally with sesame oil 0.3 mL/30g bw, once a day for 3 days. P1 (control negative) was given imunos in the dose of 0.01 g/kg bw, once a day for 2 days. P2 was given imunos with the dose of 0.01 g/kg bw, once a day for 2 days; on the third day, P2 was given prednikson with the dose of 0.01 g/kg bw. P3, P4 and P5 (treatment) were given imunos with the dose of 0.01 g/kg bw, once a day for 2 days, followed on day 3 with J. multifida L. extract with the dose of 0.028 g/kg bw, 0.056 g/kg bw and 0.084 g/kg bw, after 24 hours of administration of day 3, each of the mice were examined the number of Leukocytes using a hemocytometer and binocular microscope.

3) The Calculation of The Number of Leukocytes in Mice
Tail of the mice was cut 0.2 mm, the blood was taken using a hemocytometer to count the leukocytes [12].

C. Development Module
The results of this laboratory study were used as learning resources that were packaged in a module. The module was developed using the approach to Research and Development (R & D), of a model of Borg and Gall. The resulting module was used at learning chemistry of Natural Products for students of Chemical Education.

III. RESULTS AND DISCUSSION
The isolation of secondary metabolites were preceded by phytochemical test to extract J. multifida L., followed by isolation and testing activities in reducing the number of leukocytes in leukocytic mice. The results of this study were used as learning resources that were packaged in the form of modules for learning chemistry of natural products.

A. Isolation of Secondary Metabolites
Phytochemical test is performed to determine the content of secondary metabolites present in the extract J. multifida L. phytochemical test results for each fraction are presented in Table 1.

<table>
<thead>
<tr>
<th>Test</th>
<th>Flavonoids</th>
<th>Saponins</th>
<th>Tannins</th>
<th>Steroids</th>
<th>Terpenoids</th>
<th>Alkaloids</th>
</tr>
</thead>
<tbody>
<tr>
<td>n-hexane fraction</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ethyl acetate fraction</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ethanol fraction</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Description: (-) = not detected (+) = content, (+++) = very strong content
Based on the data in Table 1, it can be seen that in the ethyl acetate fraction contained stronger flavonoids, therefore, the separation and purification of secondary metabolites using TLC and column chromatography were carried out on the ethyl acetate fraction.

Separation techniques in chromatography columns were preceded by the election of the eluent by TLC. The election of eluent with TLC was performed by trial and error method, ethyl acetate fraction was spotted.
on TLC and then was eluted with a mixture of n-hexane and ethyl acetate at various ratio (v / v), 10: 0, 8: 2, 6: 4, 4: 6, 2: 8 and 0:10, followed by a solvent mixture of ethyl acetate and ethanol (v / v) in various variations of the same comparison. Pattern separation spot of elution results were observed using UV light at a wavelength of 366 nm. Results of eluent election by TLC were presented in Table 2.

**TABLE 2. PATTERNS OF SAMPLE SEPARATION, ELUTION RESULTS ON TLC**

<table>
<thead>
<tr>
<th>Eluent</th>
<th>Ratio (v/v)</th>
<th>Number of spot</th>
</tr>
</thead>
<tbody>
<tr>
<td>n-hexane : ethyl acetate</td>
<td>10:0</td>
<td>1 spot</td>
</tr>
<tr>
<td></td>
<td>8:2</td>
<td>1 spot</td>
</tr>
<tr>
<td></td>
<td>6:4</td>
<td>1 spot</td>
</tr>
<tr>
<td></td>
<td>4:6</td>
<td>1 spot</td>
</tr>
<tr>
<td></td>
<td>2:8</td>
<td>1 spot</td>
</tr>
<tr>
<td></td>
<td>0:10</td>
<td>4 spot</td>
</tr>
<tr>
<td>ethyl acetate : ethanol</td>
<td>10:0</td>
<td>4 spot</td>
</tr>
<tr>
<td></td>
<td>8:2</td>
<td>2 spot</td>
</tr>
<tr>
<td></td>
<td>6:4</td>
<td>6 spot</td>
</tr>
<tr>
<td></td>
<td>4:6</td>
<td>3 spot</td>
</tr>
<tr>
<td></td>
<td>2:8</td>
<td>2 spot</td>
</tr>
<tr>
<td></td>
<td>0:10</td>
<td>1 spot</td>
</tr>
</tbody>
</table>

By observing the highest number of spots with the widest distance between separated spots, therefore, the mixed eluent was used as the basis for selecting eluent for use in purifying the compound [10]. Based on Table 2, the separation of the sample by using a comparison eluent of ethyl acetate: ethanol (6: 4) obtained 6 spot, therefore, this eluent was set to be used in the purification of flavonoids by column chromatography.

Chromatography column filled with stationary phase silica gel of 60, with a total of 1.0 g of extract *J. multifida* L. in ethyl acetate fraction that was placed on the surface of silica gel, then eluted with n-hexane followed by mixture of n-hexane and ethyl acetate with a degree of polarity that different and topped 100% ethyl acetate, and then followed by elution using a solvent mixture of ethyl acetate and ethanol with different polarity level and ending with 100% ethanol. Eluate coming out of column chromatography accommodated in the tube. Each eluate in tube separation pattern observed by TLC with eluent mixture of ethyl acetate: ethanol (6: 4). Based on the TLC separation pattern obtained four groups fraction: A, B, C and D, the test of phytochemicals was repeated, in particular test of flavonoids, group fraction C was positive contains flavonoids, so this group was set to characterized using FTIR (specification IR Prestige-21 Shimadzu) and ¹H NMR (JNM ECA-500). FTIR data and interpretation of spectra of isolated compounds are tabulated in Table 3.

**TABLE 3. INTERPRETATION OF THE DATA FTIR OF ISOLATED COMPOUNDS EXTRACT J.MULTIFIDA L.**

<table>
<thead>
<tr>
<th>Wavenum (cm⁻¹)</th>
<th>Shape</th>
<th>Band</th>
<th>Intensity</th>
<th>Analysis of functional groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>3429,43 ; 3331,07 ; 3275,13</td>
<td>3700-3100</td>
<td>width</td>
<td>moderate</td>
<td>v O-H free</td>
</tr>
<tr>
<td>2931,80</td>
<td>3000-2720</td>
<td>sharply</td>
<td>moderate</td>
<td>v C-H aliphatic</td>
</tr>
<tr>
<td>1656,85; 1649,14 and 1585,15</td>
<td>1650 + 1600</td>
<td>sharply</td>
<td>stronger</td>
<td>v R:C=CR', (conjugation with C=O lowers C=C frequencies by about 30 cm⁻¹, raises λ)</td>
</tr>
<tr>
<td>1508,33</td>
<td>1600-1500</td>
<td>sharply</td>
<td>moderate</td>
<td>γ C=O Aromatic</td>
</tr>
<tr>
<td>1267,23 and 1222,87</td>
<td>1260-1000</td>
<td>width</td>
<td>Weak</td>
<td>γO-H</td>
</tr>
<tr>
<td>1124,50 and 1037,70</td>
<td>1260-1030</td>
<td>sharply</td>
<td>moderate</td>
<td>γC-O</td>
</tr>
<tr>
<td>831,32</td>
<td>840-790</td>
<td>sharply</td>
<td>Weak</td>
<td>γ R:C=CR-H</td>
</tr>
</tbody>
</table>

Description: v = stretching, γ = bending

Interpretation of the data obtained by ¹H-NMR spectrum of ¹H-NMR δH (ppm) from 0.8853 to 0.8944; 1.1629 to 1.1901; 1.2200 to 12.455; 1.2771 and 1.3225. Peak δH (ppm) = 1.0 ppm is C-CH₃ proton raminosa
(doublet width), peak δH (ppm) = 1.9646 and 2.0138 ppm is C-CH₃ aromatic proton. Furthermore, the peak δH (ppm) = 3.3485; 3.4925 to 3.5379; and from 3.5781 to 3.6663 is a proton ramnoglukosil. Peaks at δH (ppm) from 3.7662 to 3.8803 is a proton methoxyl (-OCH₃). Peak δH (ppm) from 4.0736 to 4.1164 is ramnosil proton H-1 and the δH (ppm) from 6.6665 to 6.900 and 6.9013 to 7.0154 indicates proton rings A and B [14].

Based on the FTIR spectrum analysis and 1H-NMR concluded that the isolated compounds are flavonol glycosides look at the structure in Fig. 2. Determining accurate structure still needs to be identified further by using a spectrophotometer 13C-NMR and mass spectrophotometer.

![FIGURE 2. FLAVONOL GLYCOSIDES [15]](image)

**B. Activity Test of the Extract J. multifida L on Leukocytes Mice**

*J. multifida* Lstem. was dried in a room that was not exposed to direct sunlight, drying was intended to reduce the water content, stop the enzymatic reaction and prevent fungal growth [16]. Samples were dried, mashed into powder, and then macerated using 96% ethanol for 10 days, stirring periodically. During the maceration process, solvent penetrated to the cell wall and into the cavity of the cell, the flavonoids in cell cavities because of differences in concentration between the solution inside the cell and outside the cell, and then the more concentrated solution will be crowded out. These events were repeated so that a proper balance between the solution concentration outside and inside the cell [17]. *J. multifida L.* that has been macerated, was then filtered and the filtrate obtained is evaporated using a rotary evaporator, to be tested against the number of leukocytes in mice. Based on the test results of the activity of leukocytes obtained the results as shown in Table 4 [18].

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean ± SD 10³/mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>P(0) Sesame oil</td>
<td>5</td>
<td>9.830 ± 0.936</td>
</tr>
<tr>
<td>P(1) Imunos 0.01 g/kgbw</td>
<td>5</td>
<td>16.250 ± 4.608</td>
</tr>
<tr>
<td>P(2) Imunos 0.01 g/kgbw + Prednikson 0.01g/kgbw</td>
<td>5</td>
<td>8.070 ± 1.148</td>
</tr>
<tr>
<td>P(3) Imunos 0.01 g/kgbw + extract <em>J. multifida</em> 0.028g/kgbw</td>
<td>5</td>
<td>10.230 ± 2.309</td>
</tr>
<tr>
<td>P(4) Imunos 0.01 g/kgbw + extract <em>J. multifida</em> 0.056g/kgbw</td>
<td>5</td>
<td>7.250 ± 1.571</td>
</tr>
<tr>
<td>P(5) Imunos 0.01 g/kgbw + extract <em>J. multifida</em> 0.084g/kgbw</td>
<td>5</td>
<td>11.540 ± 3.352</td>
</tr>
</tbody>
</table>

Imunostreatment given in group P (1) was able to increase the number of leukocytes in mice above normal conditions (9976-10520 / mm³). Imunos treatment activated special glycoprotein hormone which is analogous to erythropoietin whose functions are to direct the differentiation and proliferation of each cell type [19]. It turns out that imunos induction in mice may lead to infection of the lymph as seen after the mice were dissected, see in Fig 3.
Treatment of prednikson given in group (P2) was able to reduce the number of leukocytes in mice amounted to 8,180 mm$^3$. While treatment of $J. \text{multifida}$ extract at a dose of 0.028 mg / kg bw in group (P3), the dose of 0.056 mg / kg bw in group (P4) and a dose of 0.084 mg / kg bw in group (P5) can result in decreased number of leukocytes in mice amounted 6,020 mm$^3$, and 4,710 mm$^3$ 9,000 mm$^3$. Treatment of $J. \text{multifida}$ L extract at a dose of 0.028 mg / kg bw was the optimum dosage, which can reduce the number of leukocytes in induced imunosmice, until the number of leukocytes in mice approached the normal conditions.

Flavonoid compounds can be inhibitors to the enzyme of topoisomerase DNA of cancer cells [20], this enzyme plays a role in the process of replication, transcription and recombination of DNA, and also the process of proliferation and differentiation of cancer cells, this enzyme is the target of bioactive plants that have anti cancer activity since the inhibited DNA enzyme topoisomerase, the process in the cell are stopped. Based on this tatement, the flavanoid contained in the $J. \text{multifida}$ L extract is able to act as inhibitor toward the DNA topoisomerase enzym of cancer cells.

C. Development Module

The process and results of flavonoid isolation as well as the test of $J. \text{multifida}$ L extract activity in this study were developed into a module. Modules are teaching materials developed with the aim that students can learn independently with or without the direct guidance of a teacher [21]. Module development was done in accordance with the approaches of R & D from Borg and Gall [22], with some modifications. The development phase through which the modules include:

a. Needs module analysis were carried out through the analysis of basic competence, knowledge, skills, attitudes and availability of learning resources. The results of the analysis concluded that it needed the module as a learning resource especially for the isolation of flavonoids and activity test. The topic selection of module was based on the need for additional learning resources in the form of examples applied in addition to the main topics. This module needs analysis followed by analysis of the syllabus as a reference for the development of design modules.

b. Development of module design was done through mapping of competence standards, basic competence, indicators of achievement and the subject matter of secondary metabolites. Competency to be achieved, are (1) explains the basic steps of conducting research of chemical natural product , and isolation of flavonoid compounds, (2) describes how to test the activity of flavonoids. Indicators to be achieved that is capable of describing the step isolation of flavonoids and describing of activity test toward leukocytes. The material consists of two learning activities, namely understanding of secondary metabolites, providing examples of secondary metabolites, describing the stages of isolation of flavonoids and how to test the activity of leukocytes. Systematic of module consists of module title, table of contents, list of figures, list of tables, introduction, prerequisites, instructions how to use the modules, the ultimate goal, competence, ability checks, student learning plans, learning activities, evaluation and bibliography. On learning activities consist of two learning activity that is material of secondary metabolites, isolation of flavonoids and the activity test toward leukocytes. Each learning activities there are tasks, formative tests, answer of formative test, feedback and glossary

c. Validation module includes two parts, that was validation of the module content and validation of test instruments. Validation module was carried out by five experts in the field of education and expert in chemistry. The results of expert validation was tested of similarities and the confidence level of the test
results among the panelists, to see if the five panelists provide nearly the same value. If all five panelists provide an assessment of the same variant, its means the modules that had been developed have good criteria. The assessment results were tested using the intraclass correlation coefficient (ICC). ICC value obtained was 0.829, with the criteria if the ICC ≥ 0.6 then the validation results of these experts can be trusted. Validation of instrument tests, validated by experts in the field of education and chemists, the value of ICC validation test instruments is 0.774, this value ≥ 0.6, the results of expert validation for the test instrument can be trusted.

d. Revisions were made in accordance with input from five validator, validation results mention that the modules were arranged is in conformity with the standards of competence, have followed the systematic writing, and the material presented coherently with the right level of depth of the material to be applied to the college student. Improvements have been made in accordance with the validator advice, after the module was repaired, is ready to be used as a learning resource for college student of chemical education.

IV. CONCLUSION

The active compounds which can be isolated from J. multifida L is a glycosides flavanol. Extract of J. multifida L stem on the activity test were able to reduce leukocyte cell of mice with an effective dose of 0.028 g / kgbw. Results of research on the isolation of flavonoid compounds and test activities J. multifida L extract on mice can be developed as a learning resource in the form of modules. The result of the development of the module can be used in learning chemistry of natural product on chemical education college student. Learning to use the modules developed can improve learning outcomes of college student with minimum mastery is 70.

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REFERENCES


APPLICATION OF ICT IN TEACHING THROUGH PERSPECTIVES BIOLOGY EDUCATION LECTURERS

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Abstract—Nowadays, Information and Communication Technology (ICT) has become important thing as new generation in globalization. Not only children, but also younger or older people use ICT in every time and everywhere. As an efforts to maximize using ICT, needed some strategy for integrated ICT in education. Actually, integration of ICT in school or university in Indonesia has been used. Especially in biology education, application of ICT makes students interest. Students can build in their mind about invisible object through technology. They can increase their motivation for learning activity. In other hand, for biology lecturers many benefits of ICT can be takes by them. They can enrich of biology materials sources through ICT without depend on space and time. Moreover, they can modified learning media and also develop teaching materials. The aim of this research is specified in three research question: (1) what ICT application that Biology Education lecturers use in teaching?, (2) how often do they use ITC in teaching?, and (3) how lecturers perspective about ICT?. This research focus on how education biology lecturers in Biology Education of Ahmad Dahlan University use ICT in their teaching and learning process. The research adopt qualitative approach using questionnaires. The result show that the most popular application of ICT is PowerPoint used by lecturers to support face-to-face their lectures. The majority of Biology Education lecturers most frequently use Microsoft Office to support their lecture in every week. The last, 100% lecturers agree that ICT makes learning activity interest and increase students motivation.

Keywords: Application, Information and Communication Technology (ICT), Teaching, Biology Education

I. INTRODUCTION

Today, Information and Communication Technology (ICT) has become important role in globalization. ICT defined by UNESCO as a forms of technology used for creating, displaying, storing, manipulating, and exchanging information [1]. In general, ICT include: computer, software, hardware, social network, internet, and etc.

In education, ICT has been integrated, both in school and university. In biology education, application ICT makes students interest. Students not only acquiring learning resources, but also they can interact and collaborate with their friends more freely. For lecturers, ICT application makes them more easily to control their class, makes enjoy in learning activity and also increase motivation of students.

Many lecturers have high enthusiasm in their application of ICT. Mostly, they use PPT to support their presentation in learning activity. They also use videos as illustrated their materials. Especially in biology, ICT can make materials will be concrete and alive. For example: using videos in teaching digestive process, using animation in teaching absorption of water in roots, and using picture in teaching Chromosome, DNA, and genes.
Ahmad Dahlan University (UAD) is a Muhammadiyah private university in Yogyakarta. In fact, UAD have been significant developments in teaching and learning process. Especially in biology education, lecturers not anymore use conventional methods, but they apply ICT in their learning activity. Although, application of ICT not yet totality, but the lecturer have high appreciate and enthusiasm to apply ICT in their classrooms.

This research review application of ICT in Biology Education, Faculty Teacher Training and Education of Ahmad Dahlan University through perspectives lecturers. The objectives of this research are investigates: (1) using ICT application of lecturers in Biology Education, (2) frequency of ICT application in teaching, and (3) perspectives of Biology Education lecturers on Using ICT. The limitation of this research is only explores ICT application in lecturers perceptions. Moreover, because of this is case study in survey research, the result can’t be generalize with other university.

II. METHODS

The respondent of this research include 10 lecturers of Biology Education of Ahmad Dahlan University from totally 16 lecturers. Samples formed by 6 female and 4 male. Mostly, they come from basic education lecturers. Their ages around 26 to 41 years old and the majority they had teaching experiment approximately less than 2.5 years.

This research use qualitative methods with questionnaires to collect the data. The questionnaires included 15 items with Likert scale and 2 open questions. The items were categorized into three groups: using ICT in teaching, perspectives lecturers about ICT, and the most popular of using ICT in Biology teaching and learning process. The last, questionnaires were categorized and the data was analyzed.

III. RESULT AND DISCUSSION

A. Basic Information

The information background of respondents was describes according to the following variables: gender, specialization, age, number of years in teaching, competent in ICT, own certificate of ICT short courses. Mostly, they are junior lecturers (See Table 1).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>4</td>
<td>40 %</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>6</td>
<td>60 %</td>
</tr>
<tr>
<td>Specialization</td>
<td>Education</td>
<td>5</td>
<td>50 %</td>
</tr>
<tr>
<td></td>
<td>Botany</td>
<td>1</td>
<td>10 %</td>
</tr>
<tr>
<td></td>
<td>Zoology</td>
<td>1</td>
<td>10 %</td>
</tr>
<tr>
<td></td>
<td>Ecology</td>
<td>2</td>
<td>20 %</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>1</td>
<td>10 %</td>
</tr>
<tr>
<td>Age</td>
<td>20-30</td>
<td>6</td>
<td>60 %</td>
</tr>
<tr>
<td></td>
<td>31-40</td>
<td>4</td>
<td>30 %</td>
</tr>
<tr>
<td></td>
<td>41-50</td>
<td>1</td>
<td>10 %</td>
</tr>
<tr>
<td>Number of years in teaching</td>
<td>Less than 2.5 years</td>
<td>4</td>
<td>40 %</td>
</tr>
<tr>
<td></td>
<td>2.5 – 5 year</td>
<td>3</td>
<td>30 %</td>
</tr>
<tr>
<td></td>
<td>More than 5 years</td>
<td>3</td>
<td>30 %</td>
</tr>
<tr>
<td>Competent in ICT</td>
<td>Yes</td>
<td>10</td>
<td>100 %</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0</td>
<td>0 %</td>
</tr>
<tr>
<td>Own certificate of ICT short courses</td>
<td>Yes</td>
<td>5</td>
<td>50 %</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>5</td>
<td>50 %</td>
</tr>
</tbody>
</table>

Table 1 shows that lecturers sample was 10, consist of 6 female (60%) and 4 male (40%). Their ages from 26 to 41. In term of lecturers experience, 40% lecturers had teaching experience less than 2.5 years, 30% lecturers between 2.5 to 5 years, and 30% another had more than 5 years teaching experience. The majority they come from education specialization. The high rate was 100% lecturers competent in ICT. 50% of them had own certificate ICT courses and 50% hadn’t.
B. Frequency of ICT Application in Teaching

Aspect of using ICT developed from 3 categories, agree with Collis & Moonen [1]: learning resources, instructional organization of learning, and communication. Learning resources consist of: websites, education software, videos, education games, and electronic media. Instructional organization of learning include, learning management systems (e-learning), MS Office, and using combination file for making presentation. Category communication, consist of email and social network.

Table 2 presents the frequency using ICT in teaching. First, as learning resources, more than 70% ICT used lecturers in teaching, such as websites, videos, and electronic media. Whereas, education software and education games 50% lecturers did not utilize it, and 20% used with frequency less than once a month. Second, ICT as instructional organization of learning category, more than 90% lecturers using MS Office and making presentation with combine any files type more than once a month. Whereas, e-learning 90% lecturers did not use it in teaching and 10% use one a month. Third, communication category a half of them utilize email as learning support less than one a month and another lecturers 50% use it more often. About 10% lecturers never use social network in teaching, 30% use less than once a month, and 60% more often.

In summary, more than 60% applications of ICT used as learning resources by lecturers to students. Although, some applications of ICT such as education software, e-learning, and education games some lecturers not yet used it, either never or less than once a month. The majority of Biology Education of Ahmad Dahlan University lecturers most frequently use Microsoft Office to support their lecture.

C. Perspectives of Biology Education Lecturers On Using ICT

The opinion of lecturer on using ICT in learning activities is a new innovation in learning styles. More than 80% lecturers agree with application of ICT in teaching. Less than 20% they less agree about using ICT for class controlled, communication achievable with students, and professional as a lecturer.
TABLE 3. PERSPECTIVES LECTURERS ABOUT APPLICATIONS OF ICT

<table>
<thead>
<tr>
<th>No.</th>
<th>Statements</th>
<th>Estimation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Very agree</td>
<td>Agree</td>
</tr>
<tr>
<td>1.</td>
<td>ICT makes learning activities easily understand and interest</td>
<td>Frequency</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Percent</td>
<td>70%</td>
</tr>
<tr>
<td>2.</td>
<td>ICT increase students motivation</td>
<td>Frequency</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Percent</td>
<td>60%</td>
</tr>
<tr>
<td>3.</td>
<td>ICT makes class controlled easier</td>
<td>Frequency</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Percent</td>
<td>40%</td>
</tr>
<tr>
<td>4.</td>
<td>ICT makes communication with students more achieved</td>
<td>Frequency</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Percent</td>
<td>40%</td>
</tr>
<tr>
<td>5.</td>
<td>ICT make me more professional as lecturers</td>
<td>Frequency</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Percent</td>
<td>30%</td>
</tr>
</tbody>
</table>

Note:
- Low agreement
- Medium agreement
- High agreement

Table 3 shows that 100% lecturers agree that ICT makes learning activity interest and increase students motivation. More than 80% they agree that through ICT lecturers can control classrooms and also makes communication more achieved. The last, about 90% lecturers agree that ICT makes them more professional.

D. Using ICT Application of Biology Education Lecturers

In questionnaire also available open question to invite lecturers exploring their experiences use ICT in teaching. Statements made in relation about easy of application and frequently used applications to support learning.

TABLE 4. OPEN QUESTIONS ABOUT ICT

<table>
<thead>
<tr>
<th>Respondents</th>
<th>What applications you use the most easy to support learning activity?</th>
<th>What applications you use most often to support learning activity?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Microsoft</td>
<td>Microsoft</td>
</tr>
<tr>
<td>B</td>
<td>PPT, Excel, Corel Video editor</td>
<td>PPT, Excel, Corel Video editor</td>
</tr>
<tr>
<td>C</td>
<td>PPT</td>
<td>PPT, Videos</td>
</tr>
<tr>
<td>D</td>
<td>PPT, WA</td>
<td>PPT</td>
</tr>
<tr>
<td>E</td>
<td>PPT, Videos</td>
<td>PPT, Videos</td>
</tr>
<tr>
<td>F</td>
<td>Lectora</td>
<td>PPT</td>
</tr>
<tr>
<td>G</td>
<td>PPT, Mind Map</td>
<td>PPT</td>
</tr>
<tr>
<td>H</td>
<td>PPT</td>
<td>PPT</td>
</tr>
<tr>
<td>I</td>
<td>PPT</td>
<td>PPT, Videos</td>
</tr>
<tr>
<td>J</td>
<td>PPT</td>
<td>PPT with combination</td>
</tr>
</tbody>
</table>

Table 4 shows that PPT (PowerPoint) was popularly utilized by lecturers. More than 80% of lecturers said that PPT was the most applications easily to support face-to-face in learning activity. Not only PPT, some lecturers also use videos to support their lecture. Especially in Biology, videos makes lesson more alive and interest. Others applications, e.g. MS excel, lectora, mind map, corel video editor, and Microsoft used of some lecturers to support their teaching with low percentage around less than 10% (See Fig.1).
Figure 1 show that, PowerPoint is the most application used by Biology Education lecturers of Ahmad Dahlan University. Because of the contain program of PowerPoint not too different with another Microsoft Office (MS World or MS Excel), so PowerPoint reputed as an easy application for them. So, lecturers not need courses first to use it.

A PowerPoint presentation is a complex mixture of text, graphics, explanations, advanced software feature and real-time interaction with the audience [2]. The purpose of using PowerPoint presentations are to support lecturers by highlighting key points, to stimulate interest by using of clipart and cartoons, and display assignment information [3].

PowerPoint have effect in many term, such as support a learning process of student [2]; increase students motivation [4]; and self-efficacy and the academic successes of students. Moreover, PowerPoint was found have an impact on short-term memory when designed appropriately, but was found PowerPoint have no impact on long-term memory of students [2].

In fact, the quality of the PowerPoint presentation is depends on the maker. Of course, presentations which are prepared well will have a positive effect on learning. Although, the principles that need for making PowerPoint presentations are undefined, the lecturers must pay attention how to make presentations well. General principles for making presentations with PPT such as how to use of text (size, type, themes, color, etc.); how to make slide design (template themes, color, effect, etc.); slide transition; slide animation; videos or audios insert in slide; and etc. Moreover, the materials contain must appropriate with basic competences, learning objectives, and students characteristics.

Study was investigated by Açikalin [5], that Biology and Chemistry teachers most widely use PowerPoint slides in their instruction while physics teachers most widely used blackboards. In other hand, Biology teachers also use videos and textbooks. The reason for this discrepancy probably may come from their beliefs that PowerPoint is more appropriate depending on the content taught.

Moreover, there is one interest and crucial question. It’s about “does ICT have effects on learning outcomes”? Actually, the evidence of the impact of ICT is still inconsistent [6]. In fact, using ICT also cause negative and positive effect. It depends on many factors, such as: how to design and use ICT interest, how about characteristics content materials, how about characteristics of students, how expectation of basic competences, how to combine ICT with another software, and also how teacher to teach. So, ITC has not been to transform in education, but to support the teaching practice. Agree with Ilomaki [6], that ICT is not just a tool to be adopted as such in the prevailing situation, but it has effects on several factors, like teacher’s role, teaching practices, student’s collaboration, and learning tasks.

Similar study investigate about ICT come from Nguyen[1], that ICT applications as learning resources and communication to support Physics learning (except e-mail) were not regularly used by the lecturers. MS PowerPoint and some Physics simulation software, which belonged to the instructional organization of learning category, were very commonly and frequently used in Physics courses in the selected Vietnamese Universities.
The pedagogy behind the use of MS PowerPoint and the software was stimulates and help students visualize Physics phenomena and experiments.

The finding of this research showed that ICT were implemented in teaching and learning in Biology Education of Ahmad Dahlan University. In many university lecturers was correct, that they should be utilized information technology, in order to follow of globalization development and also to increase the efficiency, the integrity, and the quality of the education provided. Especially in Biology Education, prospective Biology teachers must able making presentations and presenting well because they will be a teacher in future. Recall that development of science and technology will be more sophisticated and rapid.

IV. CONCLUSION

Based on the finding of research, the conclusion that:
1. The most popular application used of Biology Education lecturers is PowerPoint.
2. The frequency of lecturers using ICT in teaching is generally 90% lecturers using MS Office every week.
3. The perspectives lecturers about ICT that ICT makes learning activities interest and increase students motivation.

ACKNOWLEDGMENT

Thanks to Biology Education lecturers of Ahmad Dahlan University on the willingness and hard work.

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[6] Liisa Ilomäki, “The Effects of ICT on School: Teachers’ and Students’ Perspectives”. Department of Teacher Education University of Turki, Published, 2008.
DEVELOPING WORKSHEETS BASED ON SCIENTIFIC CREATIVITY IN FUNDAMENTAL PHYSICS COURSE

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Abstract--The goals of this study are to develop worksheets that valid and effective to improve students’ scientific creativity in fundamental physics course. Designs of this development are include preliminary research, prototype phase, and assessment phase. The pilot study of worksheets was carried out by 30 students of Physics Education FKIP at Lambung Mangkurat University Banjarmasin in March to July 2016. Data collected from validation by experts of physics learning, tests, and qualitative descriptive analysis. Data were analyzed by descriptive quantitative and qualitative Design of worksheets include identity, learning indicators, necessary of creative learning, creatively problem finding, creatively experiment designing, creatively science problem solving, and strengthening scientific creativity. The validation results of worksheets include design, format, content, language, presentation, support innovation and learning quality in a highly valid criterion. It is developed according to the needs and logically arranged by decree of renewal of scientific knowledge. A lot of students’ scientific creativity (creatively problem finding, creatively experiment designing, and creatively science problem solving) those have creative criteria/highly creative criteria. And increasing students’ scientific creativity before and after the learning process as many as 57% is in high criteria, 43% are in the middle criteria, and no students in the less criteria. The conclusion is the worksheet that developed in this research, valid and effective to improve students’ scientific creativity in fundamental physics course.

Keywords: scientific creativity, worksheets, fundamental physics course

I. INTRODUCTION

Modern society requires creativity to solve problems [28][1], and adapt to new demands in a flexibly [8][2]. Creativity involves the production of new ideas and unusual, as well as thinking about unique solutions to solve the problem [5][3], [22][4], [27][5], [10][6], [17][7], [1][8], [2][9]. Creativity related to physics learning, known as scientific creativity [17][7]. Scientific means that the creativity must be tested through the evidence of observation or experiment [18][10]. Scientific are specific needs of scientific creativity [10][6]. Scientific creativity can be defined as the ability to use scientific knowledge and skills to produce a certain product that is original and has certain social or personal value. It is concerned with creative science experiments, creative problem finding and solving, and creative scientific activity [9][11], [10][6], [23][12].

Development of scientific creativity in the physics learning involves the interaction to generalization hypothesis, experimental design, and evidence evaluation [17][7], [1][8]. Generalization hypothesis involves students to formulating hypotheses, which derived from previous knowledge or from experimental data, and then verify the rationality of hypotheses to be investigated. Experimental design involves students when designing and implementing the right experiment to prove or disprove the hypothesis. The evidence evaluation is done by verifying the agreement between theory and the results of the investigation. Physics Learning involving as many possible questions that encourage students to use their creative ideas, give a challenge, create a fun atmosphere during learning activity, notice the difference as a profit not a problem, appreciate every products of imagination (students’ vision in the future, new ideas, solutions provided, experiments were conducted, they understood better exploration, etc.), see the mistakes as a part of learning process to create change towards success, do the innovations to
existing products by accept suggestions and criticism bravely.\cite{12}\cite{13}. Investigation based learning and a variety of fun activities, that aim to empower and motivate students to control the learning process itself \cite{14}\cite{14}.

The development of scientific creativity in the physics learning at Universitas Lambung Mangkurat Banjarmasin tends to be ignored until now. It’s because the learning process is still oriented on products \cite{25}\cite{15}. Students did not understand the usage of the physics concept for something unusual. The students also get the difficulties when using the physics concept to improve product quality and design products more creative \cite{11}\cite{16}. Therefore, the goals of this study are to develop worksheets that valid and effective to improve students’ scientific creativity in fundamental physics course. Development of scientific creativity is adapted The Scientific Structure Creativity Model \cite{9}\cite{11}. It includes creatively problem finding, creatively experiment designing, and creatively science problem solving. Creatively problem finding is to measure the degree of sensitivity to science problems. It to raise new questions, new possibilities from a new angle, requires imagination and is necessary to make real advances in science. Creatively experiment designing is to design an experiment creatively include formulating a hypothesis, identify variables, making the operational definition of variables, designing data tables, and designing experimental procedures. Creatively science problem solving to measure ability of creative science problem solving.

II. METHODOLOGY

A. Research Design

Designs of this development are include preliminary research, prototype phase, and assessment phase. Worksheets, that were developed, get validation by experts of physics learning and then modeling at 48 students of Physics Education FKIP at Universitas Lambung Mangkurat Banjarmasin. The goal of modeling is to provide a direct experience to the lecturers’ models, and also knowing the constraints worksheets during the worksheets is used in the classroom. Further lecturers models conduct the pilot study of worksheets. The pilot study used a one group pretest posttest design. It was carried out by 30 students of Physics Education FKIP at Universitas Lambung Mangkurat Banjarmasin in March to July 2016. The learning activity is began with a pretest, training scientific process skills as a provision for prior knowledge students. Implementations of learning with worksheets based on scientific creativity are finished by a posttest. Data were analyzed by descriptive qualitative. The average score of the results of the expert assessment adjusted to include the validation assessment criteria are highly valid, valid, less valid, and invalid. The pretest-posttest results were classified based on the criteria of scientific creativity is highly creative, creative, less creative and uncreative. Increasing scientific creativity is determined based on the value of n-gain with the criteria of high, middle, and low.

B. Worksheet Description

Worksheet that based on scientific creativity is developed on the electricity and magnetism subject. The development of worksheets considered the metacognitive skills theory, theory of complex cognitive process, constructivism, and scaffolding. Scaffolding can help students gain experience in solving ill-defined problem \cite{6}\cite{17}. Worksheet 1: Current and Resistance and Worksheet 2: Direct Current Circuits, used in the early learning and is designed to use the full scaffolding (lecturer’s helps have written clearly and completely in worksheet). The worksheet is used at the 1st and 2nd meeting for teach scientific creativity step by step and the autonomy of the students are still low. Worksheet 3: Magnetism is used for 3rd meeting. Scaffolding began to be reduced and began to eliminate some explanations. Students learn to use the scientific creativity automatically learn by direct experience, and internalize standards of behavior. Worksheet 4: Faraday’s Law, Worksheet 5: Alternating Current Circuits, and worksheet 6: Power in an AC Circuits used at 4th, 5th, and 6th meeting. Students are given greater responsibility for developing scientific creativity in solving a given problem.

Each worksheet outline consists of seven parts. First, the identity of the worksheet includes student group identity (name, student identity number, groups, and semester), meetings, and material to be learned. Completeness identity will make lecturers can perform the evaluation easily. It also made easily follow-up on the results of scientific creativity and learning process that has been done by the students. Second, learning indicators, the expected results after the students following the learning process. Well-defined indicators will clarify these expectations in the form of performance/performance of students were measured and observed. Indicators developed learning is to apply scientific creativity in solving
physics problems. Third, the necessary of creative learning. Students more likely to think creatively if the learning environment to able to stimulate and encourage independent thought [15][18]. Clarity of presentation tools and materials as well as the media is helping students to recognize various experimental variables that support investigative activities to be undertaken. Fourth, creatively problem finding. A science problem is an issue or problem situation related to science [4][19]. Problems playing a major role in the advancement of science. It because the problem leads to the growth of science and encourage scientific investigation [13][20]. The problem that developed was Ill-defined problem, that the problem of loosely formulated in order to produce some of the strategies and solutions [15][18]. This four phases intended to improve problem finding. Students are expected to be able to imagine the way to finding a relationship between variables. The variables can be written or not written even in its application in everyday life. So students can write as much as possible formulation of the problem to be investigated using tools and materials or media PhET available within five minutes. Fifth, creatively experiment designing. This stage has the main goal of improving creatively experiment designing. Students are asked to select one formulation of the problem that has been written in the previous stage. And the student asked to design an experiment creatively include formulating a hypothesis, identify variables, making the operational definition of variables, designing data tables, and designing experimental procedures correctly. Sixth, creatively science problem solving. This stage has the main goal of improving creatively science problem solving. Students are given the opportunity to carry out experiments based on the design of experiments that have been made in the previous stage. Students do documentation for every performed activity and recorded information is found in the design of observational data tables that have been made. Students also analyze the observed data and then compare it with the study of theory or the theory of computation. So it can draw conclusions accordingly. Seventh, strengthening of scientific creativity. This stage aims to strengthen the scientific creativity of students. Students are asked to relearn indicators of scientific creativity with examples of test items, then given the responsibility to make two test items scientific creativity and solutions with appropriate indicators of the division of tasks given group. In addition, each group was asked to present the group's work in front of the class. Moreover, added the bibliography as a major reference in the development of the worksheet.

III. RESULTS AND DISCUSSION

The validity of worksheet based scientific creativity indicates a worksheet quality measures to provide convenience to the lecturers in teaching the scientific creativity of students in fundamental physics course. The results of worksheet validation are presented in Table 1.

<table>
<thead>
<tr>
<th>No</th>
<th>Component</th>
<th>W1</th>
<th>W2</th>
<th>W3</th>
<th>W4</th>
<th>W5</th>
<th>W6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Score</td>
<td>Exp</td>
<td>Score</td>
<td>Exp</td>
<td>Score</td>
<td>Exp</td>
<td>Score</td>
</tr>
<tr>
<td>1</td>
<td>Design</td>
<td>3.74</td>
<td>HV</td>
<td>3.81</td>
<td>HV</td>
<td>3.78</td>
<td>HV</td>
</tr>
<tr>
<td>2</td>
<td>Format</td>
<td>3.93</td>
<td>HV</td>
<td>3.93</td>
<td>HV</td>
<td>3.87</td>
<td>HV</td>
</tr>
<tr>
<td>3</td>
<td>Content</td>
<td>3.78</td>
<td>HV</td>
<td>3.83</td>
<td>HV</td>
<td>3.83</td>
<td>HV</td>
</tr>
<tr>
<td>4</td>
<td>Language</td>
<td>4.00</td>
<td>HV</td>
<td>4.00</td>
<td>HV</td>
<td>4.00</td>
<td>HV</td>
</tr>
<tr>
<td>5</td>
<td>Presentation</td>
<td>3.47</td>
<td>HV</td>
<td>3.47</td>
<td>HV</td>
<td>3.93</td>
<td>HV</td>
</tr>
<tr>
<td>6</td>
<td>Support innovation and learning quality</td>
<td>3.76</td>
<td>HV</td>
<td>3.76</td>
<td>HV</td>
<td>3.81</td>
<td>HV</td>
</tr>
</tbody>
</table>

Reliability criteria: Reliable, Reliable, Reliable, Reliable, Reliable, Reliable

Note: W = Worksheet, exp = explanation, HV = Highly Valid

Table 1 shows that the results of the validation of each worksheet includes the aspects of design, format, content, language, presentation, support innovation and the quality of learning activities to get the assessment criteria are very valid and reliable. Development of worksheet has complied with all aspects of assessment, namely: (1) design, including identity, learning indicators, necessary of creative learning, creatively problem finding, creatively experiment designing, creatively science problem solving, strengthening scientific creativity, and a bibliography, (2) format, each section of the worksheet is identified clearly, the material relevant to the purpose of each activity, the numbering system is clear and compelling, balanced text and illustrations, the physical size appropriateness for students, and the level of attractiveness of the worksheet visually, (3) material, using a reference standard book, the truth of the content (facts, principles, concepts, laws, theories, and scientific processes), recency of the content,
maintaining linkage content worksheet with implementation in education, systematic corresponding structure of science, and relevant to the curriculum of higher education, (4) language, using the Indonesian language is good and right, the term is used appropriately and easily understood, using a term steady, and using language communicative and effective, (5) the presentation, can teach process skills, critical thinking, and scientific creativity in accordance with the level of thinking and reading skills of students and lecturer in physics, encouraging students to be actively involved, as well as the presentation of interesting and fun, and (6) to support innovation and improve the quality of learning activities, worksheets according to the higher education curriculum, emphasis on the application of education the real world, supporting active learning, facilitate the development of scientific creativity and problem solving, utilizing the media usage of ICT, support learning activities tinged learning to know, learning to do, learning to be yourself, and learn to live by togetherness. Means worksheet based scientific creativity is developed according to the needs and logically arranged by decree of renewal of scientific knowledge, so it is valid to be used in fundamental physics course.

The effectiveness of worksheet shows the achievement of the students’ scientific creativity before and after the learning process is presented in Figure 1.

![Figure 1. The Analysis Of Scientific Creativity](image)

Figure 1 shows that of 30 students who can complete the test scientific creativity in the criteria of creative/highly creative in the indicators of creatively problem finding as many as 3 students; creatively designing experiment as much as 1 students, and creatively science problem solving as many as 6 students. It means the most of student are still difficulties in creatively problem finding, creatively experiment designing, creatively science problem solving. Implementation of learning can increase the number of students who meet the criteria are highly creative/creative, indicators of creatively problem finding as many as 18 students, creatively experiment designing as many as 26 students, and creatively science problem solving as many as 27 students. The increasing students’ scientific creativity before and after the learning process by worksheet based on scientific creativity as many as 57% are in high criteria, 43% are in the middle criteria, and no students in the low criteria. The process of learning with worksheet based scientific creativity to make the most of the students can complete the test criteria of scientific creativity in creative/highly creative, although there are 12 students who have difficulty in creatively problem finding. Student been able to formulate the problem by using variables that are written in the given equation, but some students are still having trouble connecting in common with everyday problems. Some students also still get difficulty distinguishing the formulation of the problem with research questions. The learning process is said to be effective if the learning outcomes achieved graduates are effective with emphasis on internalizing the material is good and right in the optimum time [20][21].

IV. CONCLUSION

Worksheet based on creativity is developed to give an easy ways for lecturer during teaching of scientific creativity of students in fundamental physics course. Scientific creativity is adapted The Scientific Structure Creativity Model [9][11], includes creatively problem finding, creatively experiment designing, and creatively science problem solving. Design of worksheets include identity, learning indicators, necessary of creative learning, creatively problem finding, creatively experiment designing, creatively science problem solving, and strengthening scientific creativity. Learning worksheets based scientific creativity begins with science process skills training. Scientific creativity must depend on scientific knowledge and skills [9][11], [15][18]. The validation results of worksheets include design, format, content, language, presentation, support innovation and learning quality in very valid criteria. Means worksheet based on scientific creativity is developed according to the needs and logically arranged...
by decree of renewal of scientific knowledge, so it is valid to be used in fundamental physics course. The results show that a lot of students' scientific creativity (creatively problem finding, creatively experiment designing, and creatively science problem solving) those have creative criteria/highly creative criteria, but some students are less creative in creatively product design. And increasing students’ scientific creativity before and after the learning process by worksheet based on scientific creativity as many as 57% are in high criteria and 43% are in the middle criteria. This worksheet supporting the implementations Indonesian National Qualifications Framework and National Standards for Higher Education, in which the learning process in higher education should provide space for the development of creativity, initiative, personality, independence in looking for and finding knowledge, and to produce graduates competence creative accordance of demands of the 21st century [21][22], [19][23], [20][21]. Recommendations for further research are increasing creatively problem finding.

ACKNOWLEDGMENT

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REFERENCES


A. Indikator Pembelajaran
Menerapkan kreativitas ilmiah (creatively problem finding, creatively experiment designing, creatively science problem solving) dalam menyelesaikan masalah arus listrik dan hambatan.

B. Kebutuhan Belajar Kreatif
Diskusikan berbagai kebutuhan belajar kreatif meliputi alat dan bahan beserta media PhET yang disediakan di bawah ini.

KIT 1: Arus Listrik dan Hambatan

Media PhET: Circuit-construction-kit-dc_in

C. Menemukan Masalah secara Kreatif

Masalah dirumuskan dalam bentuk kalimat tanya terbuka dan secara spesifik (mengandung 1 variabel manipulasi dan 1 variabel respon), dan dapat diuji melalui penyelidikan.

Kamu diberikan waktu tiga menit: Tuliskan sebanyak-banyaknya rumusan masalah yang mungkin untuk diselidiki dengan menggunakan alat dan bahan atau media PhET yang tersedia (problem finding ……………………………………………………………………………………….…………………………………………………….………)

D. Mendesain Eksperimen secara Kreatif

Kamu diberikan waktu sepuluh menit:

1. Rumusan Masalah yang Ingin Diselidiki

2. Rumusan hipotesis

Hipotesis adalah suatu prediksi berdasarkan pengamatan yang dapat diuji atau jawaban sementara dari rumusan masalah. Hipotesis dirumuskan dalam bentuk suatu pernyataan, jika (variabel manipulasi) maka (variabel respon).

Beatlah rumusan hipotesis untuk menjawab rumusan masalah yang kamu pilih!

3. Identifikasi Variabel

Variabel adalah suatu besaran yang dapat bervariasi atau berubah pada situasi tertentu. Identifikasi variabel meliputi variabel manipulasi (variabel yang sengaja diubah peneliti), variabel respon (variabel yang menggambarkan perubahan akibat pemanipulasi variabel manipulasi), dan variabel kontrol (variabel yang dapat mempengaruhi suatu hasil penelitian tetapi dijaga agar tidak memberi pengaruh hasil penelitian).

Lakukan identifikasi variabel terhadap rumusan hipotesis yang sudah kamu buat!

Variabel manipulasi (Apa yang kamu ubah): ………………………………………………………………………………………

Variabel respon (Apa yang kamu amati atau ukur): ……………………………………………………………………………

Variabel Kontrol (Apa yang kamu jaga supaya kondisinya sama): ………………………………………………………………………

4. Definisi Operasional Variabel
Definisi operasional variabel adalah pernyataan yang mendeskripsikan bagaimana variabel tertentu harus diukur atau bagaimana suatu benda/kondisi harus dikenali.

Buat definisi operasional terhadap variabel-variabel yang sudah kamu identifikasi!

Definisi Operasional Variabel Manipulasi (Bagaimana kamu mengubahnya):

Definisi Operasional Variabel Respon (Bagaimana kamu mengukurnya):

Definisi Operasional Variabel Kontrol (Bagaimana cara kamu mengontrolnya):

5. Merancang Tabel Data Pengamatan

Tabel data adalah susunan informasi terorganisasi dalam baris-baris dan kolom-kolom. Merancang tabel data dilengkapi judul tabel data pengamatan, mengandung 1 variabel manipulasi dan 1 variabel respon, dan menggunakan satuan sesuai alat ukur yang digunakan.

Rancanglah tabel data pengamatan untuk mencatat data hasil pengamatan yang akan kamu lakukan!

6. Merancang Prosedur Eksperimen

Prosedur eksperimen adalah suatu deskripsi langkah demi langkah tentang bagaimana mengubah variabel manipulasi dan mengamati pengaruh-pengaruhnya terhadap variabel respon.

Rancanglah prosedur eksperimen untuk menguji rumusan hipotesis yang kamu buat!

E. Pemecahan Masalah Sains secara Kreatif

Laksanakan eksperimen untuk mendapatkan informasi yang diperlukan dan catatlah hasilnya pada tabel pengamatan yang telah kamu buat sebelumnya, kemudian bacalah berbagai referensi untuk membantu menganalisis data secara akurat dan mendalam, serta menarik kesimpulan dengan tepat.

1. Melaksanakan eksperimen

Eksperimen dilaksanakan untuk mengumpulkan data-data yang diperlukan dalam menguji hipotesis. Data hasil eksperimen dapat berupa data kuantitatif atau data kualitatif.

Dokumentasi Kegiatan (gambar kegiatan)

2. Analisis data

Menganalisis data adalah menjelaskan atau mengartikan data yang diperoleh dari hasil eksperimen. Menganalisis data dilakukan dengan cara membandingkan atau mencari kecenderungan dari data yang dianalisis, serta mengevaluasi kesesuaian hasil eksperimen dengan teori/perhitungan secara teori.

Lakukan analisis berdasarkan data yang telah kamu peroleh!

Lakukan analisis secara teori atau perhitungan secara teori!

3. Kesimpulan

Kesimpulan adalah penegasan bahwa hipotesis diterima atau ditolak, kemudian diberikan ikhtisar secara singkat dan jelas

Buatlah kesimpulan berdasarkan hasil analisis data yang telah kamu lakukan!

Hipotesis ……………………………………………………………………………………….……………………………………………………………

F. Pemantapan Kreativitas Ilmiah

Pelajari indikator kreativitas ilmiah beserta contoh butir tesnya di bawah ini!

1) Creatively problem finding: Tingkat kepekaan terhadap masalah-masalah sains.


2) Creatively experiment designing: Mendesain eksperimen secara kreatif


3) Creatively science problem solving: Pemecahan masalah sains secara kreatif.

Contoh Butir Tes: Kamu diberikan waktu lima menit. Seandainya disediakan sebuah lampu baca, beberapa hambatan, induktor, saklar, sumber DC, dan beberapa kabel. Gambarkan sebanyak mungkin cara yang dapat kamu lakukan untuk membuat lampu baca menjadi lebih serbaguna! Jangan berhenti menulis hingga kamu diminta berhenti. Ketika diminta berhenti maka letakkan pensilmu dan baliklah lembar jawabannya!

Lakukan kerja sama untuk membuat butir tes kreativitas ilmiah dengan indikator sesuai pembagian tugas kelompok berikut ini!
<table>
<thead>
<tr>
<th>Kelompok</th>
<th>Tugas Membuat Butir Tes Kreativitas Ilmiah dengan Indikator …</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 dan 2</td>
<td>Problem finding</td>
</tr>
<tr>
<td>3 dan 4</td>
<td>Creatively product design</td>
</tr>
<tr>
<td>5 dan 6</td>
<td>Creatively science problem solving</td>
</tr>
</tbody>
</table>

Daftar Pustaka
Carson, S. (2011). *Your creative brain, seven steps to maximize imagination, productivity, an innovation in your live.*
EHNANCING TEACHERS’ INFORMATION COMMUNICATION TECHNOLOGY (ICT) COMPETENCIES THROUGH DISTANCE TRAINING

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Abstract—ICT competencies is one of essential competencies for teachers. This study aims to assess the effectiveness of distance training on the improvement of teachers’ ICT competencies. In this study, teachers are given a distance training using ICT. It is expected that such training will improve teacher’s competencies of the content of the training as well as their ICT. This type of research is pre-experimental design. One group pretest-posttest design. The procedure design of this study is measuring on the subject (before distance training) on the ability of Information Communication Technology (ICT) and then the subject is treated for a period of time (exposure) through distance training. 2nd measurement performed after the treatment was given. Measurements taken is participant self-assessment of the ability of ICT. The measurement results before distance training compared with the measurement results after distance training using Paired-samples T test. Paired-samples T test performed after fulfillment of the requirements on data obtained both normal spread. Paired-samples T test results obtained by value \( t = -4.265 \), with a significance level of \( \alpha = 0.05 \) \( t \)-test values obtained \( -4.265 < -1.717 \) and significant value \( 0.000 < 0.05 \), \( H_0: \mu_1 = \mu_2 \) rejected. This shows that “There are significant differences between the ICT skills before and after the distance training”. The conclusion is obtained that through distance training can enhance ICT capabilities Biology Teacher Madrasah Aliyah. Before distance training participants self-assessment of the ability of ICT is in a category able to carry out with the help of others. After implementing the learning through distance training, participants' self-assessment of the ability of ICT is in a category capable of executing independently.

Keywords: Teachers’ Competence, Information Communication Technology, Distance Training

I. INTRODUCTION

The rapid development of science and technology has impacted into various fields including education [3]. When associated with rapid technological developments, of course teachers should be able to anticipate. The same was stated by Carmona and Marin [2], that Information and Communication Technology (ICT) is necessary in modern society, as well as in education to achieve a higher quality education. Teachers play an important role in dealing with this.

The development of technology, especially ICT play an important role in the learning process. Many learning resources that can be obtained through ICT by browsing the internet, or also the use of the computer as a medium of learning. And of course, this requires teachers to master ICT. Learning resources is not only based on teacher but also focused on the environment board (setting) [3]. This condition by using technology as a media that supports learning to accelerate and expand the knowledge and information for learner [3]. The use of interactive multimedia affects the cognitive abilities of students, as in result of research conducted by Aina [1].

There are some advantages of using ICT in education as follows [6]
- The teacher can easily use images in teaching and enhance student’s skills in remembering.
- The teacher can easily explain complex instructions and make it easier for students to understand.
The teacher can create an interactive classroom and make learning more fun that can increase student participation and concentration. Based on the positive impacts of using ICT, then teachers must have the ICT competency to run learning process well. This is analogous with the competence standards that must be possessed by the teachers. The ability of ICT is one capability that should be well posted by the teachers. It is listed in Education Ministry Regulation No. 16 Year 2007 on Teachers Competency Standards. Teachers should be able to take advantage of ICT in learning and teaching their subjects.

II. METHODOLOGY

A. Research Design

This type of research is pre-experimental design one group pretest-posttest design. The procedure design of this study is measuring firstly on the ability of Information Communication Technology (ICT) subjects (pretest) and then the subject is treated for a period of time (exposure) through distance training. Second measurement (posttest) performed after the treatment was given, and comparing the measurement pretest results with the posttest results, using statistical T Paired test with sample pairs. T-paired Test of sample pairs performed after fulfillment of the requirements all data obtained both normal spread. Statistical for normality test using Lilliefors (Kolmogorov-Smirnov) normality test. In addition, it is also use Self-Assessment, beside observation of the training participant’s ability during the long distance learning process.

B. Population and Sample

The population of the research is Madrasah Aliyah Biology teachers. Sampling is purposive which means sample was chose as the subjects based on specific criteria that have been established researcher. The criteria taken under consideration that samples can represent Madrasah Aliyah biology teachers as a population. This is based on the training participants into the sample is representative of the entire Islamic Senior High School Biology teacher who already have adequate teaching experience. Further consideration is based on the fact that the Madrasah Aliyah biology teacher as the training participants are teachers who teach in the district / city that is West Java province, which has characteristics similar to the teachers in the district / city in the other provinces.

These samples consisted of 23 participants of Long Distance Training in Subject of Biology Sciences for Ministry of Religious Affairs of Madrasah Aliyah Teacher from West Java Province at Bandung Religious Training Center in 2016.

C. Research Instrumen

Instruments used in research are measuring proficiency in ICT using self assessment questionnaire and observation sheet activity training participants in the learning process. Instruments adopted from UNESCO ICT competency standar, which involve access, manage, integrate, evaluate, and create. Before use the instrument, validity was tested using the corchan test to view the content validity and face validity. The test result values obtained instruments significant.

Self assessment of measurement results before Distance Training is compared with the measurement results after the Distance Training, using T Paired statistical test with sample pairs. To see the improvement every aspect of ICT skills before and after treatment are calculated by using the average normalized gain score (average N-gain = <g>) by using an equation developed by Hake [4] as follows:

\[ <g> = \frac{G}{Gmax} = \frac{(RTk) - (RAt)}{Smid - (RAt)} \]

To determine the category of the increase in self-assessment as a result of long-distance training program, benchmark interpretation is used of the normalized gain average (<g>) as shown in Table 1 [4].

<table>
<thead>
<tr>
<th>&lt;g&gt;</th>
<th>Increase category</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;0.7</td>
<td>High</td>
</tr>
<tr>
<td>0.3 ≤&lt;g&gt;≤0.7</td>
<td>Medium</td>
</tr>
<tr>
<td>&lt;0.3</td>
<td>Low</td>
</tr>
</tbody>
</table>

Abbreviation:
\[ \langle \text{g} \rangle \quad : \quad \text{The average gain normalized score} \]
\[ \text{G} \quad : \quad \text{The average gain actual score} \]
\[ \text{G}_{\text{maks}} \quad : \quad \text{The average gain ideal maximum score} \]
\[ \text{RT}_k \quad : \quad \text{The average final test score} \]
\[ \text{RTA} \quad : \quad \text{The average beginning test score} \]
\[ I_{\text{mid}} \quad : \quad \text{Ideal Maximum Score} \]

To determine the category of self-assessment and learning activities in ICT skills using the approach Sturges [5]. In this approach, each scored sought intervals using a total score or the average score. For this study used the way by using the total score, are as follows:

Interval of each category are the ratio between range and number of categories.

\[
\text{Range} = \text{maximum score} - \text{minimum score}
\]

Scores for each category of ICT competencies by self-assessment overall can be seen in Table 2.

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unable to perform</td>
<td>30 – 52.5</td>
</tr>
<tr>
<td>Able to carry out with the help of Others</td>
<td>&gt;52.5 – 75</td>
</tr>
<tr>
<td>Able to carry out independently</td>
<td>&gt;75 – 97.5</td>
</tr>
<tr>
<td>Able to carry out independently and develop</td>
<td>&gt;97.5 – 120</td>
</tr>
</tbody>
</table>

Scores for each category of self-assessment of ICT competencies for aspect can be seen in Table 3.

<table>
<thead>
<tr>
<th>Aspects</th>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access</td>
<td>Unable to perform</td>
<td>30 – 52.5</td>
</tr>
<tr>
<td></td>
<td>Able to carry out with the help of Others</td>
<td>&gt;52.5 – 75</td>
</tr>
<tr>
<td></td>
<td>Able to carry out independently</td>
<td>&gt;75 – 97.5</td>
</tr>
<tr>
<td></td>
<td>Able to carry out independently and develop</td>
<td>&gt;97.5 – 120</td>
</tr>
<tr>
<td>Manage</td>
<td>Unable to perform</td>
<td>3 – 4.5</td>
</tr>
<tr>
<td></td>
<td>Able to carry out with the help of Others</td>
<td>&gt;4.5 – 6</td>
</tr>
<tr>
<td></td>
<td>Able to carry out independently</td>
<td>&gt;6 – 7.5</td>
</tr>
<tr>
<td></td>
<td>Able to carry out independently and develop</td>
<td>&gt;7.5 – 9</td>
</tr>
<tr>
<td>Integrate</td>
<td>Unable to perform</td>
<td>2 – 3.5</td>
</tr>
<tr>
<td></td>
<td>Able to carry out with the help of Others</td>
<td>&gt;3.5 – 5</td>
</tr>
<tr>
<td></td>
<td>Able to carry out independently</td>
<td>&gt;5 – 6.5</td>
</tr>
<tr>
<td></td>
<td>Able to carry out independently and develop</td>
<td>&gt;6.5 – 8</td>
</tr>
<tr>
<td>Evaluate</td>
<td>Unable to perform</td>
<td>2 – 3.5</td>
</tr>
<tr>
<td></td>
<td>Able to carry out with the help of Others</td>
<td>&gt;3.5 – 5</td>
</tr>
<tr>
<td></td>
<td>Able to carry out independently</td>
<td>&gt;5 – 6.5</td>
</tr>
<tr>
<td></td>
<td>Able to carry out independently and develop</td>
<td>&gt;6.5 – 8</td>
</tr>
<tr>
<td>Create</td>
<td>Unable to perform</td>
<td>5 – 8.75</td>
</tr>
<tr>
<td></td>
<td>Able to carry out with the help of Others</td>
<td>&gt;8.75 – 12.5</td>
</tr>
<tr>
<td></td>
<td>Able to carry out independently</td>
<td>&gt;12.5 – 16.25</td>
</tr>
<tr>
<td></td>
<td>Able to carry out independently and develop</td>
<td>&gt;16.25 – 20</td>
</tr>
</tbody>
</table>

The hypothesis in this study was ICT competencies of Biology Teacher of Madrasah Aliyah in the Ministry of Religion in West Java increased through distance learning.

### III. RESULT

Study of ICT competence of Biology teacher Madrasah Aliyah within the Ministry of Religion of West Java in 2016 through Distance learning is done through several stages of activity are described in Table 4.

ICT skills are the focus of the study was analyzed based on the results of hypothesis testing. The study hypothesis "The ability of ICT in Madrasah Aliyah Biology teacher in the Ministry of Religious Affairs through Distance Training ".

The research hypothesis is tested through statistical hypothesis testing as follows:

\[ H_0 : \mu_1 = \mu_2 \quad \text{"There is no significant difference between the ability of ICT between before and after the Distance Training"} \]

\[ H_1 : \mu_1 \neq \mu_2 \quad \text{"There are significant differences between the capabilities of ICT between before and after the Distance Training"} \]
Before conducting statistical tests were first obtained normality test data in Table 5. The Statistical analysis show that the significant parameters value is 0.993. It means that data normally distributed.

<table>
<thead>
<tr>
<th>No</th>
<th>LMS Activity</th>
</tr>
</thead>
</table>
| 1  | Study modules  
|    | • Downloading module 
|    | • Downloading material from the link on the module 
|    | • Summarizing the material of the link 
|    | • Posting a summary of material |
| 2  | Chatting  
|    | • Chatting with other participants 
|    | • Chatting with facilitators |
| 3  | Discussion  
|    | • Responding to a given subject matter by facilitator |
| 4  | Assignment  
|    | • Downloading assignment 
|    | • Posting assignment |
| 5  | Quiz  
|    | • Doing a quiz at the end of the learning for each learning activity |
| 6  | Evaluation  
|    | • Conducting evaluations at the end of the whole learning activities |

**TABLE 5. ONE-SAMPLE KOLMOGOROV-SMINOV TEST**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Unstandardized Predicted Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Parameters</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>23</td>
</tr>
<tr>
<td>Mean</td>
<td>70.000</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>3.4007</td>
</tr>
<tr>
<td>Most Extreme Differences</td>
<td></td>
</tr>
<tr>
<td>Absolute</td>
<td>0.089</td>
</tr>
<tr>
<td>Positive</td>
<td>0.067</td>
</tr>
<tr>
<td>Negative</td>
<td>-0.089</td>
</tr>
<tr>
<td>Kolmogorov-Smirnov Z</td>
<td>0.427</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>0.993</td>
</tr>
</tbody>
</table>

Furthermore, the Paired Sample T-Test conducted to see an increase in the average ability of ICT Literacy obtained. These data can be seen at Table 6. Table 7 shows that the average self-assessment of ICT skills before Distance Learning at 70.00. The average self-assessment after learning ICT skills Literacy Distance Training is 88.0870. There is increased by an average of 18.087

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>70.000</td>
<td>23</td>
<td>18.37241</td>
<td>3.83091</td>
</tr>
<tr>
<td>After</td>
<td>88.0870</td>
<td>23</td>
<td>5.96134</td>
<td>1.24302</td>
</tr>
</tbody>
</table>

**TABLE 7. PAIRED SAMPLE TEST**

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-18.08696</td>
<td>20.33786</td>
<td>4.24074</td>
<td>-26.88171</td>
<td>-9.29221</td>
<td>4.265</td>
<td>22</td>
</tr>
</tbody>
</table>

Test samples Paired test results obtained by value $t = -4.265$, with a significance level of $= 0.05$ t-test values obtained $-4.265 < -1.717$ and significant value $0.000 < 0.05$, H_ (0) : $\mu_1 = \mu_2$ rejected. This shows that “There are significant differences between the ICT skills before and after the training distance learning Juah”. The conclusion is obtained that through DistanceTraining can increase the self-assessment of ICT capability Biology Teacher Madrasah Aliyah. Before DJJ participant self-assessment of the ability of ICT is in a category able to carry out with the help of others, after implementing the learning through Distance Training, participants' self-assessment of the ability of ICT is in a category capable of executing independently. Self assessment scores for each aspect of ICT skills before and after the Distance Training can be seen in Fig. 1.
Figure 1 inform that the self-assessment score every aspect of ICT skills increased after Distance Training intervention. Increased self-assessment scores for each aspect of ICT skills can be seen in Figure 2.

Aspects of access has increased by a modest increase in the category (the average value of the normalized gain of 0.41). Viewed from the aspect of access, self-assessment of participants are in a category is not able to carry out (self-assessment score as many as 43) prior to Distance Training, after executing Distance Training is in a category able to carry themselves with the help of others (self-assessment score as many as 55).

Manage aspect category increased by a modest increase (the average value of the normalized gain of 0.3). Self-assessment on the aspects of managing in the category capable of carrying out independent (self-assessment score as many as 6.6) before Distance Training, after executing Distance Training is in a category capable of executing independently and develop it (self-assessment score as many as 8.2).

Integrate aspects of the category increased by a modest increase (the average value of the normalized gain of 0.48). Self-Assessment of integrate aspects that are in the category able to carry out with the help of another person before Distance Training (the average score of the self-assessment as much as 4.52), after executing DJJ is in a category capable of executing independently (average score of self-assessment as much as 6.2).

Evaluate aspect category increased by a modest increase (the average value of the normalized gain of 0.32). Self-Assessment on aspects evaluate are in the category able to carry out with the help of another
person (the average self-assessment score of 4.6), after executing Distance Training is in a category capable of executing independently (average score of self-assessment as 5.7).

Aspect create increased with an increase in lower categories (average value gain normalized score of 0.22). Self-Assessment before Distance Training at aspects create are in the category able to carry out with the help of another person (the average self-assessment score of 11), after executing Distance Training is in a category capable of executing independently (average self-assessment score is 13)

IV. CONCLUSION

The conclusion of this study is self-assessment of ICT competencies of Madrasah Aliyah Biology Teacher in the Ministry of Religion in West Java increased through training Distance learning. The highest increase respectively is on aspects integrate, access, evaluate, manage, create.

REFERENCES

USING INTEGRATED ASSESSMENT TO MEASURE STUDENTS' ANALYTICAL THINKING AND SCIENCE PROCESS SKILLS

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Abstract—Science process skills (SPS) are the tools that are needed in chemistry learning in 21st century. SPS are thinking skills that used to build knowledge in problems solving. SPS aim to measure thinking skills and create active learning. SPS based learning can also enhance the knowledge of students towards science. In the other words, SPS have positive relationship with the cognitive domain, including the analytical thinking skills. Analytical thinking is one of a high order thinking skills that are used to elaborate, attribute, and analyze information to understand the knowledge using logical thinking. Analytical thinking is the thinking that is based on facts which will help in solving the problems and finding the solutions that supports critical and creative thinking. To measure both the competencies needed an integrated assessment instrument which able to measure the students’ achievement effectively and efficiently. Integrated assessment is an interdisciplinary process in combining, interpreting, communicating knowledge and abilities of students from a variety of sources. In summary, if the integrated assessment is done effectively by utilizing the data collection, analysis, and management of the various actions that are integrated into the teaching process, it will improve the students’ analytical thinking and science process skills.

Keywords: Analytical Thinking, Integrated Assessment, Science Process Skills

I. INTRODUCTION

Chemistry is the science acquired and developed based on the results of research to find answers to questions of what, why, and how these natural phenomena occurred and interconnected. Theoretically, learning about the chemical composition, formation, structure, properties, material changes, and energy that accompany these changes [1], involving a variety of skills and high-level reasoning. Therefore, the learning of chemistry must consider the characteristics of chemistry as process and product.

Characteristics of process chemistry as related to the skills and attitudes required students to acquire, develop knowledge, and face problems through scientific activities. The activity aims to enhance the knowledge and discovering new knowledge. While the characteristics of chemistry as related to the knowledge of chemical products in the form of facts, concepts, principles, laws, and theories is born of scientific thought processes [2].

In essence, the learning process chemistry emphasizes on direct experience of students to develop competencies through practical activities. It’s main activity requires specific skills that can support problem solving. One of the skills needed in chemistry learning in the 21st century is the science process skills [3].

During this time, students are many who think that the concept of chemistry in general abstract [4]. The concept includes the ability to represent and interpret the problem macroscopic, microscopic, and symbolic [5]. Thus, these difficulties need to look for solutions in order to improve motivation and learning outcomes of students. One way that can be used by teachers to improve students understanding of the chemistry is the use of inquiry-based learning in the laboratory.

Inquiry-based learning is a concept of learning that encourages teachers to connect students with authentic situations, explore, and solve problems in real life [6]. Through the activities of exploration,
investigation and observation, students will engage in social interaction as well as the use of high-level thinking to broaden and deepen the knowledge [7-8]. High-level thinking includes therein is the analytical thinking ability. Thus, analytical thinking can be used as a basis for understanding the facts, concepts, principles, laws, and theoretical chemistry who require high abstraction. Furthermore, the result of conceptual understanding is used to determine the procedural framework and strengthens the argument lab results.

Analytical thinking is one of cognitive domain needed in the experiment. Event experiments can involve all or a combination of science process skills. In the other words, SPS have positive relationship with the cognitive domain [9-10], including the analytical thinking. To measure both the competencies needed an integrated assessment instrument which able to measure the students’ achievement effectively and efficiently.

II. LITERATURE REVIEWS AND DISCUSSIONS

A. Analytical Thinking Abilities (ATA)

The course emphasizes the basic concepts of analytical thinking including the decomposition of complex problems, the logic of drastic simplification, the dynamics of first-cut and successive-cut analyses, the importance of being specific, the rationale for working with numbers, and the analytics of guesstimation [11]. Analytical thinking abilities influenced by the ability of students in applying, rearranging, and adding to the knowledge of the situation or environment in which the individual is located [12].

Analytical thinking abilities have some indicators can be developed through problem-based learning activities. In general, the analytical thinking classified into three types [13]:

a. Differentiating; the ability to isolate, sort, select, and focused;

b. Organizing; the ability to find, coherence, integrate, describe the role and structure;

c. Attributing; the ability to determine the angle of view or the underlying value of the material presented.

Based on various opinions, it can be concluded that analytical thinking is one of a high order thinking skills that are used to elaborate, attribute, and analyze information to understand the knowledge using logical thinking. Furthermore, analytical thinking is the thinking that is based on facts which will help in solving the problems and finding the solutions that supports critical and creative thinking.

B. Science Process Skills (SPS)

Science process skills are skills needed by students to solve problems in scientific activities in an authentic way [14]. The opinion was reinforced by Ajoke and Joe [15] which states that the science process skills are skills required by each individual in daily life to improve the quality and standard of living.

Tek and Ruthven [16] classifies 11 types of capabilities that can be developed through learning activities based approach science process skills:

a. Observing; the process of gathering information about the object or phenomenon using all or part of the sensory organs;

b. Classifying; observe and identify the similarities and differences between objects or phenomena, and categorize them in terms of similar characteristics;

c. Measuring; observing quantitatively using standardized instruments;

d. Concluding; provide an explanation for the observation or object;

e. Predicting; the process of predicting what might happen based on observation and previous experience as well as the relevant data;

f. Communicating; presenting ideas or information in various forms such as oral, written, using charts, diagrams, models, tables, and symbols;

g. Interpreting data; process give a rational explanation of the object, event or pattern of some data collection;

h. Operational definition; making the definition of each variable in accordance with the functions and how to conduct and measure it;

i. Controlling the variables; identify, manipulate, and responding variable in an investigation;
j. Formulating hypotheses; the ability to draw up a statement explaining the circumstances and examine the statement to prove its validity;
k. Conducting experiments; conduct an investigation to test the hypothesis. Experimental activities involving all or a combination of other process skills.

Harlen [17] describes five aspects to be considered by teachers in developing science process skills:
a. Providing the opportunity to use the skills in the process of exploration of matter and phenomena;
b. Giving the opportunity to work in small groups and class discussions;
c. Listening to students and learn about their products to find the necessary process in forming new ideas;
d. Encouraging students to review critically about how the activities they have done;
e. Providing techniques or strategies to improve their skills, particularly in observation and measurement accuracy, or techniques that need to be developed in communication.

Based on various opinions, it can be concluded that the science process skills are skills needed by students to solve problems in the exploration of matter and phenomena in real life.

C. The Relationship between ATA and SPS

Science process skills linked to cognitive domains students, including the analytical thinking abilities [18]. In general, the relationship between the conceptual frame-work of cognitive dimension with science process skills is presented in Figure 1.

![FIGURE 1. THE RELATIONSHIP BETWEEN ATA AND SPS [18]](image)

Results were confirmed by Oloyede [19] indicate that there is a positive relationship between science process skills in reasoning abilities and achievements of chemistry. Students are equipped with science process skills tend to be more successful and analytical thinking in solving new problems than those who are not equipped with science process skills. Thus, the use of science process skills in the learning process is the basis for the development of students' knowledge further. Additionally, another benefit of the development of science process skills which frees students from the anxiety can hamper the achievement of the results of cognitive and affective [20].

D. Integrated Assessment

Integrated assessment is an assessment focused on the ability of students to solve complex and unstructured [21]. In general, an integrated assessment model combines sub-models of various disciplines
into a single framework and then analyzes the interactions that occur between different systems [22]. Increasing the relevance and validity of the results of students using integrated assessment approach has a better quality than using single vote [23].

In practice, the integrated assessment requires a rubric scoring guidelines in order to avoid subjectivity in assessing teachers. Scoring form of partial credit the integrated assessment model that requires several steps to resolve. The assessment is done by giving a score to each step that has been done correctly. Examples of the preparation of guidelines for the integrated assessment scoring partially presented in Table 1.

<table>
<thead>
<tr>
<th>No.</th>
<th>Scoring Steps</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Writing out the work steps</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Writing out the formula of mole (n)</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Calculating the number of moles</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Writing out the formula of concentration (M)</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Calculating the concentration of the solution</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Writing out the formula of dilution</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Calculating the concentration after dilution</td>
<td>1</td>
</tr>
</tbody>
</table>

In connection with the evaluation process, Birenbaum et al. [24] suggested some key principles that need to be considered in assessing an integrated:

- a. Students participate in the evaluation process;
- b. Ratings contextual teaching that has been done;
- c. Material valuation is adjusted with the knowledge and ability of students;
- d. Evaluate the learning process and learning products;
- e. Presenting the evaluation criteria transparent for students and teachers;
- f. Students and teachers to get feedback about the results of the assessment;
- g. Inform students and teachers about their progress in learning.

Based on that opinion, it can be concluded that the integrated assessment is an assessment of learning outcomes of students who combine domain knowledge and skills. Integrated assessment aims to assess the science process skills and analytical thinking skills of students in solving complex problems through scientific learning.

### III. CONCLUSIONS AND SUGGESTIONS

SPS have positive relationship with the cognitive domain, including the analytical thinking abilities. To measure both the competencies needed an integrated assessment instrument which able to measure the students’ achievement effectively and efficiently. In summary, if the integrated assessment is done effectively by utilizing the data collection, analysis, and management of the various actions that are integrated into the teaching process, it will improve the students’ analytical thinking and science process skills that are needed in chemistry learning in 21st century.

### REFERENCES


INSTRUMENT TEST PHYSICS BASED COMPUTER ADAPTIVE TEST TO MEET THE ASIAN ECONOMIC COMMUNITY LITERATURE REVIEW

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Abstract_ The scoring system in the world of education has an important role in giving birth to a generation that is ready to face the Asian economic community. This type of article is a review of literature, which was aimed at exposing the primacy of Test instrument of physics-based Computer Adaptive Test. At first regular Physics test instruments used in high school is a Paper and Pencil Test, students are required to work the entire matter is given. Perberkembang of science and technology, demanding assessment process more effective and efficient. These adult ratin
gings system began to switch from the traditional scoring system towards computer-based scoring system, including Computer Adaptive Test (CAT). CAT is a form of computer utilization for organizing an adaptive tests where questions are presented on the learners test has been selected from a question bank of existing in a way that is appropriate to the level of ability of the learners concerned. CAT offers many advantages, including the following; the time required is relatively shorter, security problem more awake, score more accurate exam results and can reduce costs and reduce human error in the scoring. This article can be summed up that Insrument Test physics-based Computer Adaptive Test is the right measurement tool to measure the ability of learners based on their ability level, respectively.

Keywords: Instrument Test, Paper and Pencil Test, Computer Adaptive Test

I. INTRODUCTION

In the era of globalization is computer-based scoring system is more efficient and accurate compared to the traditional scoring system using paper and pencil [1]. The traditional scoring system presents a package of tests that consist of a few grains of matter, and each test-taker working on whole grains are reserved. Tests of this kind cannot give the precision of the measurements on the test-taker. The situation is the ideal test is to deliver grain tests that correspond to the test-taker's ability level tests that can measure accurately the ability of participants to the test, in which the difficulty level of the test is adjusted to the level of grain ability test-taker. Therefore, the assessment system, gradually began to shift from the traditional towards computer-based scoring system. Computer-based scoring system from time to time continue to undergo development, including the Computer Base Test, Computer Assisted Test and Computer adaptive Test. Computer-based scoring system that can present the problem in accordance with the test-taker's ability level which becomes the current selection Computer Adaptive Test (CAT).

A. Computer Adaptive Test (CAT)

Computer-Adaptive Test (CAT) is a form of computer utilization for organizing an adaptive tests where questions are presented on the assessment process have been selected from a question bank of existing in a way that is appropriate to the level of ability of the learners concerned. The selection of the problem done so that tests can be conducted to measure precisely the capabilities of each learners test, as soon as possible, using as little as possible of the items reserved are available in the question bank. Adaptive test is a test that customize the capabilities of participants [2]. Adaptive test is a test which is held for students with questions or item-item is determined based on answers or initial response given test-taker [1]. Organization of different adaptive tests with a paper and pencil test. On Paper and Pencil tests throughout the students will be given a reserved and the number of questions remain or the same, whereas
in adaptive tests each participant will be given a different problem, problems on adaptive test is adapts with the abilities of each student.

These advantages offered by CAT, among others: (1) CAT is more efficient and accurate in measuring students’ ability, paint requires no answer sheet because the score can be immediately known by students once the test has been declared completed [3] (2) a matter that has given the level of difficulty in accordance with students’ ability, not too hard or too easy, (3) the assessment can be done immediately so as to provide quick feedback to students security, (4) the test can be improved. Sets the given problem will be different for every student so that questions will arise next can't be predictable, in addition, if the amount of the reserved lot, the possibility of the emergence of the same question more than once is very small. The confidentiality of the matter can also be maintained, because the matter is stored in a database and the only manufacturer of the CAT that makes the problem which can be updated, and (5) test can be presented through text, graphics, audio, and even video clips.

Computer Adaptive Test first implemented on intelligence tests or test the intelligentsia by Binet in 1908 [4] Development CAT is also done in the field of education[2]. Lord studied the CAT because it considers the test length was fixed inefficient test-taker's ability to measure. CAT requires: (1) the bank, (2) the procedure for the selection of the initial item, (3) the procedure for the selection of items for the implementation of the test, (4) the procedure for an end to the tests, and (5) estimation ability of students [5]. In the procedure of election of the first item given the test items by difficulty level.

CAT can only be done with the computer. Computers can store information test (test items and their characteristics = the item bank) that are quite large and can display the items that correspond to the test-taker's ability. The computer can also be set up, and provide a test score on each test-taker in accordance with their respective potential test participant quickly and accurately[6] In the Computerized Adaptive Testing (CAT), the order of the items set to be raised to the monitor depends on the test-taker's achievements at the previous item. On the basis of the achievement of the capability of the test participants, then the item has maximum information about the test-taker's ability level is set by the computer. Thus, the length of the test allows for shortened without removing the precision of measurement.

After the test participants completed several test items (two or three items) which was introduced in early tests, estimated for the initial test-taker's ability can be obtained. Computer added to select an item from the item bank are available and provides information about the test-taker's ability, everything is done by a computer based on a preliminary estimate. The details of how the test items can be selected and the ability of the test-taker can being estimated, can be explained as follows: the giving of items to test participants to a number of items that have been organized and defined, how the level of precision of measurement desired (i.e., standard error = SE) about the ability estimate is reached.

Principle of Computer Adaptive Test (CAT) generally use an Item Response Theory (IRT)[2]. With the test package is then capable of test participants low nor high capable test-taker could not be retrieved information. Lord believes that the length of the test could be shortened with no kehilang accuracy in measurement. Item (item) test that is given to each participant to the test, with how to choose items that can give you maximum information about the test-taker's ability. In the theory of measurement, each test-taker is arranged in a group of items.

B. Item Response Theory (IRT)

Item response models are particularly adatable and suitable for testing because of the possibility to obtain estimates of the capabilities of the test-taker is not tied to a particular unit test items. Adaptive testing will always lead in an area of the item response theory (IRT). Although the each test-taker receives a different item, the seemingly different items, but IRT allows to compare the capabilities of the estimation of participants of different tests.

In applying item response theory (IRT) to measurement problems, the common assumption that the test-taker's ability reflected in the achievement in completing the item. Item information function was instrumental in testing adaptive Items that give the most to the precision of the measurements, selected to be shown in the monitor. Items that provide information are many, the items that are on the top ability test penempuh (about) 50%-60% chance of answering correctly.

In the testing adaptive that use the IRT, an attempt can be made to meet a variety of test items to the difficulty level of the test-taker's ability that is measurable. To find the test items which correspond to the
test-taker's ability level, a large pool of items is required, statistical characteristics of known items, so an item worth allows pulled from an item pool [7]. According to the computer must be added to meet that provision in order to construct a test required for test participants. Provisions must be made: (1) Estimates the ability of participants to the test, how to test participants will finish from various test items that have not been regulated. (2) Decision making effective use of prior knowledge to select test items to be shown on the next appearance. (3) At the end of testing a single score that describe the quantitative ability test-taker.

Two procedures were used for the selection of items [8]. The first method, the maximum information [3], involving the selection of items that provide information on the maximum (i.e., minimal errors standard) on participant ability tests that measured. To avoid the same item selected from time to time [9] proposed the item selected is the item-based random delivered items that provide the greatest information on the test-taker's ability level.

The second method, the selection of items by Bayesian methods [10], involving the selection of test items that minimize the posterior distribution of the difference of ability test-taker. When the test items is set, the posterior distribution is becoming more concentrated, reflect the precision of the test-taker's ability estimated. Bayesian method requires the specification of the first beliefs about the ability of the test-taker since, the success of the method depends on the portion of the distribution of merit comes first. The impact of the first distribution will reduce the next item setting will appear.

C. Advantage Cat

Advantage CAT based on short tests without loss of accuracy of measurement, is a lot. Some of these benefits are: (1) security tests will increase, (2) tests are conducted on the basis of the demand, (3) does not require the answer sheet, (4) appearance of the next test items associated with the test-taker's early abilities, (5) make test scores immediately and report it, (6) minimize frustration on test-taker, (7) the standardization of the tests is larger compared to traditional tests, (8) the appearance of the item passed to the item that is easier when test-taker's ability in mind, on the lower level, (9) the appearance of the items moved into the more difficult items when a test-taker's ability in mind at a higher level, (10) more flexibility in the choice of items, (11) supervision during the test time will be shorter.

II. DISCUSSION

Computer adaptive test is a test that is used for the measurement of achievement test-taker, where the appearance of the item to be adjusted with the test-taker's ability. If the test-taker's ability is higher than an item that is given, then the next item will be given an item that has a higher level of difficulty. If the test-taker's ability is lower than a given item, then the next item will be given items that have an easier difficulty levels. Setting the appearance of the test items should be carried out by participants of the tests performed by the computer. Determination of scoring measurements are also carried out by the computer. Assessment of the achievements of the test-taker is done concurrently when test participants are working on tests. Each test-taker working on test items, then the computer will provide an assessment to the test-taker. Test participants don't have to work on a long test, because the computer will provide items which correspond to the test-taker's ability. In the given test items to the test-taker is in compliance with the test-taker's ability, then the computer will provide an assessment of the achievements of the test-taker.

Each test-taker need not exercise the test with the same amount of grain, because after a test-taker's ability in accordance with the level of difficulty of the test is given, then the computer will immediately provide to participants of the test and implementation of measurement will be terminated.

III. CONCLUSION

The research adaptive tests to date have focused on six areas: (1) selection of the model of IRT item, (2) the bank, (3) the starting point for the test, (4) the election of the next test, item (5) scoring assessment, and (6) the method of choice to decide when to end test [11]. For a discussion of research in the six region. Of the six region when summarized into two major aspects, namely: assessment of the ability of the test-taker and the selection of items that should be displayed next. CAT as a test tool replaces the Paper and Pencil Test method can shorten the implementation time of the test, because with the CAT, estimated against the ability of a person may be carried out without the person concerned should complete the maximum number of sets in a matter that has been arranged.
Conducting a test using a CAT application can be more easily done, because the Administration reserved, time recording, and valuation can be performed automatically[7]. In the paint, the results obtained by a learner is stored and reused as a parameter that specifies how the implementation of the test next time. CAT can be used to accurately measure the ability of users in various levels with ease. The development of the bank can be made more easily, due to the feedback system that can provide feedback to developers about the characteristics of a set of questions has been created.

REFERENCES
THE VALIDITY OF THE MODEL-ASSISTED INSTRUCTIONAL SCAFFOLDING ANALOGIES IN SCIENCE TEACHING IN JUNIOR HIGH SCHOOL

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Abstract: This research has aimed to develop a valid learning model. The learning model that is developed and named of scaffolding model is an analogy teaching aid that is for teaching Biology of Sains in Junior Secondary School. Scaffolding model analogy aid is developed in various theory such as Piaget cognitive learning, Vygotsky costructivism theory, Ausubel meaning of theory, and information theory proces. This scaffolding analogy model of teaching aid has been validated of many experts wether in content (content validity) or in construc (construc validity). The validation describes about the needs and innovation (state of the art). Whilts the construc validation describes the consistency off the scaffolding model of consistency between model of component. The results og The Expert Validation’s determin that the model of scaffolding teaching aids analogy is stated of valid and proper to use in the learning proces to increase the learning quality of Sains in the Junior Secondary School.

Keywords: Scaffolding Conceptual Model Analogy Assistance, Valid Learning Model

I. INTRODUCTION

Constructivist recommends that students are active learners who seek to build meaning and understanding to new situations based on their knowledge and experience, both formal and informal [1][2]. Obtaining strategy takes precedence over how much students gain knowledge and recall [3]. Learning in school is not just focused on provisioning capabilities theoretical knowledge, but how the learning experience of students owned can be applied in everyday life. For example in science learning how to find out about a systematic nature, so that the IPA is not only a mastery of knowledge in the form of a collection of facts, concepts, or principles, but also a process of discovery. Based on the above opinion can be concluded that students do not just accept what is given by the teacher, but actively acquiring knowledge and skills that can be applied in everyday life. This implies that the active learning students need guidance and assistance to find or implement their own ideas that need to be designed forms and procedures suitable assistance.

To make meaningful knowledge, students must apply their own ideas in order to improve the understanding of learning and teaching. It required the guidance / coaching scaffolding that is headed from a student's actual ability to achieve its potential capability with the guidance given gradually [4]. Scaffolding including the provision of assistance to students who are more intensive and structured at the beginning of the lesson, then gradually transfer responsibility for student learning to work under the direction of themselves [2]. Excess scaffolding is to involve students actively through the encouragement of teachers to menganalogy new knowledge based on prior knowledge. Additionally scaffolding can motivate students to learn continuously and lower frustration level students. this is similar to the one proposed [5] a form of scaffolding can reduce (reduce) frustration and risk.

The construction process, knowledge and skills easily happen when students are given meaningful learning opportunities that allow students to be able to connect new material with what they have to build an understanding of student learning [1]. Teachers in teaching the material to deepen the understanding we need a link or a link in the form of an analogy that connects what you learn with what is already known. Gentner [6] defines analogy as a mapping of knowledge from one domain (base) to another domain (target) which shows a system of relations, which is what is owned by the basic domain is also
owned by the target domain. Podolefsky [7] states, the analogy is a comparison between two things that are the same, or use something "familiar" to communicate or understand something "foreign". The opinion concluded that the above analogy is a mapping of the knowledge base domain to the target domain, from the known to the unknown, from the simple to the complex. Ways of learning such as learning strategies in accordance with the IPA. The ability of the students in grasping the concept of science is not the same. Faced with this, teachers need to understand the extent to which lack of accessories concept of students and slowly help trouble students, among others, by using analogy effectively, as stated by Duzgun [8] which says that the analogy increase the understanding of student learning to help students understand the concepts of science complex, also can increase students' interest in learning the concepts.

The use of analogy is one strategy that bridges the gap between something known with something that will be studied through the creation of a meaningful relationship between the two, an analogy consists of two components: the analog and the target. In explaining scientific concepts, using the analogy effectively, teachers must explicitly identify both the similarities and the differences between analog and target concept [9].

Results of research on analogy, among others, according to Glynn, and Takahashi [10] says that the analogy is an effort to develop a strategy so that students can build and improve analogy and become more autonomous in meaningful learning. An analogy that complicated a learning tool that can promote meaningful learning by building a conceptual bridge between existing knowledge and new knowledge to the students that they can from the study [11]. That stance is similar to that presented Webb quoted by Nyoto [12] states that the analogy is a conceptual bridge that helps students understand new concepts. It can be said that this analogy can also help students build conceptual bridges between what they already know and what they do not know.

Students are not considered as scientists are trying to solve his own problems, but active learning guided by people who are experts, facilitated by connecting what will be learned with what is already known to overcome learning difficulties, and to train students' thinking skills. The task of the teacher is to facilitate this process through meaningful experiences, provide opportunities for students to find and implement their own ideas, and applying their own strategies in learning. The strategy should also be developed to equip students with the ability to think.

Biggs and Collins in Biggs and Tang [13] categorize thinking skills into five categories known as SOLO taxonomy (Structure of the Observed Learning Outcome). SOLO taxonomy is very useful in reinforce the level of understanding is expected to be achieved by students when teachers teach the material, which are grouped into five levels of different taxonomic and hierarchical namely level 0: Pre-structural, level 1 uni-structural, level 2 multi-structural, level 3 relational, and level 4 extended abstract [14]. Stages in the SOLO taxonomy is very important, interrelated, each stage is repeated literally followed by a detailed explanation.

To measure the success of mastering concepts, evaluation tools (ratings) is needed. Rate refers to the goals to be achieved using levels of levels of cognitive according to Bloom in Anderson and Krathwol [15] (2010) consists of C1 (remembering), C2 (understanding), C3 (applying), C4 (analyzing), C5 (evaluating), and C6 (creating). Mastery of the concept in question in this research is the ability of students to understand, apply, analyze and create he concept of classification of living things and the cell both in theory and in practice in our daily lives.

Subject and object of learning science in school has a distinctive character. Students will easily understand the concept of IPA if accompanied by examples according to situations and conditions faced by the practice itself and the effort of finding the concept through the handling of objects is really real [16]. These conditions require businesses to change the students, as an example of the concept of "classification of living organisms and cells" as proposed by students at several junior high schools District of Gorontalo through the interview said that the material is "tricky" to learn them, after the teacher explains the material students quite understand, but after repeated / quiz asked again when students forget about the concept. Students wanting to study the concept of classification of living things and the cell is given concrete examples are not abstract, for example in the form of images accompanied by explanations and instructions or guidance to the students to the concept becomes meaningful and lasting in the minds of students. This is consistent with the proposed [3] that the study would be more
meaningful if the child has what he learned, not notified. It is said that in contextual learning to learn a new knowledge will be more meaningful if it is connected to real world situations students and encourage students to make connections between the knowledge he already has to its application in everyday life. For example, in studying the material on “the classification of living things and the structure and function of cells”, so that the material is easily understood by the students, then it should be facilitated to associate the material with a material other studies that have been known to be of use the analogy that comes with guidance targeted and structured form scaffolding. The results of research related to scaffolding has done by Safadi et al. [17]. That research informed about the effects of scaffolding on the skills of reading. Wass, et.al. [18] doing the research on scaffolding against critical thinking. Fernandez [19] doing the research on re-conceptualization scaffolding and proximal development zone in the context of symetrical collaborative learning.

So far there is no information available to explain how the scaffolding shape corresponding to the content of science (biology), how the implementation steps, how the scaffolding models when equipped with the analogy in science teaching biology to train the ability to think and complete the junior high school student mastery of concepts.

II. RESEARCH METHODS

This study included research and development (Educational Research and Development), which produces products such model of learning through the process of testing the validity, practicality and effectiveness of the model. The procedure consisted of several stages of preliminary studies, model development, model validation, operational models, validation tools, and empirical validation. The learning model scaffolding aided analogy developed refers to the characteristic learning model according to Arends [20] which consists of four characteristics: (1) is designed to achieve specific learning (2) has the support of theoretical and empirical (3) has a syntax or learning steps (4) the learning environment necessary for learning objectives can be achieved.

Validity assessment study model developed in terms of rational aspects of learning, theoretical support, syntax, and the learning environment. The technique used to collect the data validity of the learning model is to give the book a model developed by the validator validation sheet. Validator provides an assessment of the learning model by providing a check mark (√) in the appropriate columns on the aspects that are assessed and provide some comments on the available column. Validation of the model is done through the following steps.

- Calculate scores for each aspect to all validators
- Determining the average results validate every aspect and average overall results of the validation
- Determining the validity of the category with reference to the validity of the criteria contained in Table 1. The content of Table 1 was modified from Ratumanan and Laurens [21].

<table>
<thead>
<tr>
<th>TABLE 1. ASSESSMENT CRITERIA LEARNING MODEL VALIDATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interval Score Assessment</td>
</tr>
<tr>
<td>3.25 &lt; Score ≤ 4.00</td>
</tr>
<tr>
<td>2.50 &lt; Score ≤ 3.25</td>
</tr>
<tr>
<td>1.75 &lt; Score ≤ 2.50</td>
</tr>
<tr>
<td>1.00 &lt; Score ≤ 1.75</td>
</tr>
</tbody>
</table>

III. RESULTS AND DISCUSSION

Quality learning model according Nieveen [22] has four criteria: relevance, consistency, practicality and effectiveness. Relevance refers to the support of the theories of the learning model (validation contents), internal consistency refers to the relationship between the components supporting learning model (validation constructs).

Expert assessment of the learning model performed on the content validity (validitas isi) and construct validity (validitas konstruk) which is the first requirement for a teaching model is categorized as a high quality product. Results of the assessment of the learning model validator scaffolding aided analogy "SMART" developed are presented in Table 2.

The average assessment validator of the learning model associated with content validity based on the description scale of ratings (1 = Not valid, 2 = Less valid, 3 = Valid, 4 = Very valid) are presented in Table 1 shows the average ratings of four characteristics of learning models that is rational learning (3.5),
theoretical support (3, 6), syntax / learning steps (3.7) and the management of the learning environment (3.4).

In constructs the average ratings based on the information validator grading scale (1 = not valid, 2 = Less valid, 3 = Valid, 4 = Very valid) are presented in Table 4.2 shows the rational learning (4), support the theory (3.3), syntax (3.4), management of the learning environment (3.7). This shows that the scaffolding assisted learning model developed analogy has content validity and construct validity with very valid category.

TABLE 2: ASSESSMENT OF THE VALIDITY OF THE CONTENT VALIDATOR SCAFFOLDING AIDED INSTRUCTIONAL MODEL ANALOGY "SMART"

<table>
<thead>
<tr>
<th>Num</th>
<th>Aspects observed</th>
<th>Average ratings</th>
<th>Validity Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Rational Learning</td>
<td>3</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>1. Rationality aided learning model development scaffolding analogy to the characteristics of IPA</td>
<td>3</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>2. Scaffolding model aided analogy is already meets the five-step learning</td>
<td>3,7</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>3. Stages of this model already represents the integration between the scaffolding and analogies</td>
<td>3</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>4. This learning model is suitable for students</td>
<td>3,3</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>5. This model is appropriate to teach the concept of classification of living things and the cell</td>
<td>3</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>6. Scaffolding models aided analogy appropriate to train the ability to think</td>
<td>4</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>7. Scaffolding models aided analogy to complete the appropriate mastery of concepts</td>
<td>4</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>8. This learning model using understandable language</td>
<td>4</td>
<td>Very valid</td>
</tr>
<tr>
<td>II</td>
<td>Theory Support</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Scaffolding model aided analogy with the theory of constructivism learning</td>
<td>4</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>2. Scaffolding model aided analogy instructional according to Piaget's theory, which focuses on the child’s thinking process</td>
<td>3,3</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>3. Scaffolding model aided analogy instructional with the theory of Vygotsky</td>
<td>4</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>4. Scaffolding model aided analogy instructional with the theory of information processing</td>
<td>3,3</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>5. Scaffolding model aided analogy instructional with the theory of Ausabel meaningful learning</td>
<td>3,7</td>
<td>Very valid</td>
</tr>
<tr>
<td>III</td>
<td>Syntax Learning</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. The stages of learning are arranged in sequence and clear</td>
<td>4</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>2. The stages of learning has been logical and rational</td>
<td>4</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>3. Determination syntax in scaffolding assisted learning model analogy</td>
<td>4</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>a. Serve phenomenon</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>b. Ask, formulate questions / problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Exploration activities (observation / experiment)</td>
<td></td>
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<td></td>
<td>d. Report (formulating its conclusions, compiling reports)</td>
<td></td>
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<tr>
<td></td>
<td>e. Apply the findings in a new context (evaluation and provision of duty) is based on the theory that the appropriate</td>
<td></td>
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<tr>
<td></td>
<td>4. Each syntax (stages) in Scaffolding model aided analogy contain clearly the activities of teachers and students</td>
<td>4</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>5. Description of learning activities on every syntax in Scaffolding model aided analogy can be carried out by teachers and students</td>
<td>3,3</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>6. Description of learning activities on the syntax oriented to train the ability to think and complete the mastery of concepts</td>
<td>4</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>7. Instructions for use are clearly stated analogy</td>
<td>3,3</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>8. Hints of assistance in the form of scaffolding in every stage of the learning clearly stated</td>
<td>3,3</td>
<td>Very valid</td>
</tr>
<tr>
<td>IV</td>
<td>Environmental Management Learning</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. The pattern of the relationship between teachers and students showed their teacher’s role as facilitator, mentor and motivator</td>
<td>4</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>2. The pattern of teacher-student relationship among fellow students and provide opportunities for students to interact with their friends or teachers</td>
<td>3,3</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>3. Relevance behavior of teachers in providing guidance and facilitate for students in need</td>
<td>3,3</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>4. The relevance of teacher behaviors to foster self-confidence in students</td>
<td>3</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>5. Relevance behavior of teachers in providing the motivation to arouse student interest</td>
<td>3</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>6. Learning device are arranged oriented efforts to train the ability to think and complete the students' mastery of concepts</td>
<td>4</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>7. Lesson plans prepared in accordance with the characteristics of the material</td>
<td>4</td>
<td>Very valid</td>
</tr>
</tbody>
</table>
TABLE 2. RATE VALIDATOR TO CONSTRUCT VALIDITY SCAFFOLDING LEARNING MODEL AIDED ANALOGIES

<table>
<thead>
<tr>
<th>Num</th>
<th>Aspects observed</th>
<th>Average ratings</th>
<th>Categories validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Rational Learning</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Hypothetical model: SMART learning model can train junior high school students' thinking skills</td>
<td>4</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>2. Hypothetical model: SMART learning model can complete mastery of the concept of junior high school students</td>
<td>4</td>
<td>Very valid</td>
</tr>
<tr>
<td>II</td>
<td>Supporting Theory</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The linkage supporting theories to student characteristics and characteristics of the IPA to support and complement</td>
<td>3,3</td>
<td>Very valid</td>
</tr>
<tr>
<td>III</td>
<td>Syntax Learning</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. The link in any syntax mutually supportive learning model</td>
<td>3,7</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>2. Activities of teachers and students at each syntax learning model interrelated</td>
<td>3,3</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>3. Integration between the scaffolding and analogies in the stages of learning models are complementary</td>
<td>3,3</td>
<td>Very valid</td>
</tr>
<tr>
<td>IV</td>
<td>Environmental Management Learning</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Expected activities of teachers in the learning model does not contradict</td>
<td>3,3</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>2. Student activities such as thinking, asking, answering questions appear at each stage of learning</td>
<td>4</td>
<td>Very valid</td>
</tr>
<tr>
<td></td>
<td>3. Activities of teachers in providing assistance in the form of guidance, directing, and developing thinking activities of students, participated reflected in every stage of learning</td>
<td>3,7</td>
<td>Very valid</td>
</tr>
</tbody>
</table>

Validation of learning models scaffolding aided analogy is done through a process of discussion with the experts presented in Table 1 (Validity contents) and Table 2 (construct validity), shows that the model scaffolding aided qualified validity of both content (content validity) as well as construct (construct validity). Validity can be achieved due to: the development of this model has been referred to the various characteristics of the model [21], and considering the students' learning styles [23]. Besides this model was developed through the iterative process: design models, were reviewed to obtain a draft of the model, further validated, revised, tested and revised again. The results of discussions with experts showed that the learning model developed declared valid by the validator and can be used in science teaching. According Nieveen [22], to produce a good quality learning model, it should meets the criteria of content validity and construct validity. The validity of the content regard to the relevance of the reference to the theories that support robust and advanced towards learning model. The construct validity with respect to the design models were consistently related.

The validity of the content can be viewed from the novelty (state-of-the-art) and needs. Novelty is referred to in this model is pleased with the syntax learning model that consists of 5 stages that present the phenomenon, ask and formulate problems, exploration activity, report (drawing conclusions and reports) and apply them to the new context shortened by SMART. It is categorized by the validator as syntax, new in science learning in junior high. Syntax learning model that is. 1) Phase serve phenomenon is made to attract the attention of students by giving examples / modeling through analogy dish concept to be covered for beginning students gain knowledge through observation. In accordance with the opinion expressed by Bandura that observational learning is learning that includes the acquisition of skills, strategies, and beliefs by observing others [24]. 2) Phase propose and formulate questions made to steer students toward problem by asking questions that will raise ideas that students can build knowledge within himself through discussion so that students find meaningful information for himself. As noted by the Personal that "constructivism learning theory do with facilitating students to acquire learning experience that can be used to establish the meaning of the knowledge that is being studied". At the time of formulating the question, the students begin to identify new things that did not exist in the cognitive
structure. Some of the activities that are essential in building knowledge among others to ask questions, gain knowledge, and test the knowledge they have learned (Dewey, Piaget, Vigotsky). 3) Phase of exploration activities designed to collect as much data as possible, students work in groups to observe the grain analogy with the help of teachers at the beginning of learning and gradually transfer responsibility for the students’ own work, as proposed by Slavin. 4) Phase report (drawing conclusions and preparing the report) aims to provide opportunities for students to formulate conclusions based on the data that has been analyzed to identify the various information and find their own new concepts. Final activity ie, 5) Phase apply the findings in a new context aims to provide opportunities for students to apply the concepts they have acquired in various situations for example, evaluation and administration tasks.

Other novelty in the form of relief gradually (Scaffolding) by teachers and peers is very useful to help students learn. As found by some researchers that the students have the benefit of learning from teachers who considered the relationship between teachers and students as collaborative relationships using scaffolding and participate in helping / guiding students when studying. The study is in line with that proposed by Ganvin in Santrock [25] states that engagement with others will create an opportunity for students to evaluate and improve student understanding, as students open to other people's thinking and participate in creating a shared understanding.

The construct validity of the model scaffolding aided analogy with regard to the learning of rational consistency, the consistency of the model with supporting theory, consistency between the phases in learning the syntax and consistency of the management of the learning environment. This learning model successfully achieve the learning outcomes based on some underlying theory, that is 1) the theory of Piaget; Linkages model of scaffolding aided analogy with Piaget's theory is that in this model the student / emphasis on the process of thinking, not only on the outcome, and stresses the role of students actively involved in learning activities, 2) Vygotsky's theory; in this model emphasized the provision of assistance / guidance where a person who is learning step by step acquiring expertise in interaction with an expert teacher or peers who mastered the problems, 3) the theory of information processing; The link between information processing theory with scaffolding-aided model of analogy in the learning process, to direct students' attention to the information (stimulus) is relevant, help students recognize and pay attention to important aspects of the subject matter to be delivered, 4) Ausubel theory; Providing assistance / guidance stages are necessary to achieve its potential ability, students apply their own ideas in order to improve the understanding of learning so as to make knowledge meaningful for students.

Syntax learning model interrelated beginning with phase present phenomenon, Phase ask and formulate a problem, phase of exploration activity, Phase Report (Formulate conclusions, communicate and build reports), and Phase apply to the new context and the management of the learning environment necessary for the purpose of learning can achieved include grouping students organize, organize discussion groups, and set the course of the presentation.

SMART learning model included in the category of valid both in its content and constructs that can be used as a guide for teachers (practitioners) to plan the learning program. As noted by Arends [21] stated that the learning model is a holistic approach in planning lessons. Guided by the results of the development model that has been declared invalid, the model teacher (practitioner) can apply their learning using SMART learning model.

IV. Conclusion

Model of learning aided scaffolding analogies “SMART” has content validity and construct the category of very valid based on ratings validator through discussion. The validity of the content can be viewed from the novelty (state-of-the-art) and needs. The construct validity of the model scaffolding aided analogy with regard to the learning of rational consistency, the consistency of the model with supporting theory, consistency between the phases in learning the syntax and consistency of the management of the learning environment.

REFERENCES

STUDENT CHARACTER BUILDING IN SCIENCE EDUCATION THROUGH INSTAD AND PEER TEACHING INTEGRATED LEARNING

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Abstract—in the 21st century, all output from each level of education should have skill competence and good character. In Biology education, skill competence and good character are according to scientific action and scientific think. The purpose of this paper is to describe student’s character in science, the effective combination between Inquiry-Student Team Achievement Divisions (INSTAD) and peer teaching-method to improve student cognitive and affective ability in science and build the character of students in science through INSTAD approach and peer teaching method. The integration between inquiry-method in the syntax of Student Team Achievement Divisions (STAD) can improve student character building in science. Inquiry can build the character of student to have good attitude and competence in problem analyzing by scientific thinking. STAD can improve cooperation ability and responsibility to do science learning process. Meanwhile, the using of peer-teaching in teaching learning process can give a good impact on developing student’s ability to understand. Therefore, there should be a research to get a good impact in biology learning process. The combination between INSTAD and peer teaching method not only improved student ability in cognitive and affective in science process but also facilitated the realization of purpose to build the student’s character in science.

Keywords: Character Building, INSTAD, Inquiry-STAD, Peer Teaching

I. INTRODUCTION

The 21st century is an era that many global challenges in various aspects including education. Human resources from the world of education become the benchmark quality of a nation in the eyes of the world. Therefore, Indonesia should build a generation of people who have a good skill and good character to be able to compete internationally. Student’ skills and characters can be built through a process of learning appropriately. Character building can be described in two words which are “to build” more ameliorative, develop, establish, organize things and “character” is defined as a character, traits mental, and moral character that distinguish one person to another [1]. According to Simon Philips character is a collection of values that lead to a system, which underlies the thinking, attitudes, and behaviors that appear on each individual [2]. Furthermore, according to the Ministry of National Education in Indonesia states that a person's character is someone who tried to do the best thing to God Almighty, himself, fellow human beings, the environment, the nation and the international community at large to optimize the potential (of knowledge) on him and accompanied by consciousness, emotion, and motivation (feeling). Ideals of national education in building the character of students who are competent both can be realized through character education at each level of education. According to [3] there are a number of values that need to be taught through character education, namely (1) honesty, (2) openness, (3) tolerance, (4) prudence, (5) self-discipline, (6) helpfulness, (7) compassion, (8) cooperation, (9) courage, and (10) democratic value.

Character building of a person is not only done in one environment. According to [4] there are eight environments that take an effect in the process to build the character in each person, namely: family, school ecosystems, society, geography / natural, historical, state, politics, science, technology and global system. Because science and technology included in the things that affect the development process of a person's character, the character education can be integrated into the learning in each subject, including in biology learning.
Biological science is one of the groups that are within the scope of science. Biology examines the knowledge of living things and all components in the environment. In the process of studying the biological sciences, students do not only focus on the study results but also attention to the process, the attitude and the technology it uses. So that students can build their knowledge and understanding of the learning process can be complete, intact and form the character of science to be a good person who has better skills [5].

Character education in schools can be improved and developed through the integration of character education in the learning process. The development and improvement of character education in schools can be done through learning model selection strategy, assessment, media, and appropriate teaching materials [6]. Furthermore, in his study states that there are nine models of learning that are categorized build character in students if applied in teaching and learning science subjects in which two of them are learning model-based inquiry and cooperative learning with percentages as follows: (1) cooperative learning 63.64%, (2) inquiry-based learning 30.30%.

Inquiry-based learning model has the advantage on the development of cognitive, affective, and psychomotor are balanced, so it is considered more meaningful and provide space for students to learn according to the learning style and developmental psychology of learning modern considers learning is the process of changing behavior due to their experience and learning that can serve the needs of students who have the ability above – average [7]. While learning model student Team Achievement Divisions (STAD) more emphasis on interaction among students to motivate each other and help in mastering the material and achievement to the fullest. STAD is also regarded as a model of cooperative learning is simple and effective to applied [8].

The combination of the inquiry and the Student Team Achievement Divisions (STAD) was also considered good because it is assumed able to provide a positive impact to create a conducive learning environment, so students are able to work together in a group to solve a problem that led to their interaction with other students to find a solution issue of the problems found during the learning process [9]. The integration between inquiry and STAD in the learning process is better known as INSTAD. The implementation of INSTAD in learning biology rated meaningful because during the learning process students learn to apply the rules of inquiry within the cooperative group, so it can be regarded as the activities of inquiry in group work [10].

In the learning activities using INSTAD, students are required to be active and creative. The teacher is only as facilitators and providers of strengthening against what is built and constructed by students. So the learning process that takes place will be centered on the student. Therefore, the method of peer teaching can also be integrated into the INSTEAD learning syntax. Furthermore, reference [11] describes the notion of peer teaching is an act to maximize the ability of students who excel in the classroom to teach and pass on their knowledge to those who are underachieving. So expect students who not yet have a complete understanding of the material can catch up.

Expected by integrating syntax inquiry model during the learning process can be created mutual learning based on a discovery of the solution from the problem to be studied, and confirmed by the peer teaching method to run more effectively reinforced by the character of the cooperative model. So, the
learning process will be better. Scaffolding process of students in learning activities able to foster the student's character to be a person who has respect for oneself and others, responsibility, honesty in acting, high tolerance, openness in sharing knowledge, help with sincere, self-discipline, cooperation, democratic, prudence in acting and thinking, courage, empathy, self-confident, obedient to the rules, religious, independent, logical thinking, critical, creative, innovative, respect for diversity, work hard and care about the social and environmental.

II. METHOD

The research using methods of literature review. The results obtained from the literature review of relevant journals, and conducted by descriptive analysis in order to produce a study about the effectiveness combination between Inquiry-Student Team Achievement Divisions (INSTAD) and peer teaching-method to improve student cognitive and affective ability in science and build the character of students in biology education.

III. DISCUSSION

Integrated Learning of INSTAD and Peer Teaching

The learning process that integrates biology approaches, as well as methods of inquiry, STAD, and peer teaching, requires a deeper understanding of a teacher because in the implementation, there is some inquiry learning syntax that will be inserted in the syntax of STAD by integrating into one of the advantages of peer tutoring methods.

Reference [12] suggested that the syntax of inquiry learning model consists of six stages, namely (1) the identification and determination of the scope of the problem, (2) formulate a hypothesis, (3) data collection, (4) the interpretation of data, (5) development of conclusions, and (6) analyzing the proceedings. While in STAD consists of five major components in the syntax, namely (1) a class presentation, (2) study group, (3) an individual test, (4) score of development, and (5) the award groups. If the syntax of inquiry substituted in some syntax STAD will form an integrated syntax between the two so-called syntaxes of INSTAD.

The syntax of INSTAD learning are (1) the teacher presentation stage. Students are divided into small groups which heterogenic ability (syntax of STAD), (2) the stage of work in a group. Students get the worksheet in each group which contains questions about the material that has been studied (syntax of inquiry), then the students to observe and try to solve the existing problems (syntax of inquiry) and then make a hypothesis (syntax of inquiry), followed by experiments to prove his hypothesis, process data and conclude what has been gained and done (syntax of inquiry), (3) the stage of repetition. Each group presented the results of their discussions respectively (syntax of STAD), (4) the stage of individual tests. Students work on individual evaluation sheet (syntax of STAD), and (5) the group stage of the award. Teachers give awards to the group receiving the highest score as recognition and the motivation for students (syntax of STAD) [13].

The syntax of INSTAD learning implemented in a heterogeneous group allows the social interaction in the learning process and knowledge sharing among fellow students in his group members. Interaction among fellow students in information sharing would be optimal if the execution is also applying the rules of peer teaching because the peer teaching learning model focuses on sharing knowledge, sharing ideas and sharing the experience [14]. So, the learning process with peer tutoring methods is assumed to be implemented and integrated into the learning syntax INSTAD at the group work stage and repetition stage.


Applied of biology education use INSTAD approach and peer teaching method can help the process of building the character has many advantages. But the applied in each process still has obstacles or weaknesses that also must be considered and controlled. Learning use the inquiry model that is not integrated with the cooperative learning have weakness, namely: (1) if the number of students in the classroom too much will hinder the learning process is optimal, (2) teacher requires a lot of time in fishing the students to be able to understand the material so they can solve the problems presented in student worksheet. In this case, the teacher acts as a facilitator and motivator.
Therefore, flaws found in inquiry-based learning can be helped by cooperative learning type of STAD by substituting the syntax between the two learning models such as that described in the previous description. Study results and the character of the students become more optimal and intact. Implementation of learning heterogeneous integrated into the learning process are able to ensure equity of understanding so that the realization of the process of scaffolding in the form of peer teaching.

The characters education can be built from the biology learning process use INSTAD approaches and methods of peer teaching is more visible on students' ability to work together to solve a scientific problem and find concepts through interaction between friends in the peer tutoring learning. The other of science characters can also be grown in the learning process are (1) the nature of openness in sharing knowledge, respect for diversity and responsibility (the result of habituation to the students to be able to cooperate with their peers on learning method peer teaching), (2) thinking independent, logical, critical, creative, and innovative (the result of the inquiry learning of habituation to solve the problems of the material presented by the teacher). In addition, for students who are aware of the limitations of the material will get motivated and become more confident as a facilitated to improve learning results in a fun way.

IV. CONCLUSION

This paper presents the role of inquiry-Student Team Achievement Divisions (INSTAD) approach and peer teaching method in the character building of students to study biology. Based on these studies can be concluded that the inquiry-STATD (INSTAD) and peer teaching method have a role in the education of biology to build the character of students in science. Constraints of character development using INSTAD approach based learning and peer teaching methods lies in the ability of teachers in understanding and applying the third syntax of the learning model at a time together and complement each other. Nevertheless, the approach INSTAD combined with the method of peer tutors can contribute both in character education students to be individuals who are more sensitive to the circumstances, responsible, honest, think critically, and have good skills in the use of tools practicum in teaching biology.

V. ACKNOWLEDGMENT

Many thanks to all my partners of the group who have been together finished this article. Also to our department, biology education of magister program graduate school of Yogyakarta State University.

DEVELOPMENT OF MUSSCHENBROEK BIMETALLIC VIEWER TOOL TO IDENTIFY SCIENTIFIC ATTITUDE OF JUNIOR HIGH SCHOOL STUDENTS OF VII GRADE

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Abstract—The purpose of this study was to develop a bimetallic Musschenbroek props in science subjects in junior high school students to identify scientific attitude. The method used is the Research and Development. In the early stages of development carried convection props that have been there, then continued with the implementation in the classroom. Object Research is a student of class VII A and VII B SMP N 1 Bae the academic year 2016/2017. Instruments used include a series of tools and materials to construct props, tests, questionnaires, interview guides, sheet validation and observation sheet. The results of the validation analysis, indicate that the props are developed are in accordance with its function with an average percentage of 95% and 85%. The results showed that props developed able to improve student learning outcomes, with a value of N-gain reached 0.81 are included in the high criteria. Scientific attitude can be identified by their use of props is thoroughness (75%), honesty (80%), curiosity (82%), skeptical (75%). Bimetallic Musschenbroek props can be used to grow and improve the scientific attitude of students.

Keywords: Development, Bimetal Musschenbroek Props, Teaching Science, Scientific Attitude

I. INTRODUCTION

Physics is part of subject material from science education in Junior School. According to Mee [1], physics is the study how the world behaves and how the laws of nature operate. Physics as part of science, where science is a body of knowledge, attitudes, and ways to obtain and use such knowledge. Physics should not be defined as maple hard in school but affirmed that he learned about the natural behavior and how the laws of nature that apply. That science is a way of explaining the natural world [2]. Effective science learning is learning to build a scientific attitude so that awakened the habit of applying scientific work to find concepts (products) science. To develop a scientific attitude in learning science in junior needed props that can arouse students’ scientific attitude. Props deemed necessary for use in learning science in junior high because at this stage the student is in transition between concrete pre-rational leading to the operational lifetime [3]. Thus, in this study developed science education props to teach the concept of a long expansion (conduction) that can be used in the classroom. To be able to know the length expansion of a metal is used props such as Musschenbroek bimetal. Props have been tested by experts of its effectiveness as a visual aid in learning. Unlike the previous Musschenbroek then this tool usage bimetal concept and easily observed by students. Props is developed to enhance students’ understanding of the thermal expansion of the metal. Props also have different characteristics from Muschenbroek tool that has been there before

II. RESEARCH METHOD

This research method type is research & development (R&D). The tool is limited and developed in the laboratory and then tested to experts and given a limited basis to students at the school to determine its effectiveness in learning. The sample in this study were students of class VII junior School. A class uses
to determine its effectiveness in learning. The students involved in this research are 40 students in a class consisting of 20 male students and 20 female students. The research design used is the R&D form adapted from Borg and Gall (2003). The research design steps is shown in Figure 1.

![Design of Research](image)

Explanations of each stage are as follows:

- **Preliminary studies** is a phase which the preface study builded, consists of defining the needs of props in science learning;
- **Planning stages** contains planning of the props design in accordance with the needs of the curriculum documents 2013;
- **Analyze stages**, analyzing core competencies and core competencies contained in the curriculum of 2013, so the tools will be developed in accordance with field conditions;
- **FGD (Focus Group Discussion)**, at this stage props design developed and the administration as a learning tool analyzes discussed with the teacher as a field practitioner;
- **Drafting stage prototype**, at this stage props design draft developed as a result of FGD;
- **Product Creation Phases**, at this stage props is arranged in real;
- **Validation stages**, at this stage of validation by the experts of the props are developed;
- **Test Phases**, at this stage, researcher will revise the product by considering the results of the validation;
- **Mass production**, in this phase, the props are producted massively for further dissemination

Analysis of the data used is the mix method analysis that is using qualitative and quantitative method together.

**III. RESULT AND DISCUSSION**

Musschenbroek there usually measure the expansion angle both horizontally and use three separate types of metals. While Musschenbroek bimetal props can be used to determine the expansion that can be viewed vertically. Validation of experts suggest that the tools made as much as possible can have the durability and value of the other metal variants. The results of the validation of products described as follows.

Injections are used should be made of metal so it is not easy to melt when heated. The materials used to make these tools in the form of acrylic, metal and metal injection. Unlike the Musschenbroek tools in general, then the added metal props bimetal. Variables that can be used for experiments using this tool is the time variable, high elongation, and also the curvature of the heated metal.

Musschenbroek props developed bimetal shown in the following Figure 2.
All three props are then tested in the class scale to determine the effectiveness of its use for subsequent mass produced and disseminated. Tools that have been validated by these experts were tested for effectiveness at the school to determine the extent of the effectiveness of the tools used in the classroom to support learning. Students are formed into 6 groups to use props correctly. Therefore each group provide worksheet that contains about how to use these props. The data obtained in the use of these props divided into several variables in Table 1.

<table>
<thead>
<tr>
<th>Aspect of the observation</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal expansion</td>
<td>Whether curved metal</td>
</tr>
<tr>
<td>The time needed for each metal expands</td>
<td>Time</td>
</tr>
<tr>
<td>Markers on the pipeline expansion</td>
<td>Water level indicator in the pipeline</td>
</tr>
</tbody>
</table>

These variables are then used to develop the necessary worksheets for learning. The samples are given an introduction to learning worksheets prepared by teachers beforehand. After treatment that uses props Musschenbroek bimetal obtained results the following observations: metal in the form of his experience bimetal curvature while not bimetal not undergo curvature. The curvature of the indicators marked by rising water in the pipe coming from the injection insistence metal stainless motivated by experiencing expansion. For a scientific attitude can be observed in the use of props Musschenbroek bimetal be explained in Table 2.

<table>
<thead>
<tr>
<th>Aspek of Scientific Attitude</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thoroughness</td>
<td>75</td>
</tr>
<tr>
<td>Honesty</td>
<td>80</td>
</tr>
<tr>
<td>Curiosity</td>
<td>82</td>
</tr>
<tr>
<td>Sceptical</td>
<td>75</td>
</tr>
</tbody>
</table>

The results of the validation analysis, indicate that the props are developed are in accordance with its function with an average percentage of 95% and 85%. The results showed that props developed able to improve student learning outcomes, with a value of N-gain reached 0.81 are included in the high criteria. Scientific attitude can be identified by their use of props is thoroughness (75%), honesty (80%), curiosity (82%), skeptical (75%). Bimetallic Musschenbroek props can be used to grow and improve the scientific attitude of students.

REFERENCES

DESCRIPTION OF PROBLEM SOLVING ABILITY
STUDENTS IN PHYSICS LESSON

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Abstract—This research aimed to describe the problem solving ability of students in Physics lesson. Ability to solve this problem is indispensable in solving physics problems. This research is a descriptive study, which analyzes the ability of students SMA Negeri I Limboto Gorontalo Regency in solving physics problems. The data collection was done by using the test in the form of a description, and analyzed descriptively qualitative. The results showed that the students' ability in solving physics problems on indicators of useful description, physics approach, and specific applications of physics that are in good category. For indicators mathematical procedure and logical progress indicator, the ability of students to solve problems that are in the unfavorable category.

Keywords: Problem Solving, Physics Lesson

I. INTRODUCTION

Education-related physics, [1] states that the study of physics together with the development of problem solving ability and achievement is measured by a number of problems that can be solved properly by learners. On the other hand, the physics of learners perceive it as difficult subjects [2] This statement is supported by the facts showing that there are learners who are able to make the chart but could not explain its meaning, there are learners who can answer questions but were unable to provide an explanation.

Ability to solve this problem is indispensable in solving physics problems. Ability to solve this problem is indispensable in solving the problems of this fisika. Hal as enshrined in Curriculum 2013 that one Graduates Competency Standards for Science lesson is to show the ability to solve problems in everyday life [3]. In connection that an examination of the problem solving ability of students SMA Negeri 1 Limboto on physics lesson.

II. FORMULATION OF THE PROBLEM

As for problems in this research is how the ability the problem solving high school students land 1 Limboto in physics lesson?

III. RESEARCH PURPOSES

The purpose of this study was to describe the problem solving ability of students SMA Negeri 1 Limboto on physics lesson.

IV. THEORETICAL REVIEW

Problem solving is the efforts of individuals or groups to find answers based on the understanding that has been held previously in order to meet the demands of a situation that was commonplace [4]. Problem solving is looking for a way out of a difficulty, a way around an obstacle, achieve a certain goal is not immediately achievable or use various way out to solve a problem [5] and [6] The same thing was said by [7] that problem solving is a process of cognition to achieve the goal when the method of solution is not obvious to the problem solver. For individuals or groups that get into trouble, of course, they want to solve the problem, and solving problems is something that people do every day [8].

Reference [9] reveals the stages of problem solving as follows: (1) focus on the problem, including determining questions and sketched drawings, as well as choose a qualitative approach; (2) associate the problem with the concept of physics, including diagrams describe, define the symbol and write the
relationship qualitatively; (3) planning solution, requires the selection of a relationship that includes the number of targets, eliminating unnecessary statement; (4) carry out the plan, make a simple statement, exploration, measurement, observation and counting to answer questions; (5) evaluation of solutions, evaluating a reasonable solution, complete and check whether it has been done well or not.

Reference [10] develop instruments to measure problem solving ability with 5 indicators: useful description; physics approach; specific application of physic; mathematical procedures; and logical progression. In this research of researcher adopt instruments developed by Linn as shown in Table 1.

**TABLE 1. RUBRIC FOR PROBLEM SOLVING**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>USEFUL DESCRIPTION</strong></td>
<td>The description is useful, appropriate, and complete.</td>
<td>The description is useful but contains minor omissions or errors.</td>
<td>Parts description are not useful, missing, and/or contain errors.</td>
<td>Most of the description is not useful, missing, and/or contains errors.</td>
<td>The entire description is not useful and/or contains errors.</td>
<td>The solution does not include a description and it is necessary for this problem/solver.</td>
</tr>
<tr>
<td><strong>PHYSICS APPROACH</strong></td>
<td>The physics approach is appropriate and complete.</td>
<td>The physics approach contain minor omissions or errors.</td>
<td>Some concepts and principles of the physics approach are missing and/or inappropriate.</td>
<td>Most of the physics approach is missing and/or inappropriate.</td>
<td>All of the chosen concepts and principles are inappropriate.</td>
<td>The solution does not indicate an approach, and it is necessary for this problem/solver.</td>
</tr>
<tr>
<td><strong>SPECIFIC APPLICATION OF PHYSICS</strong></td>
<td>The specific application of physics is appropriate and complete.</td>
<td>The specific application of physics are missing and/or contain errors.</td>
<td>Parts of the specific application of physics are missing and/or contain errors.</td>
<td>Most of the specific application of physics is missing and/or contains errors.</td>
<td>The entire specific application is inappropriate and/or contains errors.</td>
<td>The solution does not indicate an application of physics and it is necessary.</td>
</tr>
<tr>
<td><strong>MATHEMATICAL PROCEDURES</strong></td>
<td>The mathematical procedures are appropriate and complete.</td>
<td>Appropriate mathematical procedures are used with minor omissions or errors.</td>
<td>Parts of the mathematical procedures are missing and/or contain errors.</td>
<td>More of the mathematical procedures are missing and/or contain errors.</td>
<td>All mathematical procedures are inappropriate and/or contain errors.</td>
<td>There is no evidence of mathematical procedures. And they are necessary.</td>
</tr>
<tr>
<td><strong>LOGICAL PROGRESSION</strong></td>
<td>The entire problem solution is clear, focused, and logically connected.</td>
<td>The solution is clear and focused with minor inconsistent.</td>
<td>Parts of the solution are unclear, unfocused, and/or inconsistent.</td>
<td>Most of the solution parts are unclear, unfocused, and/or inconsistent.</td>
<td>The entire solution is unclear, unfocused, and/or inconsistent.</td>
<td>There is no evidence of logical progression, and it is necessary.</td>
</tr>
</tbody>
</table>
V. METHOD

This research is a descriptive research, describing the students' skills in solving physics problems. To assess the subject's ability to solve the problem, researchers adopted the instruments developed by Lynn (2009). The subjects were students of class XI IPA 4 SMAN 1 Limboto Gorontalo regency. Data were analyzed by descriptive qualitative research.

VI. RESULTS AND DISCUSSION

The results showed that: for the indicator (1) the ability of the students provide useful descriptions are in good category, it is marked with the student capable of organizing the information obtained from the statements given problem, such as: explain what is known, asked on a given problem. This is consistent with the opinion of [10] which states that the indicator helpful explanation, used to assess students' ability to organize information and problem statement into a representation appropriate and useful that summarizes important information symbolically and visually. Explanation considered useful if it provides guidance on the steps in the process of solving problems. An explanation of the problem must include the information that is known and not known, stating the proper symbol for the amount stated goal or target quantity, visualization (sketch or drawing), stating the purpose of qualitative states coordinate system and select systems; for indicator2) the ability of students choose physics approach are in good category, it is characterized by the students were able to choose the right concept or corresponding to the problem to be solved. This is consistent with the opinion of [10] that indicators physics approach used to assess the ability of students choose physics concepts used in solving the problem.

In indicator (3) the ability of students to use a special application of physics that are in good category, this is shown by the students were able to apply the concept corresponding to the problem is resolved. This is consistent with the opinion of [10] indicators specific applications of physics to use to assess the student's ability to apply the concepts and principles of the approach chosen for certain conditions in solving the problem may include statements definition, the relationship between the number, initial conditions, and assumptions or constraints in problems (friction ignored etc).

For indicator (4) the ability of students to use mathematical procedures that are in the unfavorable category, this is shown by many students make mistakes in algebra operations. This is not in accordance with the opinion of [10], which states that the mathematical procedures used to assess students' abilities to follow precise mathematical rules. Mathematical procedure refers to techniques used to solve physics equations number of specific targets, such as summing and reducing strategy of algebra, substitution, use the quadratic formula, or matrix operations. The term refers to the convention mathematical rules of mathematics, such as the appropriate use of parentheses, square root, and trigonometric identities.

For indicator (5) the ability of the students to give answers that focus toward goal dang evaluate the solutions that are in the unfavorable category, it is marked with the student does not check back in solution of the problems resolved, the focus or not. This is not in accordance with the opinion of [10], stating that the logical progress indicator used to assess students' skills in communicating the reasoning or excuse, remain focused toward the goal, and evaluate solutions for consistency (implicitly or explicitly).

VII. CONCLUSION

Based on the results and discussion, it can be concluded that the ability of students to solve problems on the indicator explanations useful indicator physics approach, and indicators specific applications of physics that are in good category, as for indicators of mathematical procedures and indicators of progress logically, the ability of students to solve problems that are in unfavorable category.

REFERENCES

AN INSTRUMENT OF THE IMPLEMENTATION OF SCIENCE AUTHENTIC ASSESSMENT IN IMPLEMENTING CURRICULUM 2013

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Abstract—The study aims to make evaluation instrument of implementation science authentic assessment, were: 1) to determine Aiken’s V score at evaluation instrument validity, and 2) to determine reliability score at evaluation instrument. The study was part of evaluation research using the CIPP Stufflebeam evaluation model. The research instruments were teacher’s questionnaires, students’ questionnaires, document check list, observation sheets, and interview guideline. The instruments were validated using Aiken’s V and limited trial. The Aiken’s V analysis result is valid if has Aiken’s V score more than 0.82 with seven validator (rater) and number of rating categories 5. The results of the limited trial were to know the instrument reliability. The item reliabilities were analyzed with alpha Cronbach estimate. The reliability was done on 250 student respondents. The result of reliability is reliable if has the alpha Cronbach score 0.7. The results of this research are (1) the score Aiken’s V teacher’s questionnaires obtained is 0.997, students’ questionnaires 0.997, document check list 0.999, observation sheets 0.999, and interview guideline 0.999. (2) The reliability score of teacher’s questionnaires is 0.807, students’ questionnaires is 0.79, and observation sheets 0.968. The instruments are valid and reliable to take the research data.

Keywords: Instrument Implementation, Curriculum 2013, Science Authentic Assessment

I. INTRODUCTION

Science is a way that gives us knowledge about the world. Science is always applied in everyday life. Science methods include observation, hypotheses, and predictions [1]. Science is implementing experimental activities, so that science can be used to maintain a healthy life. Itself science should have a dimension to create a way of thinking learners, the way to conduct an investigation, the street becomes the body of knowledge, and thus forming the interaction between technological and social [2]. Science here develops the scientific process to shape the mindset of learners and require special assessment techniques to be scalable nature of the science.

Science teaching received by students in Indonesia has become a benchmark of the progress of education in Indonesia, so the curriculum is turned into a required curriculum 2013. Curriculum 2013 emphasizes teachers must implement authentic assessment in learning. Authentic assessment is included in the education section. Education is promoting the creation of a study group to reflect the ability of high-level skills in learning lab [3]. Thus the authentic assessment is expected to create learners who are environmentally conscious and able to apply the scientific method.

Rating covers all ways of knowing the data about individuals [4]. Such data may include assignments and tests. Such data will provide information about individuals. The individuals are learners. The assessment process can be defined as the collection of evidence about the achievement of learners in the form of assignments and final test.

The good judgment has an assessment procedure. The assessment procedures help the teachers in identifying strengths and weaknesses of the program, monitoring the behavior of learners and motivate learners [5]. The assessment is an authentic assessment. The authentic assessment must run continuously so that active learners can be honed well and accommodated its development by the teacher.
The authentic assessment is measure aspects of knowledge, skills, and attitudes. The assessment in science teaching that measure aspects of knowledge using technical written tests and oral tests, while aspects of skills can be measured by observation, practice sheets, assignments, portfolios, and journals. The aspects attitudes are measured by observation, assessment sheets between friends, and their self assessment. Science authentic assessment is conducted with informed the students on the previous day will be held assessment to learners in accordance with the principles of evaluation.

An authentic assessment is applied in the curriculum of 2013 has been running for three years in Indonesia. Progress on the implementation of the curriculum in particular the application of the science authentic assessment can be measured using an instrument that is valid. A valid instrument must through drafting stage prior to reaching valid and reliable product. Such instruments by the government or the teacher can be used in measuring the implementation of science authentic assessments that have been implemented as recommendations for improvement. Referring to the problems outlined, the researchers sought to develop instruments the implementation of science authentic assessment in the curriculum of 2013. The instrument was developed based on a formula to determine Aiken's V score [6] at evaluation instrument validity, and to determine reliability scores at evaluation instrument.

II. RESEARCH FIELDS

A. Model of the Research

The classification of this research is the development. The products is developed in this study is evaluation of the application of science authentic assessment instrument. The developments of evaluation instruments use five-step research development instrument non test.

B. Time Research

The development of evaluation instruments science authentic assessment was conducted in November 2015 until March 2016.

C. Procedure Development

The development of this research is using non-test instrument development procedure. The stages are used in the development of evaluation instruments science authentic assessment includes five stages. (1) Determining of the instrument specification includes the analysis of students, needs analysis, curriculum analysis, choose the form and format of instrument, define indicators, making grating instrument. (2) Writing the evaluation instrument of the application of science authentic assessment is developed by grilles that have been made, and then prepare a grain instrument. (3) Determining the instrument scale is in the form scale of 1 to 4. (4) Determining the scoring system, the emergence of science authentic assessment based conducted during the learning process is given by the observer and the respondent. (5) Beating out the instrument, perform validation and reliability. Validation is done to the subject matter experts, expert assessment and junior high school science teacher. Reliability tests conducted on respondents in a limited trial.

D. Data analysis technique

Analyses of the content validation are descriptive qualitatively and quantitatively. Quantitative analysis using analysis V’ Aiken [7] with the following formula:

\[ V = \frac{xs}{n(c-1)} \]  

Information:
- \( s = r - lo \)
- \( n = \) number of assessors panel
- \( lo = \) lowest figure validity assessment
- \( c = \) Highest Score validity assessment
- \( r = \) Figures given by an appraiser
Reliability is an instrument used to measure the level constancy for many times. Reliability is used to determine a value of Cronbach’s alpha. The criteria used an instrument had a reliability index that is greater than 0.7 on a Cronbach’s alpha value [4].

III. RESULTS AND DISCUSSION

A. Evaluation Instrument Development Procedure

The development procedure is using CIPP evaluation model consisting of Context, Input, Process, and Product. The instrument developments of authentic assessment application evaluation include document check list, questionnaire technical, observation technical and interview. The technique data collections are “triangulation data”. Triangulation data is used so there is no inequality of data with one another, so that data can be retained for accuracy by analyzing three data used. The instruments are grouped in a pattern of open and closed instrument. The open instruments are in the form of questionnaire sheets, of documents check list sheets, and the interview sheets. The enclosed instrument was used observation sheet.

The teacher’s questionnaire sheets are used to measure the overall evaluation of the application of authentic assessment either context, input, process, and output. The teacher’s questionnaire sheets are filled teacher as an open instrument. The questionnaire sheets are the form of written questions that are used as the acquisition of information from respondents. Sheets of this questionnaire will be prepared for students and teachers. The questionnaires sheets are used to determine the entire assessment activities that are already running in the seventh grade.

Authentic assessment instrument development procedure is as follows.

1. Preliminary studies

A problem analysis is based on interviews with a number of science teachers at junior high school country 1 Wates, and junior high school country 1 Galur. The problem that arises is the application of science authentic assessment that has not run according to the curriculum 2013 assessment standard. Therefore, the need is for instrument of the evaluation of science authentic assessment application. The first form of analysis of curriculum 2013 is reference to a standard assessment of UU No. 104 of 2014. Analysis of teachers and students are aim to determine the characteristics of teachers and learners are students class VII.

2. Determining the instrument specifications

This instrument developed to measure the application of authentic assessment in teaching sciences in 2013. Indicator’s curriculum of this instrument is based on the assessment standards, Law No. 104 of 2014. Indicators of this instrument specifically developed to measure learning materials science classes’ chapter VII of heat and movement. The indicator is based on the definition of sciences authentic assessment operational in the curriculum 2013.

Detailed determination of the instrument can be seen in the application of science authentic assessment indicators listed in Table 1. Table 1 show that the development of indicators grouped in three aspects: planning, implementation, and reporting. These three aspects are in more detail again in 9 sub-aspects. The sub-aspects are analysis of the ability of teachers, analysis infrastructure facilities, planning instruments, preparation of the assessment exercise, attitude assessment, ratings knowledge, skills assessments, principle assessments, and reporting standard.

3. Writing Instruments

Writing instruments are made by considering aspects of material, construction, and language. Instruments of the assessment application evaluation that developed includes: the title, the identity of respondents, and instructions for use.
TABLE 1. INDICATORS EVALUATION INSTRUMENT OF SCIENCE AUTHENTIC ASSESSMENT

<table>
<thead>
<tr>
<th>Aspects</th>
<th>SubAspects</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis of the ability of teachers</td>
<td>1. Understanding the assessment standards</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Training the preparation of authentic assessment analysis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Provision of facilities in the assessment paper.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Provision of tools and materials lab.</td>
<td></td>
</tr>
<tr>
<td>Planning</td>
<td>5. The planning of authentic assessment in learning devices.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. The planning of authentic assessment in media learning devices.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7. The planning of authentic assessment in learning devices student work sheets.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8. Preparation of an assessment rubric</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10. The formulation clearly instrument.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11. Preparation of self assessment indicators can hang learners in mapping capabilities.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12. The planning of authentic assessment in practical activities.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>13. The preparation of authentic assessment in project activities.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14. The planning of authentic assessment with a portfolio that is collected.</td>
<td></td>
</tr>
<tr>
<td>Preparation of the assessment exercise</td>
<td>15. Submitting the aspects that will be assessed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16. Submitting implementation time ratings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>17. Submitting form / used assessment type.</td>
<td></td>
</tr>
<tr>
<td>Attitude Assessment</td>
<td>18. Describe the attitude assessment manual self-assessment instrument.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>19. Assessment between friends of the 3 (three) classmates or just the opposite.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20. Teachers record all findings during learning</td>
<td></td>
</tr>
<tr>
<td>Implementation</td>
<td>21. There is a daily test at the end of a chapter in the form of quiz or assignment.</td>
<td></td>
</tr>
<tr>
<td>Skills assessments</td>
<td>22. Conducting experiments</td>
<td></td>
</tr>
<tr>
<td></td>
<td>23. Learners record their findings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24. Learners conclude its findings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>25. Learners present the results of experiments in classroom</td>
<td></td>
</tr>
<tr>
<td></td>
<td>26. The teacher explains the activity of the experiments.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>27. The teacher explains things that are dangerous from the experiments (safety-lab)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>28. Acting as facilitator and offer guidance to students.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>29. Develop project activities independently.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30. Collect and save the work of learners in one box or folders to remind the students to give the date of manufacture</td>
<td></td>
</tr>
<tr>
<td></td>
<td>31. Provide repair time for work less with a specific time frame.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>32. Teachers check and restore the work of students and then provide feedback and comments that are educational.</td>
<td></td>
</tr>
<tr>
<td>Principle assessments</td>
<td>33. Transparency assessment results.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>34. The use of assessment instruments.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>35. Implement enrichment program.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>36. Implement remedial program.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>37. Implement improvement program.</td>
<td></td>
</tr>
<tr>
<td>Reporting Standard</td>
<td>38. Analysis of results reporting.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>39. Preparation of reporting student learning outcomes.</td>
<td></td>
</tr>
</tbody>
</table>

4. Determine the instrument scale and scoring system
The instrument was developed using a scale of 1–4. Acquisition of raw data beginning with the likert scale was converted into the data in Table 2 [8].

TABLE 2. CONDITIONS CHANGING QUALITATIVE VALUES BECOME QUANTITATIVE VALUE

<table>
<thead>
<tr>
<th>Answer options</th>
<th>Score Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>4</td>
</tr>
<tr>
<td>Agree</td>
<td>3</td>
</tr>
<tr>
<td>Disagree</td>
<td>2</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1</td>
</tr>
</tbody>
</table>

5. Analyzing instruments
The instruments of the Evaluation of science authentic assessment application was developed seven rater assessed by two lecturers are experts and five practitioners (junior high school science teacher).

B. Results Validation Science Authentic Assessment

Validation is done based on the assessment of the substance aspect, construction aspect, and language aspect. Validation results were then analyzed with V’ Aiken approach. V’ Aiken analysis aims to calculate the content validity coefficient (V). V is obtained from the analysis confirmed the limits of a minimum value of V in the table V’ Aiken. Instruments were made researchers validated by seven experts alike with raters (n) 7. Validations were conducted of seven individuals with 1-5 grading scale or number of rating categories 5. Therefore, the allowable range (valid) of the analytical results is the lowest Aiken 0.82 [6]. Translation of the results of the validation of each instrument is structured as follows.

- Validations of questionnaires teachers have V’ Aiken amounted to 0.998, so the questionnaires have a high validity. Value V’Aiken items 1, 9, 10, 11, and 19 are 0.994. Item 2, 4, 6, and 7 at 0.997. Item 18 V’ Aiken value of 0.998. Item 44, 45, and 46 V’Aiken 0.995, while the other points are worth 1.
- Validations of questionnaires learners have V ’Aiken amounted to 0.997, so it has a high validity. Value V’Aiken items 2 and 3 is 0.994. Item 22 of 0.998. Item 23 Aiken value of 0.991. Item 1, 5, 6, 8, 9, 11, 13, 16, and 17 have values V ’Aiken 0.997, while the other points are worth 1.
- Validation observation sheets instruments have V ’Aiken amounted to 0.999, so the observation sheets have a high validity. Value V ’Aiken items 1, 5, and 6 are 0.996, while the other points are worth 1.
- Validation interview guidelines have V ’Aiken amounted to 0.999, so the interview guidelines have a high validity. Value V ’Aiken points 1 and 13 is 0.996, while the other points are worth 1.
- Validation of the instrument check list documents had V ’Aiken amounted to 0.999, so check list documents have a high validity. Value V ’Aiken items 1 and 6 is 0.994. Item 22 worth 0.998, while the other points are worth 1.

Based on analysis of the amount of content validity coefficient of the fifth instrument V’ Aiken assessment shows that the instrument are in conformity with the minimum limit in table V’ Aiken. Instruments evaluation of the application of sciences authentic assessment are developed comply content validity. In addition to knowing the validity of the instruments developed, the validation is to obtain suggestions that can be used as material improvements to the instrument before testing in schools.

C. Revised Product

Revision products obtained from the advice of experts and practitioners. During the trial is limited not found things that require revisions, so the revision is only done when the review process instruments. In more detail, some revision of the product can be described as follows.

- Revised indicators that measure less aspects authentic assessment that demonstrated their more sciences authentic assessment activities.
- Revision grains that statement more communicative statement and homogeneous with other grains in a single indicator.
- Revision clause of the teacher’s capabilities analysis aspects that understand the standards the most votes in the corresponding years of research that No. 104 of 2014.
- Revision grains students’ statement use the learner’s statement on all instruments.
- Revised item questionnaire’s learners statement that shows individual learners like the word “I” is omitted in the statement.
- Revised point statement clarified that point statement for every assessment that should be carried out in the ratings authentic natural sciences special material for heat and displacement.
- Revisions of interview questions contain a question which was significantly higher and interviews carried out developed 5W principle.
- Revised writing student worksheets into worksheet learners.

D. Product reliability
Instruments of research were conducted limited trials in junior high school Yogyakarta implementing Curriculum 2013. The trial was limited to knowing the grains of the instrument that has a reliable high that the grain does not fall. Teacher questionnaire reliability was analyzed with SPPS. The result of the analysis of the teacher’s questionnaire reliability is 0.807. Teacher’s questionnaire sheets get reliable conclusions per nut is nothing aborted. Student questionnaire reliability was performed on grade VII students in junior high school in Yogyakarta. The numbers of learners were used as many as 250 learners. Results were analyzed performed by Quest application shows the estimated reliability of the learners questionnaire sheet have a value of 0.79. Values learners’ questionnaire reliability can say reliable instruments to measure the implementation of science authentic assessment, besides it has a value fit point statement which is in the range 0.70 -1.3. Sample tests have MNSQ value the higher the more convincing that the sample test match or fit with the item being tested. Conversely if MNSQ is the lower grades, the more test samples that do not provide the expected information (not doing or doing random). Based on the mean value and SD INFIT MNSQ overall, is in the range of items that are allowed, is between 0.70 <MNSQ <1.30. INFIT MNSQ and SD were obtained by the 1 ± 0.12, still within the range suggested by [9].

Reliability observation sheets were made for teacher 5 on VII grade in junior high school in Yogyakarta. The fifth teachers were observed 2-3 times learning in order to obtain the data 11 times observation. Reliability observation sheets are calculated with use by third rater and the results were analyzed with the ICC. The result of analysis of reliability observation sheets was amounted to 0.968. Observation sheet to the conclusion of each grain is reliable. Analysis results Cronbach alpha on the observation sheets say every item has the same level of constancy.

IV. Conclusion

The results of this research are as follows. (1) Aiken’s V overall score is valid with a value of more than 0.82. The score Aiken’s V teacher’s questionnaires obtained is 0.997, students’ questionnaires 0.997, document check list 0.999, observation sheets 0.999, and interview guideline 0.999. (2) The reliability score of teacher’s questionnaires is 0.807, students’ questionnaires is 0.79, and observation sheets 0.968. The instruments are valid and reliable to take the research data.

References

DEVELOPMENT OF VIRTUAL LABORATORY
CIRCUIT BUILDER WITH ADOBE ANIMATE CC
FOR ENHANCING STUDENT MASTERY IN
ELECTRICAL CIRCUIT

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Abstract— Observation in SMA N 6 Yogyakarta led by authors showed that the teachers rarely use kinds of instrument to teach electrical circuit. Moreover, it also showed that most of students are familiar with notebook for daily use. Actually, the teachers can engage it during teaching them physics. Hence, the authors developed a virtual experiment about electrical circuit that acts like the real one. It can be accessed easily by students on their notebook. This study introduces a flash-based animation Circuit Builder as simulation designed to help students understanding electrical circuit. The purposes of this study are: (1) to analyze the feasibility level of Circuit Builder for enhancing student mastery in electrical circuit and (2) to know the effectiveness of Circuit Builder based on student mastery in electrical circuit. Circuit Builder was developed by 4D (Define, Design, Develop, and Disseminate) model. The feasibility level was analyzed by CVI (Content Validity Index). Then, the effectiveness was tested with one-sample t-test and Levene’s test. This study proved that: (1) Circuit Builder is feasible to be implemented in physics class with high CVI score (0.82), and (2) it is more effective for teaching electrical circuit than Direct Instruction with high significance value (0,03) based on 5% significance level.

Keywords: Simulation, Circuit Builder, Electrical Circuit, Virtual Laboratory

I. INTRODUCTION

Computers have been used extensively in education. The use of computers has been widely applied in the school and university. In the classroom, computer can be used to display an animation or a moving image. Dancy and Beichner found that students learning with animation get information easier than students writing in the textbook [1]. While in the lab, a computer is used as a tool to collect and display data in real-time [2].

Today, the use of computers in the laboratory is not only to facilitate students in obtaining experimental data. The computer can be used not only as an aid for experiment, but also as an alternative experiment tools. Researchers have developed a computer based simulation that can be utilized by students to do experiment like in the real laboratory. Steinberg found that students who study air friction through computer simulations are as effective as students who studied with traditional methods. In fact, the students who study with simulations tend to be more confident than they don’t [3].

Software like PhET, an interactive science simulations, provides virtual appliances that can be found in the laboratory [4]. PhET simulations have provided 70 simulations including the simulation of electric circuits. Through this simulation, students can vary the value of both the resistor and the battery autonomously. Students are also able to build electric circuits themselves and measure the current and voltage using electrical measuring instrument in their own computers. In fact, these simulations effectively assist students to understand the motion of electrons that can’t be observed by students in the laboratory [5]. The use of simulation in electrical circuit experiment is proved to be as effective as a hands-on experiments in the laboratory [6].

Many simulations have been provided to assist students understanding the concept of electricity. However, most of simulations are produced in a language that is difficult to understand by the students. Simulation only provides the electrical components named in English. This could lead to student find terms
that do not correspond to their textbooks. In addition, many simulation are not equipped with a guide to reach the learning objectives appropriate with the curriculum of 2013. Teachers can’t just rely on simulation to achieve the learning objectives. The existence of lesson plan and worksheet are greatly needed so that the learning is structured and appropriate with the learning objectives.

The existence of laboratory is quite important for good physics learning in the school. Laboratory needs to have appropriate and sufficient teaching materials in order to be an effective science learning [7]. The use of simulation as a substitution for laboratory equipment could be beneficial for the schools, especially for those which have limited equipment. Simulations can be carried out by every students in the class as long as the students have an access to their laptop. In the observation conducted by authors, it found that some senior high school teachers are difficult to teach electrical circuit because of limited practical tool. Besides that, laboratory tools require regular maintenance which many schools rarely done that. Therefore, researchers need to develop an electrical circuit simulation that is contextual to students learning equipped with worksheet and lesson plan.

Authors develop the simulation named Circuit Builder. It is an electrical circuit simulation that is developed with Adobe Flash CC. This simulation is specifically used to learn physics. With this simulation, students are able to conduct electrical circuit experiments which is similar to hands-on experiments in the laboratory. Students are able to build the circuit, vary and measure the quantities provided in the simulation. Students can easily open the simulation on their own laptop because students don’t need to install the simulation. Development of Circuit Builder comes with the worksheet so that students can autonomously carry out electrical circuit experiments. The lesson plan and worksheet of Circuit Builder has been aligned with the curriculum of 2013 so that it can directly be used in the classroom by teachers.

II. METHODS

A. Research Design

This is a research and development study where the authors develop the learning media of Circuit Builder. Products developed in this research include software, lesson plans and worksheets of Circuit Builder. Those are developed with the 4D model [8]. The development steps in this model include defining, designing, developing and disseminating.

This study is a one-shot case study because the assessment only uses the final score of learning outcomes (post-test) without using the pre-test. Researchers only review the post-test because the purpose of this study was to determine the effectiveness of the learning instruments in terms of the achievement of physics passing grade. In this design, there are two groups chosen randomly. The first group called as the control class is a group taught by direct instruction. Meanwhile, the second group referred to the treatment class is a group taught by Circuit Builder.

B. Participant of Study

Research was conducted at SMA N 6 Yogyakarta which is a school of research in Yogyakarta. Subjects of the study include two classroom i.e, X3 and X4. Class of X3 is chosen as a control class and X4 is a treatment class. Either control or treatment class has equally 28 students. The research was conducted during the learning of dynamic electricity held in the second semester of the 2015/2016 academic year. Students get the physics learning once a week for 135 minutes. Dynamic electricity is scheduled to be taught in three meetings. Before students using the laboratory simulation, students have been taught the concepts of dynamic electricity during two meetings.

C. Development Procedure

The procedure of learning instruments development uses the 4D model. This model has development steps as follows:

1) Define

In the beginning of study, researchers conduct observation aimed to observe the condition of physics learning in SMAN 6 Yogyakarta. Through observation, researchers can design appropriate development to meet the needs of physics learning in the school. This step is also conducted in order to find out the character and condition of the students. From this step, authors know that the school needs some new laboratory tools. Beside that, most of students are very familiar with the laptop.

2) Design
In this step, authors identify the learning objectives of Circuit Builder learning aligned with curriculum of 2013. Authors also need to design how Circuit Builder simulation will be implemented in class. Another important thing is identified the criteria of assessment instrument.

3) Development

At this step, researchers develop the draft of Circuit Builder learning instrument. Learning instruments developed include lesson plan, worksheet, and simulation. First, the draft of learning instruments is consulted to lecturers and experts. After that, the draft is tested to the test class. From these activities, researchers found some weaknesses in the learning instruments that should be revised. The suggestions obtained from the experts is helpful for better development. The results of this step are the learning instruments that are ready to be implemented.

D. Instrument

1) Teacher questionnaire
   Questionnaire was used to obtain a score of feasibility for draft of lesson plan, worksheet and simulation. The questionnaire contains 20 items as a form of teacher’s response to the developed products. Questionnaire is previously consulted with experts before being used for the assessment.

2) Student questionnaire
   The questionnaire contains 14 items as a form of student’s response after doing Circuit Builder learning. Items provide the feasibility criteria of the worksheet and simulation with understandable diction for students.

E. Data Analysis

1) Analysis of The Feasibility of Learning Instruments
   The feasibility of the learning instruments is determined from the questionnaire of students and teachers. Assessment in the questionnaire is analyzed with Content Validity Ratio (CVR) and Content Validity Index (CVI) [9]. First, questionnaire scores are analyzed using a CVR. After that, the CVR scores obtained on each items are analyzed using CVI. Steps to analyze with CVR and CVI are as follows:
   a) Determining the assessment criteria for validator
      Validator provides a response to the learning instruments by giving a score to each criterion as in the Table 1.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is no one of criteria</td>
<td>1</td>
</tr>
<tr>
<td>The criteria is less complete</td>
<td>2</td>
</tr>
<tr>
<td>The criteria is complete</td>
<td>3</td>
</tr>
</tbody>
</table>

   b) Calculating the CVR
      The value of CVR can be calculated including the number of validator who agree ($N_e$) and the total number of validator ($N$) to the following formula:
      $$\text{CVR} = \frac{N_e}{N - \frac{N_e}{2}}$$

   c) Calculating the CVI
      After each item is analyzed using CVR, CVI is calculated to be the validity index of learning instruments. Basically, CVI is the mean of CVR from each item of validation questionnaire.
      $$\text{CVI} = \frac{\text{sum of the CVR}}{\text{the number of items}}$$

   d) Categorizing the CVR and CVI value
      The range of CVR and CVI value is between -1 and 1. But, the feasible learning instrument should have score between 0 until 1. The feasibility value of instrument can be categorized as shown in Table 2.

   | TABLE 2. CATEGORY OF THE FEASIBILITY OF LEARNING INSTRUMENTS [10] |

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is no one of criteria</td>
<td>1</td>
</tr>
<tr>
<td>The criteria is less complete</td>
<td>2</td>
</tr>
<tr>
<td>The criteria is complete</td>
<td>3</td>
</tr>
</tbody>
</table>
### Value and Category

<table>
<thead>
<tr>
<th>Value</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.875 &lt; X ≤ 1</td>
<td>Very Good</td>
</tr>
<tr>
<td>0.583 &lt; X ≤ 0.875</td>
<td>Good</td>
</tr>
<tr>
<td>0.417 &lt; X ≤ 0.583</td>
<td>Average</td>
</tr>
<tr>
<td>0.192 &lt; X ≤ 0.417</td>
<td>Bad</td>
</tr>
<tr>
<td>0 &lt; X ≤ 0.192</td>
<td>Very Bad</td>
</tr>
</tbody>
</table>

2) **Analysis of Effectiveness of Circuit Builder**

The effectiveness test is based on students work on the worksheet from both control class and treatment class. This study uses one sample t-test calculated with SPSS 21. The decision criterion is null hypotheses will be rejected if the significance value is less than the significance level (α).

Firstly, authors test the effectiveness in control class. Control class is a group that being taught electrical circuit by direct instruction. This test determines whether the direct instruction is effective to teach students electrical circuit. The students post-test is analyzed using SPSS 21 based on the physics passing grade (75). The hypothesis of the effectiveness test in the control class are as follows:

\( H_0: \text{Direct Instruction is ineffective for student in achieving physics passing grade} \)

\( H_a: \text{Direct Instruction is effective for student in achieving physics passing grade} \)

Next, effectiveness test is conducted to the treatment class. This class is a group that uses Circuit Builder in physics learning. The purpose of this test is to analyze the effectiveness of Circuit Builder for enhancing students mastery in electrical circuit. The processed data is the students work to Circuit Builder worksheet with a passing grade (75). Hypothesis of the effectiveness test in the treatment class are as follows:

\( H_0: \text{Circuit Builder learning is not effective for student in achieving physics passing grade} \)

\( H_a: \text{Circuit Builder learning is effective for student in achieving physics passing grade} \)

The previous test will show us that Direct Instruction and Circuit Builder learning is effective or not. If Circuit Builder is effective and Direct Instruction is not, it clearly describes that Circuit Builder learning is more effective than Direct Instruction. Nevertheless, if it founds that both of them are effective, this study has to make further analysis, Levene’s Test with SPSS 21. It compares the mean of score between the control and treatment class. The result of this analysis shows whether there is a difference between the mean score of control and treatment class significantly. Then, if treatment class score differs from control class significantly and it is bigger, it can be concluded that the treatment class is more effective than control class. Hypothesis constructed in this test is as follows:

\( H_0: \text{there is no significant difference on the student learning outcomes between Circuit Builder learning and Direct Instruction} \)

\( H_a: \text{there is significant difference on the student learning outcomes between Circuit Builder learning and Direct Instruction} \)

### RESULTS AND DISCUSSION

**A. User Interface (UI) and Features of Circuit Builder**

Circuit Builder was developed by Adobe Animate CC with Actionscript 3.0. Circuit Builder had been designed based on the easy of use for students so they didn’t feel difficult when using Circuit Builder during learning process. The details of each Circuit Builder UI are described below.

1) **Splash Screen**

This part contained flash information about apps name, Circuit Builder (shown in Figure 1 below).
2) **Learning Objective**

Learning outcomes that must be students achieved would be explained in this section as shown in Figure 1.

3) **Introduction**

As shown in Figure 2, it described a brief description about electrical circuit to recall student to the matter.

4) **Components**

It had information about electrical components which would be used in experiment such as cell, wire, bulb, resistor, switch, ammeter, and voltmeter (Figure 2).

5) **About the Tutorial**

It described about what we could do with Circuit Builder (Figure 3).

6) **Circuit**

This was the flagship feature of Circuit Builder. It was the virtual laboratory UI for student to build the desired circuit, measure electrical current with ammeter, and measure voltage with voltmeter autonomously. The details were described in Figure 3.
B. The Feasibility of Circuit Builder

The feasibility of Circuit Builder was analyzed based on assessment by student and teacher who had used Circuit Builder on physics learning.

1) According to Assessment by Students

As shown in Table 3, Circuit Builder get the average of CVI value 0.72 (good category). It means that Circuit Builder had been able to be understood and approved by student. Circuit Builder had also been feasible to be used in physics learning. Nevertheless, there were some aspects that became the weaknesses of this apps. It was shown by the two lowest scores i.e character and motivation aspects. It might be caused by the monotonous interface so that students hadn’t be encouraged to study physics.

2) According to Assessment by Teacher

Table 4 inferred that Circuit Builder gets the average of CVI value 0.82 (good category). It means that Circuit Builder had been able to be understood and approved by teacher too. Circuit Buider had also been feasible to be used in physics learning. However, some weaknesses were still found in two aspects, i.e subject matter and instruction. Teacher said that the contents hadn’t been good enough. There were some misconceptions found in Circuit Builder. And also it was still found some operational verbs that might be difficult for student to understand, or even it could cause misunderstand. Hence, the score of those aspects was still categorized as average.

TABLE 3. ASSESSMENT BY STUDENTS TOWARDS CIRCUIT BUILDER

<table>
<thead>
<tr>
<th>No</th>
<th>Aspect</th>
<th>CVI</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Contents</td>
<td>0.95</td>
<td>Very Good</td>
</tr>
<tr>
<td>2</td>
<td>Pleasure</td>
<td>0.74</td>
<td>Good</td>
</tr>
<tr>
<td>3</td>
<td>Character</td>
<td>0.46</td>
<td>Average</td>
</tr>
<tr>
<td>4</td>
<td>Language</td>
<td>0.81</td>
<td>Good</td>
</tr>
<tr>
<td>5</td>
<td>Motivation</td>
<td>0.26</td>
<td>Bad</td>
</tr>
<tr>
<td>6</td>
<td>Illustration</td>
<td>0.85</td>
<td>Very Good</td>
</tr>
<tr>
<td></td>
<td>Content Validity Index (CVI)</td>
<td>0.72</td>
<td>GOOD</td>
</tr>
</tbody>
</table>

C. The Feasibility of Lesson Plan and Worksheet

According to the assessment by physics teacher, the feasibility of lesson plan and worksheet was assessed. Teacher agreed that the worksheet of Circuit Builder had been feasible to be used in physics learning in good category. Nevertheless, there were some differences opinion between teacher and students. Students thought that the worksheet appearance was bad, but the teacher said that the worksheet had a good appearance. It could be caused by the difference point of view between them. She thought that the essential feature that must be presence in worksheet is the tasks and concepts included inside. If those were presence, the appearance aspect is not important. But, it could be a good suggestion for the authors to revise the appearance, so students would be more interested to study with the worksheet.

Lesson plan of Circuit Builder was also assessed as a feasible learning instrument based on teacher assessment. She concluded that lesson plan had a good category. However, she felt that there wasn’t
methods to assess learning outcomes. In her opinion, it was needed to give students exercise so that they are able to solve physics problems. Then, teacher could measure the student achievement.

D. Effectiveness of Circuit Builder for Enhancing Student Mastery in Electrical Circuit

As shown in Table 5, it presents the result of effectiveness test on Direct Instruction (control class). This effectiveness was analyzed by one-sample t-test towards students achievement based on physics passing grade. According to Table 5, Direct Instruction was actually effective for studying electrical circuit.

Then, Table 6 presents the result of effectiveness test on Circuit Builder learning (treatment class). This effectiveness was analyzed by one-sample t-test towards students attainment based on physics passing grade. According to Table 6, Circuit Builder was also effective for studying electrical circuit.

### TABLE 4. ASSESSMENT BY TEACHER TOWARDS CIRCUIT BUILDER

<table>
<thead>
<tr>
<th>No</th>
<th>Aspect</th>
<th>Value</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Learning process</td>
<td>0.75</td>
<td>Good</td>
</tr>
<tr>
<td>2</td>
<td>Curriculum</td>
<td>0.92</td>
<td>Very Good</td>
</tr>
<tr>
<td>3</td>
<td>Subject Matter</td>
<td>0.67</td>
<td>Average</td>
</tr>
<tr>
<td>4</td>
<td>Color</td>
<td>0.75</td>
<td>Good</td>
</tr>
<tr>
<td>5</td>
<td>Diction and Language</td>
<td>1</td>
<td>Very Good</td>
</tr>
<tr>
<td>6</td>
<td>User Interface</td>
<td>1</td>
<td>Very Good</td>
</tr>
<tr>
<td>7</td>
<td>Instruction</td>
<td>0.67</td>
<td>Average</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>0.82</td>
<td>GOOD</td>
</tr>
</tbody>
</table>

### TABLE 5. ANALYSIS RESULT OF ONE SAMPLE T-TEST IN DIRECT INSTRUCTION

<table>
<thead>
<tr>
<th>One-Sample Test</th>
<th>Physics Passing Grade = 75</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Instruction</td>
<td></td>
<td>3.295</td>
<td>27</td>
<td>.003</td>
<td>4.07500</td>
<td>1.5376 - 6.6124</td>
</tr>
</tbody>
</table>

Interpretation:
According to $\alpha = 0.05$, it achieved sig. value 0.03 that less than 0.05 so Ho was rejected. It proved that Direct Instruction was effective according to student achievement based on physics passing grade.

### TABLE 6. ANALYSIS RESULT OF ONE SAMPLE T-TEST IN CIRCUIT BUILDER LEARNING

<table>
<thead>
<tr>
<th>One-Sample Test</th>
<th>Physics Passing Grade = 75</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuit Builder</td>
<td></td>
<td>2.993</td>
<td>27</td>
<td>.004</td>
<td>7.03571</td>
<td>3.0311 - 11.0403</td>
</tr>
</tbody>
</table>

Interpretation:
According to $\alpha = 0.05$, it achieved sig. value 0.04 that less than 0.05 so Ho was rejected. It mean that Circuit Builder was effective in terms of student attainment based on physics passing grade.

Unfortunately, this study found that Circuit Builder Learning was as effective as Direct Instruction. It required further analysis to determine what learning method that would be better. Then, we should analyze with Levene’s Test to know the mean difference between Direct Instruction and Circuit Builder learning. The analysis result shown in Table 7.

### TABLE 7. ANALYSIS RESULT OF LEVENE’S TEST

<table>
<thead>
<tr>
<th>Independent Samples Test</th>
<th>Levene’s Test for Equality of Variances</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Equal variances assumed</td>
<td>9.955</td>
<td>.003</td>
</tr>
<tr>
<td></td>
<td>Equal variances not assumed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Interpretation:
According to $\alpha = 0.05$, it achieved sig. value 0.03 that less than 0.05 so Ho was rejected. It means that there is a mean difference of student mastery in electrical circuit between direct instruction and Circuit Builder learning.

It was clearly proved that there was student mastery difference between Direct Instruction and Circuit Builder learning significantly. As shown in Table 8, the mean of student mastery in Circuit Builder learning was also more than Direct Instruction get. Therefore, it could be concluded that Circuit Builder was more effective than Direct Instruction.

This findings showed that learning with computer-based simulation had a benefit for students in learning electrical circuit. Circuit Builder had a considerable impact for student in learning concepts of electrical circuit. In this study, there were four aspects in assessing students’ mastery in electrical circuit, i.e. collecting data, data analysis, discussion, and conclusion. They were contents included inside the worksheet. According to the student score accumulation, students get the highest score in collecting data and data analysis aspects. It indicated that students were still focused in calculating and formulating on physics learning. Actually, students had really had enough knowledge about electrical circuit that they had learned before. They are also skilled to build circuit, measure with ammeter and voltmeter. Then, they could apply the Ohm’s law to analyze the collected data. Nevertheless, students was still confused in making discussion and conclusion of experiment, as also showed by Reference [5]. It could be caused they didn’t usual working experiment activity in physics class.

**TABLE 8. DESCRIPTIVE ANALYSIS OF STUDENT MASTERY IN DIRECT INSTRUCTION AND CIRCUIT BUILDER LEARNING**

<table>
<thead>
<tr>
<th>Group Statistics</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>28</td>
<td>Direct Instruction</td>
<td>79.0750</td>
<td>6.54368</td>
</tr>
<tr>
<td>Score</td>
<td>28</td>
<td>Circuit Builder</td>
<td>82.0357</td>
<td>12.44092</td>
</tr>
</tbody>
</table>

IV. CONCLUSIONS

According to the research result and analysis towards findings during research, it could be concluded that:

1. Virtual Laboratory Circuit Builder was feasible to use in physics learning on electrical circuit. It is proved by the CVI value 0.72 (good category) from assessment by students and from teacher 0.82 (good category).
2. Learning electrical circuit with Circuit Builder was more effective than Direct Instruction which was proved by the significance value 0.03 based on 5% significance level.

ACKNOWLEDGMENT

This study is a final project of authors’ course, Innovation of Physics Learning, in Graduate School of Physics Education of Yogyakarta State University. We would like to say big thanks for lecturers (Dr. Insih Wilujeng, M.Pd and Prof. Suparwoto, M.Pd) and also colleague teacher in SMA N 6 Yogyakarta (Estri Utami, S.Pd) who have directly given guidance for us during finishing this study. The contents of this study are solely the responsibility of the authors and do not necessarily represent the official views of Yogyakarta State University and SMA N 6 Yogyakarta.

REFERENCES


Abstract—This study aims to develop an integrated science learning non-textbook using webbed model with theme of health. The method that used is educational research and development with 4D model. This book serves as an enrichment teaching material for student in junior high school. The book emphasizes the interesting illustration and applicable information of science related to human health. The research instruments are judgement sheets for assessing four main aspects of a good learning book (i.e. material, presentation, language, and graphic), questionnaire, and interview guide. The result of judgement of experts show that quality of book is classified very good with a percentage of eligibility of 86%. Based on the results of the students questionnaire, the book is classified very good with a percentage of response of 82%. According to the response of the teachers, the book is good as it meets the standard of non-textbook writing in Indonesia, contain the applicable information, and easy to be understood by students with various achievement. We conclude that the book could be a choice to help conducting an integrated science teaching and learning in junior high school.

Keywords: Applicable Information, Integrated Science, Non-textbook, Webbed model

I. INTRODUCTION

Teaching material is one of three important elements in teaching and learning process, besides teacher and student. It helps to reach the goals of learning in particular and the goals of national education in general. The goals of national education is derived to curriculum. In Indonesia, if we analyze 2013 Curriculum, we could see that the curriculum requires science to be taught by integrated approach. Integrated curriculum has a huge potential to make a difference in school. History has given many evidences of the success of the integrated curriculum [1]. Integrated curriculum has also gained a lot of acceptance among educators. Many educators have given testimonials about the effectiveness of their teaching units, and many professional organizations emphasize integration across the curriculum. Moreover, proponents of the integrated curriculum reported the benefits of the integrated curriculum to help students gaining a deeper understanding, seeing the big picture concepts, making the curriculum more relevant to students, building relationships between the main concepts, and the main attraction and motivation in school [2].

Being taught by an integrated approach, students are expected to understand science completely and thoroughly. Application of integrated science curriculum provides a powerful learning experience design to enrich the knowledge and conceptual understanding [3]. Justification for integrated learning is that the experiences or problems in our daily life are not separated into varieties of different subjects such as the school curriculum in general [4]. Integrated science teaches the basic principles of science and helps unify science concepts in order to obtain a better understanding of the students of junior high school [5].

We develop an integrated science learning non-textbook as a teaching material to help teacher and student gaining the expected goals. Learning non-textbook can be helpful as a complement to learning textbooks as stated in the Ministerial Regulation No. 2 of 2008 Education Article 6 (2) which states that “In addition to learning textbook, educators can use the guidebook educators, enrichment books, and reference books in the learning process”. This description is reinforced by paragraph (3) which states that “To increase knowledge and insight of students, educators can encourage students to read enrichment books and reference books”. The non-textbook book developed provide a context that facilitates students’ understanding and relate the material learned with their daily life.
According to the Ministry of Education [6] integrated learning in science can be packaged with the theme or topic of a discourse that is discussed from various viewpoints or scientific discipline that is easily understood and known to students. That means, the teaching materials should be presented in a theme or topic anyway. Teachers also will be easier to transform teaching materials to students.

The use of the theme as a binder in combining the concepts in the integrated sciences in line with one of the models for the integration of the curriculum, which is a model webbed. This model uses a theme that will be the hook between concepts, so that science can be understood completely. Webbed model can increase learning motivation as a result of the selection of attractive themes. In addition, this model provides a clear explanation and motivation for students because students can see how different ideas and activities be connected [7]. Webbed approach is often obtained through the use of conceptual themes, are common yet spacious. The conceptual theme provides many possibilities for use in a variety of disciplines. So that learning science is very beneficial in everyday student life, the theme chosen should be a contextual thing close to students' everyday lives.

When examining national education goals, it can be seen that the national education aims at developing students' potential to become a man of faith and fear of God Almighty, noble, healthy, knowledgeable, skilled, creative, independent, and become citizens of a democratic and responsible. One of the aspects mentioned above is healthy. In the analysis of basic competencies in the curriculum in 2013, can be seen the relationship between the number of basic competencies with the health aspects. In addition, a healthy lifestyle is one of the graduates’ competence in the domain stance on natural elements on the Curriculum 2013 science subjects. If the health theme was used as the theme of a non-textbook of integrated science lessons, then the science lesson is expected to be more meaningful and useful for student life. Using the theme of health, students are expected to also understand that health is a gift from God, and maintain health is one form of gratitude towards the award. We believe that learning is not just a transfer of knowledge but also the transfer of value. There is six chapters in the non-textbook developed; Nutrition of Food; Human Digestive Systems; Human Circulatory System; Human Respiratory System; Additive Substances, Addictive Substance’s and Psychotropic Substance; and Motion, Force, and Human Health.

II. METHODS

A. Design of Research

This study use an education research and development design with the 4D model that consist of define, design, develop, and disseminate phase [8]. According to [9], to develop teaching materials, there are four steps that must be taken before the instructional materials is feasible to be delivered for student. The four steps is a selection process, structuring, characterization, and didactic reduction. The four steps is known by 4 STMD (Four Steps Teaching Material Development). We do two of four steps, which is selection and structurization.

B. Participants and Instruments

Five experts assessed the non-textbook using the judgement sheets developed by the governor. These experts are lecturers taught science in five universities in Indonesia. They assessed four components of a good learning book: component of material, component of presentation, component of language, and component of graphic, based on criterias on judgement sheets. 30 student of junior high school give their opinion about the non-textbook. We also interviewed five science junior high school teacher using interview guide to get their opinion about the non-textbook.

III. RESULT

Based on experts judgment, the integrated science non-textbook with theme of health which is developed in this study declared eligible by the very good predicate, with a percentage of 86% eligibility. Experts judge four components of the non-textbook which is component of material, component of presentation, component of language, and component of graphic. The component of materials of the non-textbook is in excellent grade with a percentage of 89%. The component of presentation of the non-textbook is in excellent grade with a percentage of 90%. The language component of the non-textbook is in good grade with a percentage of 84%. The graphics component of the non-textbook is quite well with the percentage of 83%.
After getting the results of the assessment of experts, we asked the students' response to the non-textbook book which developed. Students' response was obtained through a questionnaire. The questionnaire was developed using Likert scale. The questionnaire used in this trial was made in the form of a checklist with four gradations of response, namely Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). The answer of the students were then given a score corresponding weight of each gradation answers. Answer SA was given a score of 4, A was given a score of 3, D was given a score of 2, while SD was given a score of 1.

The results of teachers interview obtained a positive response for the non-textbook book to meet the three conditions. According to the teachers, the non-textbook developed is quite easily followed by students with various achievement level. This is in accordance with the terms of didactic. The use of language in the phrase is good as it is short and clear. This shows quite eligibility construction. In terms of appearance, the non-textbook is interesting. It shows that the book is quite technically qualified. In addition, also obtained feedback that the illustrations used to attract students' motivation to learn the material. Some suggestions are obtained is relating to the addition of evaluation questions for challenging students to test their knowledge, adding other concepts associated with the health theme, and updating the cover with the more interesting picture. Positive response from assessment's teachers indicated that the non-textbook developed can be used as an enrichment of science learning in school.

IV. DISCUSSION

Previous studies have shown that an integrated learning has been widely demonstrated positive effects for students, for example to enrich their knowledge and help students gain a deeper understanding [1][2][3][5]. We use webbed model that use a theme as a core of curriculum alignment. Thematic learning is supported by scientific research that people will process information through patterns and connectedness rather than through a separate knowledge [10].

This book is intended to provide the more applicable information, by incorporating the concept into context. In addition to the main material, in each chapter presented additional information that aims to facilitate students to apply the material learned into daily life. Additional information is presented in a box. This information helps students to see the connection between the materials being studied, so that is much easier to implement the concept in daily life. Additional information aims to enrich students' knowledge and understanding of science, especially in the material that is being presented in the book. For example in the chapter "Nutrition of Food" on the matter "Carbohydrates", we present additional information on obesity, which is about the dangers of excess carbohydrates in the body. With such information, the students can know that they have to balance their carbohydrate intake with their needs.

We conducted various analyzes to initiate planning of development books in this study. The first analysis is the analysis of the curriculum. This analysis is useful for the book developed to meet what is mandated by curriculum. It is as did in previous studies [11]. These preliminary analyzes are also useful to answer problems that occur [12]. Books that match with the curriculum will help teachers to achieve the goal of learning, it can also be a means to improve the professionalism of teachers. This also relates to how teachers use textbooks available, as reported earlier research [13][14].

The results showed that students responded very well to the non-textbook. Students agree that the non-textbook developed contains material which is easy for them to apply it in daily life. A positive result is in line with previous studies [15] which also developed the applicative concept but it is on the disciplines of biology. Students also thought that they feel happy if the non-textbook book developed in this study is used in science learning in the classroom. This corresponded to what is said in [16] that students will be motivated if the information in the book can be easily carried or applied in daily life. Creating materials related to student life can also increase students' interest as reported by [17]. Our study answered recommendation from previous studies that recommend that textbooks should also give advice on how to implement the activities and materials that are relevant and suitable in the specific context in life [18][19]. A previous study of [20] also recommends that science learning may associate an abstract material of science with phenomena that are relevant to students' lives. From the results of the questionnaire, obtained the overwhelming response that the students feel happy if the book developed in this study is used in science learning in the classroom.
Based on the results of expert assessment and student responses, the language used in the book were developed well. Students argued that the sentence in the book can be understood. We used a style that appropriate to the target readers which is junior high school students. This is in line with research from [21] which examines the suitability of the use of language to the target reader.

From the aspect of graphics and presentation, both the results of expert assessment and response of students and teachers show good results. Students agreed that the appearance and the illustrations in the book is fascinating. Students also agreed that the illustrations featured in the book help them to understand the material [19]. Appearance on content and images or illustrations got a good response. Students responded that the presentation of images in each material help them understand the material. These results are consistent with previous studies of [5] reporting that a presentation of learning materials can significantly affect students’ interest and understanding. Graphic components is the one of the main reasons in choosing a particular book to be studied, as reported by research of [22].

V. CONCLUSION

The result of judgment of experts show that quality of book is classified very good with a percentage of eligibility of 86%. Based on the results of the students questionnaire, the book is classified very good with a percentage of response of 82%. According to the response of the teachers, the book is good as it meets the standard of non-textbook writing in Indonesia, contain the applicable concept, and easy to be understood by students with various achievement. We conclude that the book could be a choice to help conducting integrated science teaching and learning in junior high school.

REFERENCES

THE APPLICATION OF CHARACTER EDUCATION OF COLLEGE STUDENTS THROUGH ACADEMIC ORIENTATION AND STUDENT ACTIVITIES

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Abstract—This paper aims to explain the application of character education of college students through academic orientation and student activities. Character education, built and established in the first year, in order to later students became graduates who have the tough minded individuals, personal, moral, and cultured. His character also are established and established from previous education in order to be ready to enter the world of work. Ornik becomes the first time recognition of activity entering the world of campus so it could be an early mover in the formation of character. The next activity is an activity of Student Affairs as part of a continuous process until the students complete the accompanying lecture became a scholar.

Keywords: Academic Orientation, Character Education, Student Activities

I. INTRODUCTION

Character education in the last six years, has become an important and fundamental part of the mandatory courses by students, such as religious education, civics, citizenship education (PKN), Moral education, and character education. This is an effort from the campuses to develop and apply the values of kindness, nor a positive habit in the student. For the development of character education at the campus, in fact it is not difficult because the freshmen have gotten stock and experience during the previous level in school, from primary school (Elementary School/SD), further to the level of junior high school (Middle School/SMP), and high school (High School/SMA). Moreover, if these new students have the opportunity to follow various activities or organisation of students when the school and the community in the neighbourhood.

This paper highlights regarding the implementation of character education through academic and student activities orientation. Academic orientation is the first door in the an introduction to campus for freshmen. Meanwhile, activities of student activities is next door for students to engage actively in the various activities offered by the College. Therefore, according to the author, in addition to the process during lectures each semester, the implementation of character education can be started from activities orientation and student activities in order for various values of the characters want to be observed on a freshman, can be easily monitored and viewed the extent of the development or implementation of character education goes as expected.

II. THE APPLICATION OF CHARACTER EDUCATION IN COLLEGE

Campus environment (College) is a formal institution that became stock preparation a student entering the world of work. In addition, the campus has the mandate and the scientific challenges to creating an environment of academic integrity, ethical, cultural, moral, and social change agent can be a (agent of social change) in the environmental community.

There are several definitions regarding education, character education, and character of the various opinions of experts, including the opinion of Sukmadinata that education is essentially an interaction between educators with learners, to achieve the goals of education, which takes place in a particular environment [1]. This interaction is called the interaction of education, namely the interplay between educators with learners. It complies with Law Number 20 in 2003 regarding the notion of education is planned and conscious effort to bring about an atmosphere of learning and the learning process so that learners are actively developing the potential for her to have a religious, spiritual power of self-control, personality, intelligence, morals, as well
as the necessary skills themselves, society, nation, and state. Whereas, the opinion of Thomas Lickona that the character is "A reliable inner disposition to respond to situations in a morally good way." Furthermore, Lickona adds "Character so conceived has three interrelated parts: moral moral feeling, knowing, and moral behavior." According to Lickona, noble character (good character) includes knowledge of the good (moral knowing), and then gives rise to commitment (intention) against goodness (moral feeling), and finally really do good (moral behavior). In other words, the character refers to a series of knowledge (cognitives), attitudes, and motivation, as well as the behaviors and skills" [2].

Furthermore, understanding the character of Indonesian Language Dictionary, that the word refers to a character by character, psychological traits, morals or character that distinguishes a person with another, and character [3]. The character can also mean letters, numbers, space, special symbols that can appear on the screen with the keyboard. Meanwhile, Zainal and Sujak states "character refers to a series of attitudes, behavioural (behaviors), motivation, and skills. The character of Greece, which means 'to mark ’ or mark and focuses how to apply the value of goodness in the form of action or conduct" [4].

Furthermore, the understanding of character education from Frye that "Character education as a national movement creating schools that foster an ethical, responsible, and caring young people by teaching and modeling good character through an emphasis on universal values that we all share" [5]. Further, Frye explains that "character education is a deliberate attempt to help someone understand, guarding, and behave in accordance with the values of noble character" [5]. Whereas, Kemendiknas tells us that character education is instilling good habits (habituation) so that learners are able to behave and act on the values that have become his personality. In other words, a good character education should involve a good knowledge (knowing moral), feeling good or loving good (moral feeling) and good behaviour (moral action) so formed the embodiment of unity of the behavior and attitudes of life learners [6]. For the development of character education, teachers must also cooperate with the family or parents/guardians of students. Thus, the development of character education in schools, it is also the process of coaching, giving guidance and facilitation to the learners to become employees of the younger generation and a smart, skilled, independent, ethical sublime, faith and piety, as a manifestation of the results though thought, though careful, sport, sports, as well as sports karsa.

Appropriate explanations of the Kemendiknas, can be described also for implementation of character education in the PT (the world campus) is a college professor is able to show and explain some of the characters that are expected on the students in the learning process as well as the time of giving individual tasks and task groups, so that students can apply in daily is in the campus environment as well as his residence. In addition, the campus party (in this case the University or Faculty) may facilitate the development of character education in the activities of the academic orientation and student activities to run over the build process, form, and developing character education to students. As for according to Kemendiknas, values education culture and national character that must be developed in the learners, comprised of 18 values are presented in Table 1 [6].

Appropriate Table 1 regarding the educational values of culture and the national character that must be developed in students consisted of 18 values are presented according to the Kemendiknas [6], it is understood that these values represent 18 different characters that are expected from a student who demonstrates the attitude of religious tolerance, friendly/communicative, and appreciate the achievements (attitude and behavior to be obedient and disobedient running devotion as a servant of God , be appreciative and respectful of other religions, are able to become endeared to his peers as well as adults, achievers in any field to express himself and his ability, as well as maintaining good relations and harmony with various tribes, religion, or social). There are honest, independent, attitude and responsibilities (attitudes and behaviors that make other people believe in personal as well as the ability of a student can complete his studies or his role in the activity of a student with good).

So does with discipline, hard work, creative, have a curiosity, and an avid reader (be an indication that the student is able to organize and manage herself, an effective time for each lecture and student profile, always actively involved and contributing positively in every given task, being able to decide an issue with a calm,
controlled demeanor, as well as the always renewed itself with information and the latest news so it could show its best-in-class quality and student activities).

**TABLE 1. DESCRIPTION OF EDUCATIONAL VALUE THE CULTURE AND CHARACTER OF THE NATION [6]**

<table>
<thead>
<tr>
<th>No.</th>
<th>Character Values</th>
<th>Character value Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Religious</td>
<td>Attitudes and behavior that comply in carrying out the teaching of the religion adhered, tolerant of other religions, and implementation of life get along well with other religions</td>
</tr>
<tr>
<td>2</td>
<td>Honest</td>
<td>Behavior is based on the efforts of making himself as someone who can be trusted in the word, action, and employment</td>
</tr>
<tr>
<td>3</td>
<td>Tolerance</td>
<td>Attitudes and actions that respect differences of religion, tribe, ethnicity, opinions, attitudes and actions of others different from themselves</td>
</tr>
<tr>
<td>4</td>
<td>Disciplinary</td>
<td>Action that demonstrates the behavior of the orderly and obedient at various conditions and regulations</td>
</tr>
<tr>
<td>5</td>
<td>Hard work</td>
<td>Behavior that shows an earnest effort in overcoming the various barriers to learning and assignments, as well as a job as well as possible</td>
</tr>
<tr>
<td>6</td>
<td>Creative</td>
<td>Attitudes and behaviors to make way for new results or from something that has been owned</td>
</tr>
<tr>
<td>7</td>
<td>Independent</td>
<td>Attitudes and behavior that is not easily depending on others to complete tasks</td>
</tr>
<tr>
<td>8</td>
<td>Democracy</td>
<td>A way of thinking, behaving, and act which assesses the same rights and obligations with others</td>
</tr>
<tr>
<td>9</td>
<td>Want to know</td>
<td>The attitude and action is always striving to know more profound and pervasive than anything he had learned, seen, and heard</td>
</tr>
<tr>
<td>10</td>
<td>The spirit of the national</td>
<td>A way of thinking, acting and insightful that puts the interests of the nation and the country above self-interest and group.</td>
</tr>
<tr>
<td>11</td>
<td>Love the homeland</td>
<td>How to think, Act and do that show of loyalty, care and appreciation towards language, the physical environment, social, cultural, economic and political Nations</td>
</tr>
<tr>
<td>12</td>
<td>Appreciating The Achievements</td>
<td>The attitudes and actions that encourage him to produce something useful for the community, recognising, as well as respect for other people's success</td>
</tr>
<tr>
<td>13</td>
<td>Friendly / Communicative</td>
<td>Action that shows a sense of love to talk, hang out and collaborate with others.</td>
</tr>
<tr>
<td>14</td>
<td>Peace-loving attitudes</td>
<td>Words and actions that cause others to feel happy and secure over the presence of himself</td>
</tr>
<tr>
<td>15</td>
<td>An avid reader</td>
<td>Habits provide time to read the various readings which give virtue for him</td>
</tr>
<tr>
<td>16</td>
<td>Care for the environment</td>
<td>Attitude and actions that are always working to prevent damage to the surrounding natural environment and developing efforts to repair the damage that has already occurred</td>
</tr>
<tr>
<td>17</td>
<td>Social care</td>
<td>Attitude action that always wants to provide help to other people and communities in need</td>
</tr>
<tr>
<td>18</td>
<td>Responsibility</td>
<td>The attitudes and behavior of a person to perform the duties and obligations that he was supposed to do, against oneself, society, environment (natural, social and cultural), country, and God Almighty</td>
</tr>
</tbody>
</table>

In addition, the attitude of democracy, national spirit, and love of the Fatherland (being one unit indicated students regarding attitudes and behavior in the westernization, thinking of the interests of the nation and the State, as well as loving and supportive cultural uniqueness as well as products from the beloved country). The last three values that can be shown to a student is a peace-loving, caring environment, and social care (students could put himself well in various communities around the residence environment, be able to help build, maintain, and create an environment that is clean, green, comfortable, educative, entertainment that educates, benefit or contribution by sharing knowledge, as well as share experiences or skills acquisition).

Furthermore, the campus party (in this case is the Faculty) coordinate at the level of Departments and programs of study, so that each active lecturers on campus which was given the mandate to become guardians, professors are obliged to do the coaching, mentoring, and monitoring on every student who was in her care in order to implement the conditions set out by the campus to be able to implement character education in everyday life. This is expressed by Darmiyati Zuchdi that "Character is basically obtained through interactions with parents, teachers, friends, and the environment [7]. The characters are derived from the learning outcomes directly or observation of others. Direct learning can be lectures and discussions about the character, were the observations of everyday observations obtained through what is seen in the environment including the medium of television. Characters associated with attitudes and values. Attitude is a predisposition against an object or a symptom, that is positive or negative. The value associated with the good and bad with regard to individual belief. So the confidence was established through daily experience, what is seen and what is heard especially from someone who be a reference or one's Idol ". To know the success of
character education at the level of the course (Prodi), students can be given a target close to the expected accomplishments, as follows:

- **First Semester**: students have already followed one of the students Affairs in the Prodi level (these options are explained in the student activities below);
- **Second Semester**: students are already plays a role in being a member, at least one student organization at the level of departments and Prodi or mass organization or youth organization;
- **Third Semester**: the student has become the core of the Organization's activities/Student Center at the University level/Faculty/Department/Prodi or mass organization or youth organization;
- **Fourth Semester**: students have already made at least one proposal PKM or scientific papers that match fields or suitable conditions required of the community around the site of the campus and the community that has not experienced an increase in standard of living;
- **Fifth & Sixth Semester**: students can follow a variety of race or the student for personal development and sharpening of the best of its ability, including already involved in the research conducted by Professor researching ability so that students increasingly honed;
- **Seventh and/or Eighth Semester**: students can already make scientific publications based on the shared experience of researching professors so that the process of settlement of the thesis and scientific publications is a suitable target before 4 years or exactly 4 years;
- **In addition to the activities of Student Activities who can follow the student**, there is a compulsory supplementary activities attended each semester to hone critical thinking and creative abilities, more understand the issue or the most current information about the world of education and useful community-appropriate science, as well as improving the skills students, in the form of National Seminars (SemNas), training (Training), and Workshop.

Based on the above explanation regarding the success of character education at the level of the course (Prodi), are expected to work together, work together, communicate effectively, be an example and a role model for students, as well as fully committed between Prodi and lecturer Coordinator guardian to help embody values that are the Foundation of the indicator, that later the student graduates have demonstrated personal character, cultured, immoral, and teamwork.

III. **THE APPLICATION OF ACADEMIC ORIENTATION**

Implementation of character education in College, can be started from the introduction of the world's Academic Orientation activities on campus. The name of the activity on each campus can be different, depending on the purpose and benefits of the implementation of the new student welcome into the institution or campus institutions, namely the College thus achieved the perceived expectations of new students in getting to know the new campus grid.

Academic orientation into the doors of the world get to know the campus along with the content that is in it, the location of various places related activities and associated faculties as well as each Program of study; a variety of Science Development Studies Centre research, outreach, development languages, and communications center; various building auditorium, library, research center, media center, cafeteria, student cooperative-the cafeteria; as well as various Student Activity Units (SAU) spread at the University level, the Faculty, Department, or Program of Study.

Academic orientation is held every year in college and became a mandatory activity followed by every new students and old students who have yet to follow suit, as well as being a requirement of completion of studies as well as the requirements of being a steward of Student Agency. Some of the goals and benefits of academic orientation is to develop understanding freshmen against the education system on campus; Develop a variety of spiritual intelligence, intellectual, emotional, and social; Build a sense of community, the spirit of solidarity, and tolerance among not only academic and love of Homeland; Develop a sense of belonging and a sense of academic social responsibility and commitment to the choice of disciplines; Develop an attitude of critical, creative, and social care students; Cultivate a sense of appreciation and respect their lecturers, staff officer, the senior student or fellow new students in University/Faculty/Department/Prodi; Build a sense of belonging and maintaining the campus environment in order that created the comfort, security, hygiene, as well as the sustainability of nature.
Furthermore, for the implementation of this academic orientation is performed by the University and coordinated with the faculties and departments, especially at the lower level is a Program of Study (Prodi) is the smallest place or environment on campus that are entered by students who choose to take their science and got a firsthand experience in the learning process in the classroom and outside the classroom (the practice at the location specified by the Prodi). During the process of preparation of academic orientation this. Of course, prepared to guide the implementation of academic orientation of University/Faculty/Department/Prodi in order to welcome new students into the campus environment runs smoothly and successfully. Through the academic orientation implementation guidelines, contained about general guidelines, General provisions are followed, the basic law, the theme of the academic orientation, goals and benefits, time and place of the performance of academic orientation, the code of conduct for participants (new students and old students who have not been following the academic orientation), the Committee (the Executive Board, the student Senate Executive Board Department as well as the set in each Status, and staff officers), and Superintendent (of the lecturers, especially Dean the Vice Dean, the Chairman of the Department, the Coordinator of Prodi, and Chairman of the Lab Studio); as well as the evaluation and assessment criteria.

In addition, there is a description of the material provided by the lecturer as well as campus officials according to academic capacity and the office. The material provided in the form of academic recognition at the central level, the introduction of university, an introduction to library, Development Studies Center introduction research and public service, the introduction of language development centre, the introduction of student organization at the University level, the introduction of faculty, the introduction of vocational and keprodian, the introduction of student organizations at the level of the faculty, character education, the achievement of the strategy's target of lectures, as well as self-motivated. Through this paper, the authors want to explain related evaluation and assessment criteria the students who follow academic orientation. For the evaluation of the activities of the academic orientation, this is done every day against all activities in accordance with a predetermined schedule and assessment during the following academic orientation be the responsibility of the Committee authorized by the Rector of the College in question. As for the graduation criteria is determined by considering the following:

- Follow all the activities of the Pre academic orientation and as evidenced by the presence of the entire session presentation activities for a minimum of 90%;
- Make report form review material from the speaker to appear;
- Implementation the code of conduct set appropriate academic orientation Committee;
- The participants who followed the academic orientation entitled to Character's Pocket Book (CPB) which must come in the form of the identity of participants, photos of participants, position statements, values of the characters appear (filled by the Committee), liveliness or involvement in activities of academic orientation, as evidence of the early assessment of the character of the new students in an introduction to the campus at the University level, the faculty, departments, and Programs of Study.

In respect of the above explanation regarding the Character's Pocket Book (CPB), suggested by the author, because the initial stages for BSK became new students to engage fully in the overall activity during academic orientation to know the campus and the surrounding world. In addition, the student can have moments and memories can be recalled from notes or books written according the experience or experienced directly by themselves. The memories or experiences will help them remember times struggled in the first year of being a freshman, then entered the second year, third year, up to the completion of the fourth year of study at.

### IV. APPLICATION ON STUDENT ACTIVITIES

Student Activities can become a part of the supporters who completes the process of introduction to the world of the campus along with any activity that is carried out every week or month or per semester by the campus as well as all levels of the faculty, Department, or Program of study. Regular student activities, shortened to Student Activity Units (SAU) for the various areas of its choice provided at the University level, the Faculty, Departments, and Programs of Study (Prodi). Every new student in the campus environment, are required to follow at least one SAU. Every SAU has its own, which was then under the supervision of the Student Executive Body (SEB or BEM). There are several choices of SAU in College, started the nature of nationalism, social care, brain and ideas fresh, though the arts to physical exercise (sports). Every student who
follows the SAU are expected to follow the schedule of weekly or biweekly that has been determined by its administrator of each.

To the University level, the choice of SAU are usually more numerous and varied. A wide selection of SAU, can be divided according the field developed, including the characters that are expected on the students who follow a variety of existing SAU. Explanation of some SAU below, adjusted with the availability of the means or infrastructure that provided the University and faculty party. The choice of SAU that normally exists at the University level, as follows:

- The field of Bakti Negara, there is a voluntary Corps (civic and social activities by sharing the science nor the skills possessed) and Student Regiment;
- Areas of reasoning, there is Research SAU, scholarly Press Institution student SAU, Development Creativity the students SAU;
- The field skills, there is a Radio Broadcasting SAU, Broadcasting Television/Broadcasting SAU, development of foreign language SAU (usually depending on the field of study, there are United Kingdom Language SAU, language of Japan SAU, Korea SAU, Language Arabic SAU, the language of France SAU, Mandarin SAU);
- The field of art and culture, there is Music SAU, Vocal SAU, Dance SAU, Literature and Theatre Studies SAU, Family Fine Art SAU, Painting SAU, Calligraphy SAU, Family Fine Art and Photography SAU, Marching Band SAU;
- The field of sports, there is an athletic SAU, basketball SAU, volleyball SAU, Badminton SAU, chess SAU, Hockey SAU, Judo SAU, Karate SAU, Archery SAU, Pencak Silat SAU, Swimming SAU, Softball SAU, Soccer SAU, Taekwondo SAU, Tennis SAU, Kempo SAU, Table Tennis SAU, Diving SAU, Survival Fitness and Gymnastics SAU, Futsal SAU;
- The field of welfare, there are Campus Islamic propagation Institute SAU, Fellowship of Christian Students SAU, Student Catholic Family Ties SAU, Student Family of Hindu Dharma SAU; and
- Special areas of expertise, there are Willing Corps Indonesia Red Cross SAU, Scouts SAU, Student Cooperative SAU, Lovers of Nature SAU.

For the level of faculty, typically tailored to students interests and talents that can be coordinated by Faculty in order for personal development as well as the potential student can be supported by the College. For majors, usually there is only a set of Departments that hosting a variety of activities as well as the reasoning race between Prodi’s existing at the level of departments. Whereas, at the level of Prodi, in addition there is a set of student of Prodi, there is also the Unit of Activity, namely which was initiated by the set, such as the field of art (choirs, dance, theater, arts and creativity) and art sports (martial arts or sports the most dominant, followed by Student Status).

Based on the above explanations, it became the primary focus in this paper is the application of character education, one of them through student activities. New students who have gone through the process smoothly and noted academic orientation graduated with got an academic orientation, it can be advisable to begin to engage in the activities of the student center that has been introduced during the introduction of the material organization of Student Activities of the University and Faculty level.

The process of implementation of character education through student activities can be seen in the Character's Pocket Book (CPB) is received by the student first time academic orientation. CPB is becoming the next step to explain the options selected and student affairs activities followed, accompanied by reason of involvement or hope to be achieved during the activity. CPB in the process of student activities that followed, later reviewed and evaluated by Professor guardian to see to what extent the development and potential of students who applied in such activities. Lecturer guardian will see values from the expected character appears or appeared in the process of student involvement during the following activities within monthly to each semester.

Lecturer guardian can also give advice, input, criticism, build motivation, give positive reinforcement as well as giving feedback regarding the learning process in the classroom and outside the classroom, including assessment of the attitudes and behaviors of college students in their interaction with other lecturers, staff
employees, as well as senior fellow, in CPB. It is done so that the student can read back the original purpose of being a student, lecture target that must be reached, always do a self-evaluation and renewing attitude or behavior that is positive, as well as the expectations of the parents nor the teachers towards the achievement of the already carried out by the student in CPB.

V. CONCLUSION

Character education has become fundamental in the creation of private topics students are expected to demonstrate a range of values for the development of the best potential nor himself. In addition to the 18 values expressed Kemendiknas, the other characters are expected to come up is the attitude of the leadership, confidence, strong and tough minded individuals, able to manage themselves and their time, smart and creative, reliable and dependable, easy to empathize, and able to be polite and mannered.

In addition to the lecture process which takes place every semester, academic orientation and student activities can be part of the applicable that applying the values of character during the process of its implementation so that the expected cooperation, support and active involvement from the campus, in which case it is at the level of the course (Prodi), Coordinator of the trustee Professor Prodi and several students in her care to see his character education implementation in the activity of academic orientation and Student Affairs who have followed each semester until evaluated each academic year running.

REFERENCES

Abstract—There is a clear distinction between scientists and science teachers in Indonesian universities, with scientists focusing on pure biology (science) and science teachers focusing on learning biology (pedagogy). Some educational institutions in Indonesia still emphasize this dichotomy between content and learning, which has been noted as a classical problem in science education. This paper presents an overview of policies for developing both science and learning research capacity to show that these two identities can co-exist in a single individual and that this can be very beneficial. Three biology teachers involved both science and learning research concerning Sumatran turtles. Each of them completed biological investigations, as scientist, on one of three prepared species (*Coura amboinensis*, *Notochelys platynota*, and *Siebenrockiella crassiocollis*), and then they obtained direct experiences of scientific approach in the real scientific work. Furthermore they used a part of their gathered data to develop teaching-learning modules in biology, as science teacher, for their science students at schools where they served. This model of biology teacher education placed more emphasis on (a) learning science through investigation and inquiry, (b) integration of science and teaching knowledge, and (c) integration of theory and practice in schools settings. It should be summarized that *C. amboinensis*, *N. platynota*, and *S. crassiocollis* can be used as a source of contextual teaching-learning, and the combination of biological and learning research offers a prospective model for professional biology teacher development in Bengkulu.

Keywords: Biology Teacher Development, Sumatran Turtles, Science and Learning Research

I. INTRODUCTION

Forest ecosystems have been converted to oil palm plantations throughout the Bengkulu province in the past decade. While it has been argued that oil palm plantations resemble a forest, in that the trees provide varying amounts of shade and microclimates exist, most of the amphibians and reptiles that are found in the oil palm plantations are species that are commonly found in agricultural landscapes and not forested areas. Thus, the conversion of natural forests to agro-ecosystems or urban areas will result in destruction of most species that previously occurred in certain areas [1]. Foreign scientists have done most herpetofauna studies conducted in Indonesia. This happens because of a lack of trained herpetologists in Indonesia, as well as the lack of funding to conduct field research. These issues need to be addressed by universities in Indonesia [2]. Herpetology should be included as part of the formal science curriculum [3]. Furthermore, it is suggested that herpetofauna such as the message of turtle conservation should be integrated early into science teaching plans for elementary [4] and high schools [5]. In the first herpetology research ever conducted in Bengkulu, the cooperation between Bengkulu University, the University of Andalas, ITB, and the National University of Singapore, identified the presence of several rare species of herpetofauna [6]. As with other research conducted in Indonesia, researchers tend only to identify the presence or distribution of the animals in the area.
It was reported that 15 (fifteen) species of freshwater and terrestrial turtles have been noticed in Sumatra (Bengkulu; [7; 8]). Ten of the fifteen species were identified and collected on a limited number in the Biological Garden of Bengkulu University (Unib). Now in Bengkulu the turtles became endangered animals, because of their habitats were never safe from many interests. Without a real conservation effort, the turtles will soon disappear in Bengkulu. Conservation efforts require spatial space certainty, and real support from those who understand that the conservation is moral responsibility of parents to the younger generation. A program of "Unib Campus, A Safe Home for Turtles" is pioneering conservation which needs support. The existence of the turtles on the campus of Unib will be a learning resource of conservation education to young people in Bengkulu. Implementing the first (2013, Cylclemys odhamii) and second (2014, C. amboinensis) year of the program were students of Graduate School of Science Education (GSSE; https://sites.google.com/site/unibpendipa/welcome), Faculty of Teacher Training and Education (FTTE), Unib. The majority of them are young science teachers in middle and high school from Bengkulu and South Sumatra. Further information of the program can be obtained through this web: http://www.unib.ac.id/2014/11/kampus-unib-ramah-aman-bagi-kura-kura/

This paper will present an overview of policies for developing both science and learning research capacity in ex situ conservation of Sumatran freshwater and terrestrial turtles as an alternative model for biology teacher education.

II. MATERIALS AND METHODS

GSSE, FTTE, Unib, was established by the Directorate General of Higher Education in August 2009. GSSE was reaccredited by the National Accreditation Board in February 2016, and later declared with B qualification. GSSE program has four concentrations: (1) biology education, (2) physics education, (3) chemistry education, and (4) integrated science education. The four concentrations were designed for four semesters (two years) of study with the motto: "Natural Conservation Education for a Better Life" [9]. The GSSE program aims to meet the increasing demands of science teacher competence in Bengkulu and surrounding areas through advanced graduate study. Based on a needs analysis for future science teachers, the program of study was designed to combine scientific research and educational learning experiences based on local issues (Fig.1). One goal of the program and this kind of teacher professional development is to develop ‘green teachers’, who focus on ‘teaching green’, and encourage the establishment of ‘green schools.’ Each year the program enrolls an average of 40 participants, and generally up to 75% of the participants finish the program of study on time.
Three biology teachers involved both science and learning research concerning Sumatran turtles as a part of the PEER project (http://sites.nationalacademies.org/PGA/PEER/PEERscience/PGA_168049). Each of them completed biological investigations, as scientist, on one of three prepared species (Coura amboinensis, Notochelys platynota, and Siebenrockiella crassiocollis; Fig. 2), and then they obtained direct experiences of scientific approach in the real scientific work. Furthermore they used a part of their gathered data to develop teaching-learning modules in biology, as science teacher, for their science students at schools where they served. Their research foci are listed in Tab. 1. In accordance with the policies of the GSSE program, three doctoral supervisors supervised each teacher-researcher. The thesis process begins with a proposal seminar. Proposals must be submitted prior to implementation of the research projects. Once the research is completed, the results are presented at an open seminar in front of students, lecturers, and supervisors. The final stage of the thesis process is a closed oral examination in front of the student’s five examiners.

![Figure 1](image1.png)

**FIGURE 1.** THE COMBINATION OF SCIENCE AND LEARNING RESEARCH BASED ON LOCAL ISSUES AS AN ALTERNATIVE MODEL FOR SCIENCE TEACHER DEVELOPMENT. A SCIENCE TEACHER MUST KNOW NOT ONLY THE SCIENCE CONCEPTS, BUT ALSO THE SCIENTIFIC PROCESSES (EXPERIMENTS, MODELS) AND LIMITS OF VALIDITY

![Figure 2](image2.png)

**FIGURE 2.** SPECIES TARGET THE PROGRAM OF "UNIB CAMPUS, A SAFE HOME FOR TURTLES" THAT WILL BE A LEARNING RESOURCE OF CONSERVATION EDUCATION TO YOUNG PEOPLE IN BENGKULU; (A) COURA AMBOINENSIS; (B) NOTOCELYS PLATYNOTA, AND (C) SIEBENROCKIELLA CRASSIOCOLLIS.

<table>
<thead>
<tr>
<th>Name of Teacher researcher</th>
<th>Sumatran Turtle/Number of animals</th>
<th>Focused topic of study</th>
<th>Number of doctoral supervisors/validator/observers</th>
<th>Place of Implementation</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ermawati P. Ningsih</td>
<td>Siebenrockiella crassiocollis /30</td>
<td>Acclimatization of Siebenrockiella crassicolor at Bengkulu University’s conservation site and its use for development of biological teaching material at high school.</td>
<td>3/3/2</td>
<td>Senior High School, Ketahun, North Bengkulu.</td>
<td>16</td>
</tr>
<tr>
<td>Yessy Santari</td>
<td>Notochelys platynota /24</td>
<td>The effect of feed composition (ration of water to Nile tilapia) on the growth of Notochelys platynota and the development of this science research as teaching materials of integrated natural science in junior high school.</td>
<td>3/3/2</td>
<td>Junior High School, Kapahiayang, Bengkulu.</td>
<td>15</td>
</tr>
<tr>
<td>Ningsi Julia</td>
<td>Coura amboinensis /21</td>
<td>The numbers of erythrocytes, leukocytes, and blood protein profile of Coura amboinensis from Bengkulu, Enggano, Aceh and the development of this science research as teaching materials for biology course in senior high school.</td>
<td>3/3/2</td>
<td>Senior High School, Curup, Rejang Lebong, Bengkulu.</td>
<td>20</td>
</tr>
</tbody>
</table>

**TABLE 1.** BIOLOGY TEACHER-RESEARCHERS, THEIR TOPICS OF STUDY, THEIR SUPERVISORS & VALIDATORS, THE SCHOOL WHERE THE TL WAS IMPLEMENTED, AND THE NUMBER OF STUDENTS INVOLVED.
For each topic of study chosen by the three teacher-researchers in this study, both the scientific research and educational research were implemented at each teacher’s individual school and involved three validators (teachers with a masters (S2) degree who were experienced in teaching biology and/or biology education), two observers (certified senior biology teachers with a minimum of 15 years teaching experience), and 15-30 students. Biological research was conducted first, and then data obtained were generalized using standard procedures. Based on the applicable curriculum and the results of biological research, each teacher developed four LDs (learning devices) including (1) a syllabus, (2) a lesson plan, (3) student activity sheets, and (4) assessment instruments. Before implementation of the TLs, both biology experts and experienced biology teachers validated the LD drafts.

III. RESULTS

A. Siebenrockiella crassicollis

This study aimed, first, to determine the best feed combination using talas leaves (Colocasia esculenta) and nila fish (Oreochromis niloticus) for S.crassicollis acclimatized within conservation area of Bengkulu University, and second, to determine the effectiveness of the use of teaching materials such as syllabi, lesson plans, student’s worksheet and assessment instruments developed from the findings of acclimatization S.crassicollis study at the year XII students at MAN Ketahun on the aspects of knowledge, skills and scientific attitude towards learning. Development of teaching materials referred to modified model of Dick and Carey.

(1) Science research

The feed combination used were P1: 100% C.esculenta, P2: 75% C.esculenta + 25% O.niloticus, P3: 50% C.esculenta + 50% O.niloticus, P4: 25% C.esculenta + 75% O.niloticus, P5: 100% O.niloticus. The data were analyzed by weight growth, carapaces growth (length and width), and body thickness, also environmental factors. Physiological data are the number of red blood cells, white blood cell, haemoglobin level. Learning outcomes were measured on aspects of knowledge, skills and scientific attitude. The results indicated that the best feed is 25% C.esculenta + 75% O.niloticus. Physiological conditions of S.crassicollis in the area of conservation showed no indication of infection with the number of red blood cells ranged from 135,000 to 350,000 cells/microliter, white blood cell count between 18,000 to 161,000 cells/microliter, and hemoglobin concentration ranged between 5.7 to 7.3 g/mL.

(2) Learning research

The use of teaching materials developed from research results can improve student learning score from 63.12 to 85 also fall in very good criteria in the aspects of knowledge, skills, and scientific attitude.

B. Notochelys platynota

This research consisted of two studies. The first study was aimed at knowing the effect of feed ingredient composition, namely different ratio of water spinach (Ipomoea aquatica) to Nile tilapia (Oreochromis niloticus), on the growth of fresh water turtle Notochelys platynota. The results of the first study was developed as teaching material for the integrated science in class VII of State Junior High School number 1 (SMPN 1) in Kepahiang, Bengkulu.

(1) Science research

In the first study, five ratios of I. aquatica to O.niloticus, were used as feed for the turtles, namely P1 (100%:0), P2 (75%:25%), P3 (50%:50%), P4 (25%:75%), and P5 (0:100%). The growth parameters tested were: weight, carapace’s curve length, carapace’s curve width, and body thickness. The results showed that P2 was the best ratio which could produce an average of 3.34% growth for all parameters within eight weeks of observation.

(2) Learning research

Teaching materials developed from the first study could improve the student learning outcomes from the aspect of knowledge with a percentage of 30.6%. The scientific attitude and the skill of students were categorized very well

C. Coura amboinensis

This study aimed to compare the number, shape and blood protein profile of C. amboinensis origin Bengkulu, Enggano, Aceh, and to determine the effectiveness of the use of teaching materials such as
syllabi, lesson plans, worksheets and assessment instruments developed from the results of scientific research with the view of learning outcomes class XI IPA at SMAN 1 Merigi on aspects of knowledge, skills and attitudes of students towards learning science. This type of research is the Research and Development quantitatively analyzed descriptively. Development of teaching materials referring to the development model of Dick and Carey modified.

(1) Science research

Blood sampling performed on *C. amboinensis* origin of Bengkulu, Enggano and Aceh respectively 7 animals. The observation of the shape of leucocytes *C. amboinensis* from Aceh, Bengkulu and Enggano has the same shape is spherical, has a central core or without a core. The observation of cell shape erythrocytes in *C. amboinensis* origin of Bengkulu, Enggano and Aceh there is no difference in the shape of an ellipse with the nucleus in the center. The results of non-parametric statistical tests Kruskal Wallis showed there was no difference in the average number of erythrocytes *C. amboinensis* from Aceh, Bengkulu and Enggano with p-Value: 0.953 greater than α = 0.05, Annova test results also showed that there was no the average difference in the number of leukocytes *C. amboinensis* from Aceh, Bengkulu and Enggano because the p-value: 0.720 greater than α = 0.05, thus it can be concluded that *C. amboinensis* originating from Bengkulu, Enggano and Aceh can be indicated as having a tendency kinship. Profile measurement known that the protein molecular weight estimation of blood Enggano 88 kDa and 99 kDa, 13 kDa plasma Aceh, 111 kDa and plasma Enggano 125 kDa and 99 kDa.

(2) Learning research

Research study concluded that the use of teaching materials developed by the research results can improve student learning outcomes, the knowledge aspect of an increase in the average value of 41.40 pretest and posttest is 80.20, on skills and attitude aspects of scientific criteria good value.

IV. DISCUSSIONS

Scientists and science teachers' identities and the relationship between the two is often discussed. It was proposed a link between the identity of scientists and science teachers. Scientists were characterized as having freedom and lots of time to engage in activities that are messy, in which they are exploring, floundering, and taking risks, all while driven by theory. Science teachers were characterized as controlled by others with limited time to engage in orderly linear instruction about basic information; they are responsible for students, have a fear of not knowing, and are clearly driven by practice. The two professions share the following characteristics: mentoring, questioning, working with others, critiquing, and relating. A scientist usually spends his/her time doing research that has not been done before, in attempts to make contributions to theory and possibly new discoveries. A science teacher communicates what has been discovered by scientists to students in the best way. Scientists and science teachers should have a good understanding of the process of scientific research, and they must be good at communicating with others [10]. But, perhaps the roles of scientists and science teachers are not so easily distinguished. Some researchers argue that a science teacher should also be a scientist.

It seems individuals chose to become a scientist or a science teacher based on relevant requirements and dedication to the chosen profession. If the judicial reviews of the RI Constitutional Court (2013) concerning teacher education could be interpreted as an opportunity for scientists to be teachers, then perhaps they could also be interpreted as an opportunity for teachers to be scientists. It was suggested that when scientists desire to dedicate themselves to being an educator, science should be seen not as a goal, but as an educational tool [11]. There is a clear distinction between scientists and science teachers in Indonesian universities with scientists focusing on pure biology (science) and science teachers focusing on learning biology (pedagogy). Some educational institutions in Indonesia still emphasize this dichotomy between content and learning; this position has been noted as a classical problem in science education [12].
If these two identities can co-exist in a single individual, then it can be very beneficial. It has been recommended that science teacher development place more emphasis on: (a) learning science through investigation and inquiry, (b) integration of science and teaching knowledge, and (c) integration of theory and practice in schools settings [13]. It was reported that pedagogical aspect of partnership between school and universities to improve science education in Indonesia could increase the quality of TL [14]. Meanwhile professional competence can be envisioned as a threefold structure with the anchoring pillars being subject matter knowledge, pedagogical knowledge, and pedagogical content knowledge [15]. This study revealed the model of threefold structure partnership between faculty members and teachers. Furthermore, the work can foster scientific "curiosity" about a specific topic from the field of science. Teachers, who really only on literature reviews and a textbook for teaching and learning, will see that students find learning dry. The combination of science and learning research suggests that using local issues contextualizes learning and makes it more meaningful [16; 17].

V. CONCLUSIONS

It should be summarized that *C. amboinensis*, *N. platynota*, and *S. crassiocollis* can be used as a source of contextual teaching learning, and the combination of biological and learning research offers a prospective model for professional biology teacher development in Bengkulu.

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REFERENCES


THE IMPLEMENTATION OF PROBLEM BASED LEARNING MODEL WITH LESSON STUDY BASED ON STRATEGY

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Abstract - Improving the quality of professional educators must begin with classroom management capabilities, one of the ways is through implementation of collaborative learning. This research study aims to improve the quality of lesson plan produced by the lecturers and to enhance the motivation of lecturer for self-developments through Problem Based Learning Model with Lesson Study Based on Strategy of Chemistry Instruction. This research was conducted using a mixed method research design known as Concurrent Embedded Experimental model, which incorporated both quantitative and qualitative data collection. Lesson study activity with step plan, do, and see was conducted at STKIP Surya with 8 involved observers. A sample of 2 novice lecturers and 35 students participated in this study. The instrument used in the quantitative study was a rubric assessment form as an observational tool for assessing creativity student and assessing teacher performance in their teaching skills during the microteaching observation conducted in three cycles.

Keywords: lesson study, problem based learning, acid and base

I. INTRODUCTION

Learning is a process of interaction between educators and learners with learning resources in a learning environment through a variety of strategies, approaches, and methods to achieve the goals that have been planned [1]. New standards for what students should be able to do are replacing the basic skill competencies and knowledge expectations of the past. To meet this challenge schools must be transformed in ways that will enable students to acquire the creative thinking, flexible problem solving, collaboration and innovative skills they will need to be successful in work and life [2]. In the knowledge society, creativity and innovation are in high demand. There is increasing focus on the role of education as a place not only for unlocking the creative potential of gifted students but also for teaching all students how to be creative and innovative [3]. Educator is one critical component in the success of the educational process. Therefore, improving the quality of education should be an improvement of the capacity of educators and lecturers in the university. Knowledge about teaching and learning in higher education has been based on a rapidly expanding body of research which has increased our understanding of many areas, such as, student perceptions of effective teaching [4]. Novice lecturers should be able to devise a method and learning an approach that suits the purpose or competence to be achieved. Accuracy in using learning methods not only motivation, interests, and learning achievement but also improve students understanding of the material supplied, resulting in a real interaction between lecturers and learners.

Lesson study is one of the ways to enhance the learning process conducted by a group of teachers or lecturers collaboratively [5]. This learning method is expected to increase novice lecturers knowledge about preparing teaching materials, learning implementation in accordance with the planning of learning and reflection on the implementation of learning, strengthen relationships collegiality either between the lecturers and the observers, strengthening the connection between the application of daily lessons to the learning objectives term long, increasing the motivation of teachers to constantly evolving, and improving the quality
of the lesson plan. Moreover, the lesson study is expected to improve the quality of novice should be absorbed within a relatively limited. In general, students tend to learn by rote rather than actively seeking to build their understanding of chemistry concepts. One subject matter in chemistry is acids and bases that are close to daily life and can be observed directly by learners. One of the ways to make chemistry more attractive through problem-based learning, lecturers and to create students who are well qualified. The PBL’s consist of five phases; meet the problem, problem analysis and learning issues, discovery and reporting, solution presentation and reflection, overview, integration, and evaluation [6].

II. RESEARCH METHOD

This research was conducted using a mixed method research design known as Concurrent Embedded Experimental model, which incorporated both quantitative and qualitative data collection. Lesson study activity with step plan, do, and see was conducted at STKIP Surya with eight observers consist of expert and novice lecturers. A sample of 2 novice lecturers and 35 students participated in this study.

The instrument used in the quantitative study was a rubric assessment form as an observational tool for assessing creativity student and assessing teacher performance in their teaching skills during the microteaching observation conducted in three cycles.

III. RESULTS AND DISCUSSIONS

Lesson study has been carried out in the Basic Chemistry subject consist of three stages; plan, do see and a total of three cycles. In the plan stage conducted several meetings to discuss the learning activities of acids and bases that are taught through problem-based learning models. Problem-based learning (PBL) with practical activities using local materials.

a. The First Cycle

In the second stage is an implementation of PBL models in the class. Students were divided into eight groups so that each student could actively make their investigations.

FIGURE 1. THE FIRST IMPLEMENTATION

Lecturers give worksheets that contain three different problems to be considered and solved by each group of students. One issue discussed by the two groups. Then the students were given time to discuss in their respective groups. The first and the sixth group get the problem of how to deal with stomach ulcers caused by
a buildup of stomach acid. The second and fifth get the problem of how to clean grease stains on the kitchen wall. The third and fourth group get the problem of how to clean a clogged sink drain. After they had discussed in the group, the issues will be addressed by all the students in the classroom. Lecturers guide students to be able to make the hypothesis of the issues that discussed in each group.

After the learning process complete, the next step is further reflection activities attended by lecturers models and observers. Based on observations, there are inputs from the observers, namely:

1) The purpose of learning and apperception not mentioned in learning the process.
2) Some students less active unnoticed by lecturers models.
3) One of the indicators of critical thinking that is asked a question yet to emerge from the students.
4) Lecturer yet discussed the moral values of the lessons.
5) Less instructional media.
6) Lecturers need to guide students how to find a good reference and directed by keyword or on the right site.

b. The second cycle

In the second cycle begins with the stage plan that discusses improvements that need to be done in further learning and the learning plan for the second reporting period. The lesson study team also checked the equipment and materials required for the second meeting, which is the stage of organizing students to investigate and assist with investigations independently or in a group. There are some suggestions for the next meeting, namely:

1) Lecturer has to give more attention to students who are less active.
2) Lecturer needs to explain the moral value in the lessons.
3) It should improve the instructional media.

The students identify the properties of acids and bases for some samples by using natural pH indicator in the implementation stage. Students divided into six groups are the same as the first meeting. Before practical begins, lecturers give worksheets as a guide to practical activities. The inquiry-based 5E worksheet equipped with a hands-on activity, minds-on activity, and local materials.
The implementation phase of the second cycle began when the lecturer explained briefly the purpose of learning, local materials that used in the lab, and short procedure of practical activities. Local materials used in the lab are the tools and materials easily and readily available in the environment such as plastic cups instead of glass chemistry, medicine dropper instead of a pipette, filter cloth instead of filter paper, and mold jelly plate instead of drop plates. The ingredients are a locally-based material such as hibiscus, turmeric, and mangosteen peel as an indicator of natural acid-base, baking soda, floor cleaner, ulcer medications, vinegar, guava juice, bleach, a solution of sugar, oil and mineral water.

During the practical activities, students recorded observations in the worksheets that have been provided. Inquiry-based worksheet 5E expected can lead students to conclude their lab results and can help they find the concept of the learning by experience. The results are discussed together in the classroom to get a conclusion. Moreover, in the worksheets are also equipped with evaluation, so as to help the students in remembering the concepts learned.

After that, the lecturer’s guide students to determine the products that can be made to be displayed at an exhibition. Each group must have a product such as posters, mini lab, instructional videos, and others that can be displayed. This activity is a stage of development PBL students’ work. Students can discuss it to the lecturer about the products that will be developed. On the second reflection, there are several inputs, among others:

1) There is some missing information on LKS, technically less practical implementation according to plan.
2) It should be added the guided question to students in understanding the practical procedures.
3) It should be added creativity and critical thinking indicators in the assessment rubric.
4) If there is important information, lecturers should notify centered in front of the class.
c. The Third Cycle

Furthermore, some design and improvement arrange in plan stage on the third cycle. In the implementation stage, the students exhibit their products to others. There are varieties of work displayed by the students as a poster on the acid-base learning and problem solved suitable group, a mind map chemistry learning, chemistry games, and a mini-trial on the utilization of acids and bases. The exhibition was attended by the students, lecturers, administrative staff, professor, and observers. This step is using authentic assessment which is every group assessed by two lecturers, two visitors, and two of their classmates.
The third stage is reflecting on exhibition activities that have been implemented and also summarized all the input from the first until third reflection. Based on observations of the cycle of one to three, there are some results can observe, namely:

1) Students increasingly active in share ideas and opinions,
2) Students can make hypotheses on the given issue,
3) Students have a way of thinking different from the others,
4) Students were providing a variety of interpretations of things,
5) Students can interact with both during the discussions and practical activities both the lecturers and with friends classmates
6) Pedagogical competence of teacher models reflecting the improvement of teaching skills.

IV. CONCLUSIONS AND DISCUSSIONS

Based on this research problem-based learning models using lesson study based-on strategy can improve learning process on acids and bases. There are some results:

a. Students increasingly active in share ideas and opinions,
b. Students can make hypotheses on the given issue,
c. Students have a way of thinking different from the others,
d. Students were providing a variety of interpretations of things,
e. Students can interact with both during the discussions and practical activities both the lecturers and with friends classmates
f. Pedagogical competence of teacher models reflecting the improvement of teaching skills.

REFERENCES

THE DEVELOPMENT OF PROBLEM BASED MODULE ON EVOLUTION TOPIC BY USING LIANG BUA CAVE AS LEARNING SOURCE

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Abstract—Liang Bua is one of the prehistoric caves which exists in Indonesia. This cave becomes one of the witnesses of history describing the human evolution process and contains a lot of knowledge to be traced. In general, the evolution process is often considered complicated by students because learning it means describing abstract things. Apparently, this is a result of the lack of the utilization of local context in their place as learning sources. Therefore, in order to improve effective and efficient learning process in accordance with the curriculum 2013 that emphasizes scientific ability so the local context needs to be used by the academia. However, the curriculum 2013 demands students to participate actively in learning process. The purpose of the utilization of local context is to promote local culture to the realm of education, also at once to develop students ability in inquiring and discovering new information as well as increase their knowledge. Allegedly, so far the learning process in Manggarai does not use Liang Bua as an alternative learning source to learn evolution. In fact, the teachers and students fully refer to textbooks in the process. This study used qualitative approach with library research method. The data about Liang Bua cave were collected from various resources. Furthermore, the data were analyzed to identify its relevance for the development of biology module on evolution topic based on problem based learning. Based on the analysis result, Liang Bua cave can be used as learning source for Manggarai twelfth grade students.

Keywords: Liang Bua cave, Learning source, Problem Based Learning

I. INTRODUCTION

The development that occurs in 21st century, emphasizes each individual has creativity, communication ability, critical thinking ability and other abilities in order to compete with others. In line with this, Indonesia has tried hard to align its education system with this development through the implementation of curriculum 2013. The curriculum 2013 is believed to bring a change in Indonesian education. In order to support the effort, teachers' and school councils' creativity is persistently demanded to achieve the goals of curriculum 2013. It is crucial for teachers to maintain the essence of learning. Learning should be a way for self-actualization, not a pressure. Therefore, learning activity has to be able to make students know themselves, their community, and their environment, even the world. Koran, Willems, & Camp said situated learning’s viewpoint suggests that individuals learn by interacting with their environment, and cognition is essentially created through the interactions between learners and situations. The situated learning outlook can provide information about the ways in which the organization of classrooms may affect the opportunities for productive learning [1].

Learning through the environment can give real experience for students because the environment is a learning source. However, the reality of education in Manggarai regency does not maximize local context as an alternative of learning sources. One of the well known archaeological sites is Liang Bua cave. This cave is a pre-historical cave which becomes important area of the discovery of Homo floresiensis that located in Manggarai. Homo floresiensis has body size like children (height 10 cm), approximately living together with pigmy elephants or Stegodon and giant lizards like Komodo [2]. Liang Bua cave is an Endokarst phenomenon of limestone [3]. The age of this limestone is around mid-Miocene, or about 15 million years. Indeed, one of the ways to utilize the Liang Bua site for education purpose is by using it in learning process. This can be done by developing a learning module which uses the site as the learning source. The module gives chance for the students to explore the source and learn by themselves. Notably,
the module is developed based on problem based learning, so it assists students to form scientific attitudes, such as objective, highly motivated, discovering and solving problems.

In order to improve students' ability in inquiry, discovery and problem solving, there are several learning models that provide a place for those abilities. One of the learning models that already known is problem based learning. PBL can improve problem solving ability. PBL orientates towards constructivism theoretical framework. The learning focuses on chosen problems so the students not only learn about concepts related to the problems but also the scientific method for solving the problems [4]. PBL emphasizes the authentic aspect of learning in context. Teachers can create a real-world problem that students will attempt to solve within a particular educational situation. PBL is made up of these real-world problems that are meaningful to students, collaborative problem-solving communities where students are self-directed and actively involved in critical thinking and other higher-order thinking skills (such as the ability to apply, analyze, synthesize, and evaluate), opportunities for scientific thinking (identification of problem, generation of hypotheses, inquiry, and investigation), incorporation of multiple learning resources, and culminating/assessment activities that allow learners the opportunity to demonstrate their mastery of material [1].

II. METHODS

This study used qualitative approach with library research and used descriptive analysis. The data about Liang Bua cave and problem based learning were collected from various resources. Furthermore, the data were analyzed to identify its relevance. The data has been identified will be the basis for the development of biology module on evolution topic based on problem based learning.

III. DISCUSSIONS

1. Liang Bua as learning source for learning process

Many things compose the structure of biology could be the organism, environment and interaction among them with all complicated processes involved. Evolution is one of topics in biology that taught to high school students. This topic will be complicated to understand if the students never learn what is available in their environment. Therefore, it is very vital in learning process to familiarize students with the real things existed in their environment than the abstract things. According to Edgar Dale that cited by Rahman, said learning sources are everything which can be used to facilitate one's learning activity. In coupled, Association of Educational Communication and Technology stated that learning sources are every source - data, people, or any manifest - which can be utilized by the students in their learning, whether it is separated or combined, to make it easier for the students to achieve the learning objectives [5].

Furthermore, Sutikna explained that besides the discovery of three fossils of Homo floresiensis, it was also found in Liang Bua the fossil of giant stork, called Marabou which was also found in China, and kinds of vulture-native African birds which live in colony [6]. The science preserved in Liang Bua is not only about those fossils, but also about the structure of karst from the cave. By exploiting these potencies for evolution topic, high school students' curiosity will be fostered. If the curiosity increases, the students will try to collect information and find the answer of the problem regarding the evolution process.

Subsequently, based on the findings in Liang Bua, teachers need to identify the potential source of knowledge. For instance, teachers can ask the students why the vultures which should be in Africa come to Liang Bua which actually located far away from the birds' place. In reference to the evolution theory, fossil discovery, geographic distribution, migration, embryology comparison and its variation can be the hints of evolution and its mechanism. Hence, the students can have the opportunity to learn by themselves and do the exploration.

2. Local context to improve students' engagement

According to Gilmore, "rating a text’s difficulty is not an exact science and is, to some extent, dependent on the learning context in which it is used and recommends careful planning, selection and sequencing of materials and tasks to overcome the challenges you may face when using authentic materials [7]. It means the utilization of local context like Liang Bua cave, must be well planned so it will not cause problem in practice. The initial purpose of using alternative learning source that available in surrounding environment is to create students engagement and then can impact to another positive result.
Peacock that cited by Catherine [7] empirically investigated the use of authentic materials in the classroom and concluded that motivation and on-task behavior increased significantly when learners used authentic materials. Catherine also said that authentic materials are beneficial because expose learners to language that serves a useful purpose; provide a refreshing change from the textbook; focus more closely on learners’ interests and needs; provide information about a variety of topics; increases learners’ motivation; and connect the classroom with the outside world.

3. Local context to improve teacher’s creativity

Every local context is different, and what works in one classroom may not work in another [7]. Learning source in relation with local context is certainly different among each place. As a result of this difference, the pattern of the approach that made by teachers in each place is completely different. Therefore, emphasizing teachers’ creativity for utilizing the local context into learning process is vital. Teachers are expected to be able to improve students’ engagement to learn by innovatively using appropriate local context to support learning. One of the ways is by developing learning module. Zeichner and Flessner said; discuss a pre-service project that asks “those enrolled in the teacher education program to examine the resources, history, demographics, and community assets that surround the schools in which they are placed” [8].

In the curriculum 2013 which emphasizes learning based on scientific approach, it requires teachers and students to observe anything around the environment that are worthy and could potentially be learning sources and knowledge. The source also must be reproduced by the teacher in the form of clear instructional design to guide students to construct their own knowledge. Catherine argued that when select authentic materials, keep focus on local relevance and help the students stay connected to their reality [7]. In coupled with this, Taylor and Parsons clarify one common prerequisite for engaging learners is “relevancy. Today’s learners ask that their learning apply to real-life scenarios whenever possible as opposed to being theoretical and text-based. Students, themselves, clearly want their work to be intellectually engaging and relevant to their lives [9].

The teachers are expected to do innovation in the learning process by using learning source in its territory. Besides improving students' engagement, this is also the form of simple preservation of the archaeological site of evolution. Claxton said, it can be done by do the teaching which contains more interaction, negotiation, and exploration among learners and teachers, who explore and discuss content together, often with teachers modeling learning as opposed to telling students what the answers, process, or outcomes should be [9].

4. Relationship between using local context and problem based learning

Taylor and Parsons, have synthesized the following categories as the result of elaborate several opinion by expert to improve student engagement that is (1) Interaction, (2) Exploration, (3) Relevancy, (4) Multimedia, (5) Instruction, and (6) Authentic assessment [8]. From the several categories, the first three categories become the pivotal base of the effective learning condition. The relationship among teachers and learners becomes a key factor for the success of the learning process. Therefore, teachers must have ability to pick out the right method or learning model. The interaction between both sides will create active communication, so there will be no awkwardness. The good interaction in classroom also will create good circumstance in the school environment. Students today are intensely social and interactive learners and they want to interact with people both within and beyond the classroom and school environment [9].

In order to support learners' discovery, inquiry and problem solving, the teacher must utilize local context in their surroundings to support the learning process so it matches the real life experience. Research by Parsons, McRae, & Taylor showed that PBL supported students’ exploration ability [8]. While in research by Sousa with Hos (Historical of science) proposed by Alfred Wegener for teaching geological mobility integrated with evolution with PBL model proved PBL was efficient [10]. It is supported by several experts who said that in a classroom based on learner-centered principles, decision-making is shared, where by students are involved in decisions about how and what they are learning, and students assume increased responsibility for their learning [1]

PBL is one of student-centered learning model. PBL can make learning more meaningful because the students can find and solve their own problem. This directly improves cognitive ability of students. Cook, Buck and Rogers also said, by providing students with several opportunities to discuss their thoughts on evolution, this teacher engaged them in high-level evaluative discussions. He facilitated student
involvement in several discussion forums where students could assert their opinions, as well as a chalk talk in which they could respond to each others’ opinions through post-it notes around the room. Students claimed they appreciated the chance to position take, hear multiple perspectives, and contribute to the classroom debate, all of which are indications of enhanced cognitive engagement. As well, students acknowledged an appreciation for learning from each other [11].

5. Problem Based Learning as Learning Model on Evolution Topic for HOT (Higher-Order Thinking)

According to Neo, PBL model is an effective learning strategy as it motivate students to be self-learners and can develop their cognitive skills, such as critical thinking, problem solving, and collaboration [12] [13]. The implementation of PBL in learning evolution can be executed by familiarizing students to solve problems by identifying the problems, then solving it using the PBL syntax. The syntax of PBL explained by Arends is as follow [12]:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Teacher’s activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1: Orientating students to the problem</td>
<td>Explain the learning objectives, describe logistics, and motivate the students to actively participate in the problem solving activity</td>
</tr>
<tr>
<td>Phase 2: Organizing students to learn or investigate</td>
<td>Help students to limit and organize the tasks related to the problem</td>
</tr>
<tr>
<td>Phase 3: Guiding the investigation individually and in group</td>
<td>Motivate students to collect appropriate information, do the experiment, and find the explanation and solution</td>
</tr>
<tr>
<td>Phase 4: Developing and presenting the result</td>
<td>Assist students in planning and preparing the proper result, such as report, record, video, and models, and also help them to share the task with their friends</td>
</tr>
<tr>
<td>Phase 5: Analyzing and evaluating the problem solving process</td>
<td>Assist students to reflect on their investigation and all the process used during the problem solving activity</td>
</tr>
</tbody>
</table>

The eight-stage of problem solving in PBL according to Panen, cited from Ngalimun is: (1) identifying problem, (2) collecting data, (3) analyzing data, (4) solving problem based on the data and its analysis, (5) selecting the problem solving method, (6) planning the application of the problem solving, (7) testing the already made plan, (8) executing (doing the action for) the problem solving. The first four phases are used in every level of thinking, while the rest must be acquired if the learning is intended to achieve higher order thinking skills [4].

Based on Arends’ PBL syntax, teachers has important role in the learning process of evolution topic. Firstly, teachers must orientate the students to the evolution problem. Then, teachers should limit the problem related to the use of Liang Bua cave as an object of study for the material. Students are directed to identify the possible problems found on the object. After that, students are asked to collect data. This will engage students’ creativity and critical thinking. Furthermore, teachers guide the students in organizing the problems by opting and classifying them, and combining them in the form of products, such as report, video, or model. This can help them to solve the problem in organized manner followed by the arrangement of facts. Finally, teachers direct the students to analyze the facts and evaluate them until the students meet the point of agreement to develop arguments.

Problem based learning was helping students relate theory to practice and in encouraging an active and enquiring approach to evidence, but teachers raised important questions about its practice [14] and PBL, in addition to didactic lectures, in a large classroom setting has several positive outcomes on student satisfaction with the learning process and have positive effects on the problem-solving skills [15]. In several research with different topic has proving that PBL can increase critical thinking ability [16] [17], student engagement, reasoning and creative thinking ability of students [18] [19] [20] so the students can gained maximize benefits on learning activity as well as students performance.

IV. CONCLUSION

Based on the analysis above, it can be concluded that Liang Bua cave can be used as a learning source for high school students in Manggarai regency. The form of its utilization can be done by developing a problem based learning module on evolution topic. It is possible because there has been a discovery of pre-historic human and animal fossils and also the geographical location of the cave which is related to...
the migration pattern and distribution. Hence, the development of such module is of great possibility due to its usefulness in supporting the students’ HOT skills.

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REFERENCES

OPTIMIZING LOCAL POTENTIAL INTO SCIENCE LEARNING TO IMPROVE SCIENCE PROCESS SKILLS AND SCIENTIFIC ATTITUDES
MINA SARUA-PRODUCTION IN BIMA REGENCY

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Abstract—Science learning is aimed to improve the ability to apply science concepts, thinking skills, learning skills, curiosity, environmental awareness and social responsibility. Learning science should be done by exploring the biological and natural environment, and many local potentials around the nation. To get the goal, science teacher should present many natural phenomenons which are contextual or familiar to student’s life. But, the local potential in Indonesia hasn’t been optimized on science learning. One of the local potential in Indonesia is Mina Sarua Production in Bima Regency. Mina Sarua Production’s process is potential to be used as learning source on science learning, especially States of Matter and Separating Mixtures. Integrating Mina Sarua Production’s process into science learning provides opportunities for student to observe, make inference, classify, predict, use tool and material, apply the concept, make hypothesis, plan an experiment, communicate, and ask question. Those activities can improve student’s science process skills. Beside, Mina Sarua Production’s process as learning source can improve student’s scientific attitudes. Therefore, this paper will present the optimizing local potential of Mina Sarua into science learning to improve science process skills and scientific attitudes.

Keywords: local potential, science learning, science process skills, scientific attitudes

I. INTRODUCTION

Science education is related to the methods of exploring natural phenomena systematically, not only a set of knowledge such as facts, concepts, principles, and theories, but also a discovery process or inquiry. Through science learning, students gain direct experiences. It can improve student’s process skills such as observing, measuring, identification, interpretation, predicting, inferring, and communicate information in the form of oral, written, and pictures. The optimum process will encourage student’s scientific attitudes development, namely the attitude of the experts in conducting scientific process. These attitudes are curiosity, honesty, open minded, cooperation with others, and meticulous. The process of science learning that is done through the development of the process of science and scientific attitude will make the learning more meaningful in receiving, storing, and understanding of holistic science concepts. Then, those concepts can be applied by the students to solve problems in daily life.

But, the fact shows that science learning in the Bima, West Nusa Tenggara, hasn’t optimally developed student’s process skills and scientific attitudes. Science learning is only aimed to improve cognitive domain (understanding of IPA product only). Based on the information through an interview, science is still teacher centered. It makes students feel less interested in studying science, become passive and did not dare to express their opinions, embarrassed to ask, and less focused in implementing science learning.

Beside, some elusive science concepts is not associated with their experience of daily life, neither related to the natural phenomena nor socio-cultural phenomena. In addition, the contents at science handbook on Kurikulum 2013, given by the Central Government, are mostly not directly related to student’s daily lives in the Bima Regency. Teachers are not creatively exploit local potentials that exist in the community as a learning resource in order to increase the interest of students to learn science. Lots of local potentials in the Bima Regency can actually be used as resources of science learning. One of the local potentials is the processing of Mina Sarua. This traditional beverage is made from black sticky tape,
coconut milk, brown sugar, blandro, and spices. Those materials are cooked together. In the process of making Mina Sarua, many stages of manufacture can be used as a source to learn science, like on the themes "matter and states of matter" and "separation of mixtures". Integrating Mina Sarua-making process in science learning is expected to improve student’s scientific process skills and scientific attitudes.

II. LITERATURE REVIEW

1. Science Learning

Science is a systematic of knowledge and arranged regularly, universally applicable, and consists of a collection of data from observations and experiments [4]. Based on this opinion, science can be defined as a knowledge that studies the phenomenon or event through a series of processes known scientific process that is built on the basis of scientific attitudes and produce a scientific product. The scientific product is composed by concepts, principles, theories, and laws that apply universally. Reference [5] defines science is a way of thinking, a way of Investigating, a body of knowledge, and its interaction with society and technology. Based on that definition, science contains the dimensional thinking, the ability to investigate, and a knowledge that is inseparable from the science and technology community. So, science should be developed through the stages of the scientific method and inseparable from the interaction with technological developments and the needs of the community.

Meanwhile, reference [13] explain the science through an integrated approach. Science learning involves scientific methods and organizing principles in explaining natural phenomena and their connection to daily life. Science is seen as a basic science that can be attributed to a variety of fields such as physics, chemistry, biology, technology, environment, geology, health and safety, and astronomy. Beside, reference [14] explains that science essentially be viewed as a product, process, and application. As a product, science is a collection of knowledge, concepts, and concept map. As a process, science is a process that is used to study an object of science, find, enhance, and develop science products. As an application, science theories will produce technology capable of solving problems that arise in human life. Based on the above statement, it can be concluded that science learning is an activity to learn about natural phenomena through scientific methods to reveal the facts, concepts, and principles that are useful for the life and development of technology. Science grown by curiosity and interest in people to learn various things related to the universe and human beings.

2. Mina Sarua-Making Process As A Local Potential

Kurikulum 2013 instructs the use of contextual and scientific approach into learning. Therefore, it is required learning materials or resources that come from the environment around the student as in [7]. Optimization of local potential into science learning has significance for strengthening the application of the concepts learned. Integrating local potentials that are tailored to the needs, starting with analyzing the basic competencies of science learning. The analysis aims to determine the form of the local potential in accordance with the concept being learned, so that students continue to assess the holistic concept, while the local potential as a supplement [11].

Mina Sarua is a kind of traditional beverage of Bima that is made from sticky tape and spices. Mina Sarua has been a cultural heritage of ancestors of Bontokape Sumbawa, Bolo District for hundreds years. It is also good as a drug or as body warmers drink. In the rainy season, it is very good for keeping the body's healthy, because it contains natural ingredients. Mina Sarua is a favorite beverage, not only for people of Bima, but also for tourists from outside. Many tourists deliberately been to the village, or just stop by, to buy and drink Mina Sarua.

Mina Sarua making process lasts for two days. Glutinous rice and yeast mixture will be set aside for one night. Next, spices include ginger, clove, cinnamon, nutmeg, brown sugar and pepper are fried. The sticky tape that has mixed with herbs are fried. Last, the mixture is cooked with coconut milk and ready to be served.

According to some sources, Mina Sarua is derived from the Minyak Saruang, an oil that serves as a topical drug sprains, stomach pain, and colds. Mina Sarua was first made by immigrants from Sumbawa. Then, Bima community dispensed the drug into a body warmers beverage by modifying the basic ingredients of Minyak Saruang with sticky tape. Because the Bima language doesn’t recognize consonants at the end of the word, the Minyak Saruang changed to Mina Sarua. Mina Sarua still
continued in production villagers Sumbawa Bontokape until today. Ironically, Mina Sarua is still a traditional beverage of Bima [15].

3. Science Process Skills

Science process skills are generally used to describe a set of capabilities possessed by scientists in conducting scientific investigations to find a concept of science. According to [6], science process skills are specialized skills that facilitate students to study science, help students to be more active in developing concepts and knowledge as well as teach students about research methods directly. These skills are grouped into two types, namely basic science process skills and integrated science process skills. Basic process skills provide the foundation for learning integrated skills. Integrated science process skills are more complex skills which are used to solve a problem or perform science experiments. Basic science process skills include observation, classification, communication, measurement, prediction and inference. Whereas, integrated science process skills include determining variables, tabulated data, preparing charts, giving the relationship between variables, construct hypotheses, data processing, and analyzing investigations [10].

Science process skills are the foundation of the scientific method. There are some basic science process skills, such as observation, communication, classification and measurement, which can be integrated together when the scientists design and conduct experiments to find a science concept. All parts of the science process skills are essential both as a single skill and as integrated skill. Reference [2] describes some of the components of the science process skills as follows:

a. Communication

Communication is an important aspect of scientific investigation. Without communication, scientific investigation would be pointless. People can not know the results or findings of investigation without any communication. Thus, communication skill is basic skills that should be taught at the early stages of science learning. Thoughts, ideas, research findings, and all kinds of important information need to be communicated for sharing an awareness, learning, teaching, and other purposes. There are many ways to do so, for example, speech, text, images, charts, graphs, mathematical formulas, tables, and figures.

b. Observation

Observation is the first stage and the most basic thing of science process skills. Almost every activity of science starts with observation. Observation is used as long as the observation of natural phenomena until proceed to experiments in laboratory activities.

c. Classification

Classification is the process of sorting, grouping and organizing based on similarities and differences. Classification as a science process skills are important for contributing a scientist to understand, conceptualize and attach meaning of scientific ideas.

d. Measuring

Measuring is an important process because it is indispensable ability. Measuring is needed to prove or test a hypothesis. Then, the results of these measurements will be used as a conclusion.

Science learning is not just studying the existing knowledge in science, accept the theory on the books and memorizing scientific concepts. By contrast, students should be able to acquire scientific knowledge with the thinking process, analyze and interpret the facts that are observed. In other words, students must go through the thinking process as what was done by scientists in finding science theories.

An approach in science learning should be able to trigger the thinking processes, analyze and conclude the result of investigation. Science process skills approach is an approach that is designed to achieve the objectives in teaching science. In other words, science process skills approach is an activity that presents instruction in science by stimulating intellectual and scientific thinking skills of students. Science process skills approach requires students to be able to utilize their intelligence and ability to engage in thinking and reasoning. Through science process skills approach, students should build a scientific research concept by themselves. Reference [8] revealed that the process skills approach is an approach that gives an opportunity to the students to find the facts, build concepts, through activities or experiences as a scientist. In addition, according to [3], science process skills are the development of intellectual, social and physical abilities. Based on the statements, it can be concluded that the scientific process skills approach is a learning process that is designed for the students to find facts, build concepts and theories with the intellectual skills and scientific
attitude by themselves. Students are given the opportunity to be involved directly on scientific activities as done by the scientists. But, the process skills approach does not intend every student to be a scientist.

Implementing the science process skills approach on learning can help to develop the personality of students. Evolving personality is a prerequisite for stepping into any profession that interested students. Process skills approach is the treatment which is used in the formation of learning that emphasizes the skills to acquire knowledge and then communicate the acquisition. The development of those skills can be done with the thinking skills or psychomotor skills.

Besides being able to help the students to develop science concepts, scientific approaches will also be able to improve the skills and scientific attitudes of students. Those skills are:

A. **Observing**

Observing skills require students to use many senses (the senses of sight, smell, listen, taste and touch). Thus, they can collect and use the facts which are relevant and adequate. If students get the ability to make observations using several senses, their consciousness and sensitivity to everything will develop. Observations which are done using only sensory perception called qualitative observation, while the observations which are done using a measuring instrument called quantitative observation. Student should identify which one is the right senses to observe of an object.

B. **Interpretation**

Interpretation is a skill to link the data of observations to found a pattern or regularity of a series of observations.

C. **Classification**

Classification is a process when scientists grouping objects or events. Classification skills can be mastered if the student has been able to do two of the following skills.

1. Identify and name the properties that can be observed from a group of objects that can be used as a basis for classifying.
2. Develop a classification in the levels of certain correspond to the properties of the object.

Classification is useful to train students show the similarities, differences and reciprocal relationship.

D. **Prediction**

Skills to estimate about something that has not happened or has not been observed by a trend or pattern that already exists. In other word, predict is alleging several upcoming events on the basis of an event that has been known.

E. **Using the Tools and Materials**

Students may have the skills to use the tools and materials guided by the teacher. In addition, students must also know why or how to use the tools and materials.

F. **Applying the concepts or principles**

Using a concept that has been held, the student should be able to apply these concepts in new events or experiences related to how to explain what happened.

G. **Formulate hypothesis**

Formulating hypothesis is a work to predict about the effect that will occur from the manipulation of variables. The hypothesis can be formulated inductively or deductively. The hypothesis could also be seen as a temporary answer from the formulation of the problem. Hypothesis can be a statement or file a relationship between variables approximate cause of the matter.

H. **Plan the experiment or research**

To plan an experiment, student should be able to determine the tools and materials to be used. Furthermore, students should be able to determine which variables are made constant and change, determine what can be observed, measured or written, as well as determining how and work steps. In addition, students also must be able to determine how to process the data as material to draw conclusions.
I. Communication

Communication is aimed to deliver the results of the investigation. To achieve communication skills, students should be able to discuss in specific groups to prepare and submit a systematic report of the activities which have done. Students should also be able to describe the data that are obtained in the form of graphs, tables or charts. For example, students develop the skills to communicate a description of certain object and events in detail. Students are required to observe and describe several types of small animals (such as size, shape, color, texture, and the way of motion), then students explain the description of the observed object in front of the class.

J. Asking question

Questions are needed to make an explanation of what, why, how or inquire background hypothesis. Questions about the background of the hypothesis suggests the students to have an idea or an estimate to test or check. By asking question, students are expected not just to ask but involves thinking.

Referring to some aspects of the science process skills, this paper will only discuss about observation, classification, interpretation, prediction, and using the tools and materials.

4. Scientific Attitudes

On the learning activity, positive attitude of students is needed to encourage the students’ skills in the learning objectives. The positive attitude towards the unknown thing can encourage students to learn. It affects the position taken by the students in line with their interests against an object. Thus, students have the confidence and conviction about what they should do.

Attitudes can be interpreted as internal ability that play a role in taking action [12]. The actions will be selected, depending on their attitude towards the value of somethings, such as good-bad, profit-loss, or satisfied-dissatisfied. Those attitudes will motivate student to act on learning. In other word, the students' attitudes can be an important factor to determine their attitudes on learning.

The students’ attitudes on learning can affect the learning outcomes. Attitudes on science learning is often associated with scientific attitude. Those are closely related, and both influence the actions. Scientific attitude focused on persistence, openness, a willingness to consider the evidence, and willingness to distinguish fact from opinion. Some expertsgather the scientific attitudes to some different group. But, deeper analysis shows that almost no significant differences. Variations appear only in the placement and naming of the scientific attitudes. For example, the different grouping by Harlen in [9] and [1], are summarized in Table 1.

| TABEL 1. SCIENTIFIC ATTITUDES GROUPING |
|-------------------------------|-------------------|
| **Harlen**                     | **AAAS**          |
| 1. Curiosity                   | 1. Honesty        |
| 2. Respect for evidence        | 2. Curiosity      |
| 3. Critical reflection         | 3. Open minded    |
| 4. Perseverance                | 4. Skepticism     |
| 5. Creativity and inventiveness|                  |
| 6. Cooperation with others     |                  |
| 7. Willingness to tolerate uncertainty |            |
| 8. Sensitivity to environment  |                  |

Scientific attitudes are product of the learning activities. Attitude is obtained through a process such as experience, learning, identification, and behavioral role (teacher-pupil, parent-child). Because attitudes are learned, attitudes can bemodified or changed. New experiences are constantly affect and change the attitudes. Scientific attitudes can be measure based on the dimension of attitude. Each dimension will be developed into some indicators. In this paper, the dimensions of scientific attitudes are curiosity, honesty, open minded, cooperation with other, and meticulous.

5. Mina Sarua Making-Process To Improve Science Process Skills And Scientific Attitudes

Mina Sarua as Bima local potential can be used as a science learning resource at the theme “States of Matter” and “Separation Mixtures” to improve the science process skills and scientific attitudes of students. The connection between the process of making Mina Sarua, Core Competencies-Basic
Competencies at the theme “States of Matter” and “Separation Mixtures”, components of process skills, and components of scientific attitudes can be mapped as follows.


<table>
<thead>
<tr>
<th>Core Competencies</th>
<th>Basic Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Understanding knowledge (factual, conceptual and procedural) by curiosity about science, technology, art, cultural phenomena and events related to the visible phenomena.</td>
<td>3.2 Classify the living things and objects based on the observed characteristics</td>
</tr>
<tr>
<td>4. Try, process, and present in the concrete realm (using, parse, compose, modify, and make) and the abstract realm (writing, reading, counting, drawing, and writing) in accordance with the learned in school and other sources in the same viewpoint /theory</td>
<td>3.3 Understanding the concept of mix and single substances (elements and compounds), physical and chemical properties, physical and chemical changes in everyday life</td>
</tr>
<tr>
<td>4.2 Presenting the results of the classification of living things and objects in the environment based on the observed characteristics</td>
<td></td>
</tr>
<tr>
<td>4.3 Presenting the results of the investigation or work on the solution properties, changes in physical and chemical changes, or separation of the mixture</td>
<td></td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Process</th>
<th>Science Concept</th>
<th>Science Process Skills</th>
<th>Scientific Attitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify the materials</td>
<td>States of Matter</td>
<td>Observation, Classification</td>
<td>Curiosity</td>
</tr>
<tr>
<td>Measuring the composition</td>
<td>Measurement</td>
<td>Measuring, Using the tools and materials</td>
<td>Meticulous</td>
</tr>
<tr>
<td>Fermentation (tape)</td>
<td>Chemical changes</td>
<td>Observation, Interpretation, Prediction,</td>
<td>Open minded</td>
</tr>
<tr>
<td>Grated coconut</td>
<td>Physical changes</td>
<td>Observation</td>
<td>Honesty</td>
</tr>
<tr>
<td>Slicing sugar</td>
<td>Physical changes</td>
<td>Observation</td>
<td>Cooperation with others</td>
</tr>
<tr>
<td>Smooths spices</td>
<td>Physical changes</td>
<td>Observation</td>
<td></td>
</tr>
<tr>
<td>Boil the mixture</td>
<td>Physical changes</td>
<td>Observation, Interpretation</td>
<td></td>
</tr>
<tr>
<td>Making the coconut milk</td>
<td>Separating Mixture</td>
<td>Classification</td>
<td></td>
</tr>
</tbody>
</table>

III. CONCLUSION

Science education is related to the methods of exploring the natural phenomena systematically, not only a collection of knowledge (facts, concepts, principles, and theories), but also a discovery process (inquiry). Learning science through optimizing local potential such as the manufacturing process Mina Sarua, students gain direct experience so as to improve students’ process skills such as observing, measuring, identification, interpretation, predicting, inferring, and communicating information either orally, in writing, or drawing. The development process is good and true science will also encourage the growth of scientific attitude, namely the attitude of the experts in conducting scientific process. These attitudes include curiosity, conscientious, diligent, open, disciplined, able to work together, care for the environment, and sensitive to changes.

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REFERENCES


