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# THE EFFECTIVENESS PF PROJECT-BASED LEARNING FOR BIOLOGY CLASS IN DEVELOPING THE SCIENCE PROCESSING SKILLS AND CREATIVITY OF HIGH SCHOOL STUDENTS

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## Abstract

This research aims to measure the effectiveness of Project-based learning in developing the science processing skills and creativity of XI grade students of SMAN 1 Wewewa Timur and SMA Swasta Manda Elu in Sumba Barat Daya, NTT. This research employs quasi-experimental design. The effectiveness of the project-based learning of biology is known after the improvement in the 1st, 2nd, and 3rd test as well as the observation of students' science processing skills. The result of the research shows that the learning approach, project-based learning, is effective to improve students' science processing skills. The conclusion came from the observation score of 79.5%. The students experienced improvement through test 1 to test 3. In this case, they got the average score of 44 in the 1st test, 49 in the 2nd test, and 60 in the 3rd test. The gain of the score was 0.2 or categorized as low. Meanwhile, the students' creativity score was 69%. In summary, project-based learning can develop students' science processing skills and creativity.


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## INTRODUCTION

The improvement of education quality in Indonesia happens through the changes and development in the 21st century. One of the ways to develop that is through the changing of curriculum. In Indonesia, the national curriculum is the Indonesia's 2013 curriculum. The curriculum sets four national standard of education, which are the graduate competence standard, standard of content, standard of process, and standard of scoring. The changes in all four elements cause the dynamics in the learning process which also copes the learning utility.

Teacher experiences difficulty in choosing the learning model which is based on students' characteristics and development (Yahya, N 2014). The difficulty raises because the students face more complex core and basic competence to achieve. The competences include cognitive, affective, and psychomotoric aspects. The complexity of the core and basic competence also affects the difficulty of the teacher in planning the instruments of scoring to measure students' competence in authentic way.

The result of previous researches shows that in a High School class of biology, teacher still dominates the learning process. Teachers' domination in the classroom makes students cannot optimize their potentials. The learning process tend to be monotonous under the routines of taking notes to biological concept, memorization, and self-reflection. Students' improvement were merely scored from their test score.

From an initial interview, students also tend to be very depending on teachers' direct lecture. This fact is not in line with the demand of 2013 curriculum, which requires students to be active in learning. Hence, there should be a learning model which can make the students more active in the learning process that it can help them develop their competence in the future.

A learning model which is proposed in 2013 curriculum is called project-based learning. Project-based learning can improve students' processing skills and creativity. The model requires the students to plan and solve a problem using the decision that they make (Sukmawati, et al, 2015). Project Based Learning is a model which give the students final task of making a simple project in relation to the learning material ( Muktisari E, et al, 2016)

Project-based learning bridges the students to develop their creativity through solving problems. This is in line with what is said by Yahya, N (2014) that project-based learning is a very good model in developing the basic skills needed by students for their life, such as decision making, creativity, and problem-solving. Wirasana (2014) says that creativity can develop through solving problems. According to Widowati, et al (2015), creative students can solve problems they found each day. Beside, creative students are more aware to their environment. Aside of creativity, students also need to develop their ability in observing, inferring, and experimenting as a pack of science processing skills. Science processing skills is the ability of thinking like scientist in formulating a result of discussion (Ozgelen, 2012). Project-based learning can adjust the students to conduct scientific method in developing their science processing skills (Hayati, et al, 2013). Besides, in Siwa, et al (2013), students will be more active in the a class which implements project-based learning. The learning will focus on students and give meaningful activities to them. The learning process will help the students in building their concept of the materials ( Afriana, et al, 2016)

Project-based learning is still rarely implemented in the material of human digestive system. The problem happens because teacher has limited time in preparing materials based on the approach. Hence, they will do that based on the shortcut; that is doing it in conventional way. Actually, the chapter of human digestige system is a material which suits with the model. In the material, students can find problems related to the digestive system and investigate on what actually happens with it. In this research, the students have a project of analyzing problems of human digestive system and solve it.

In order to solve the problem, the researcher conducted this research under the title of "The Effectiveness pf Project-Based Learning for Biology Class in Developing the Science

Processing Skills and Creativity of High School Students".

## METHODS

This research is a quasi-experimental research. The research observes the changes which happens after the implementation of two lesson plans in two schools. The focus of the research is to the science processing skills and the creativity of the students. The research was conducted from January to February in six meetings. The research was conducted in SMA N 1 Wewewa Timur and SMA Swasta Manda Elu, Sumba Barat Daya, Nusa Tenggara Timur. The research employs action research method with experiment in the classroom.

The collection of the data in this research include the observation of science processing skills, written test, and students' creativity. Meanwhile, the instrument for the data collection was the exercise for students' science processing skills, the observation sheets for the skills, and the scoring sheets for students' creativity. The analysis of the science processing skills contains the indicators of the skills and a written test for the measurement. The score of the students becomes the reference for the effectiveness of the learning equipment of biology to improve students' science processing skills. Meanwhile, for the written test, the researcher administered three test for the students. The result of the test was analyzed using the formula of N-gain as follows (Sugiyono, 2010).

$$g = \frac{Stes\ 2 - Stes\ 1}{\text{Smax} - \text{Stes 1}} \ \&\ g = \frac{Stes\ 3 - Stes\ 2}{Smax - Stes\ 2}$$

Notes:

| | |
|---|---|
| $g$ | = Gained Score |
| Stes1 | = 1st Test Score |
| Stes2 | = 2nd Test Score |
| Stes3 | = 3rd Test Score |
| Smax | =Maximum score |

The obtained questionnaire and gained score is used to observe the effectiveness of the learning process. The criteria for the gained score are as follows.

**Table 1.** Gained Score

| Gained Score Criteria | Categories |
|---|---|
| $0.7 < \boldsymbol{g} \leq 1$ | High |
| $0.3 < \boldsymbol{g} \leq 0.7$ | Medium |
| $\boldsymbol{g} \leq 0.3$ | Low |

(Sugiyono, 2010)

The data of students' creatigity was obtained from the product of the students. The aspects of creativity were based on Munandar (2012).

## RESULTS AND DISCUSSION

The researcher's study to project-based learning includes syllabus, lesson plan, students' worksheet, scoring instrument of science processing skills, and the scoring instrument of students' creativity. The instrument of students' processing skills consists of observation sheets and written tests focusing on the science processing skills and creativity of the students.

After arranging the lesson plan of biology, there is a validation process. The process of validation in this research involve four experts who concern on the development and validation. These experts conclude that the learning equipment is feasible to use for a biology class. After the conclusion, there should be a classroom action to implement the learning equipment to both schools. The result of the experiment can be seen as follows.

***The Data of Students' Science Processing Skills***

The data of students' improvement in science processing skills were obtained from observation and written test.

***The Observation of Students' Improvement in Science Processing Skills***

The data of students' improvement of science processing skills came from the observation of students while they were doing their worksheet. The observation was done by three teachers, where each teacher observe two groups of students. The observation of each teacher were recapitulated and obtained the result of 78.5%. The result means that there is an effective development to students' science processing skills. The data can be seen in the following table 2.

Based on table 2, there is an aspect which is less effective to SMA Swasta Manda Elu. This is because the infrastructure of the laboratory in

the schools are less supportive. The comparison between the observations of two schools can be seen in Figure 1.

**Table 2.** The Observation of Students' Improvement in Science Processing Skills in Both Schools

| No | Aspects | SMA N. 1 Wewewa Timur | | | Mean | SMA Swasta Manda Elu | | | Mean |
|---|---|---|---|---|---|---|---|---|---|
| | | Meetings | | | | Meetings | | | |
| | | 1 & 2 | 3 & 4 | 5 & 6 | | 1 & 2 | 3 & 4 | 5 & 6 | |
| 1 | Observing | 49 | 100 | 100 | **83** | 84 | 66 | 96 | **82** |
| 2 | Grouping | 46 | 73 | 100 | **73** | 78 | 50 | 54 | **61** |
| 3 | Interpreting | 100 | 100 | 100 | **100** | 92 | 84 | 84 | **87** |
| 4 | Predicting | 40 | 80 | 60 | **60** | 68 | 84 | 68 | **73** |
| 5 | Asking Questions | 91 | 80 | 80 | **84** | 68 | 51 | 100 | **73** |
| 6 | Making Hypothesis | 40 | 60 | 80 | **60** | 51 | 68 | 84 | **68** |
| 7 | Planning Experiment | 66 | 86 | 100 | **84** | 64 | 76 | 96 | **79** |
| 8 | Using Equipments and Tools | 40 | 60 | 91 | **64** | 68 | 43 | 84 | **65** |
| 9 | Implementing Concept | 80 | 80 | 100 | **87** | 92 | 76 | 92 | **87** |
| 10 | Communicating | 100 | 100 | 100 | **100** | 100 | 78 | 89 | **89** |
| 11 | Conducting Experiment | 100 | 100 | 100 | **100** | 100 | 84 | 84 | **89** |
| Average Score | | | | | **81** | | | | **78** |
| Average Score | | | | | **79.5** | | | | |

Based on graphic 1, the science processing skills in SMA N 1 W. Timur had higher score than SMA Swasta Manda Elu. SMAN 1 W. Timur had the score of 81. Meanwhile, SMA Swasta Manda Elu got 78. The observation of the researcher in SMA N 1 W. Timur showed that the school had almost complete infrastructure as in the learning process. Meanwhile, in SMA Swasta Manda Elu, the learning process was not supported by adequate laboratory tools.

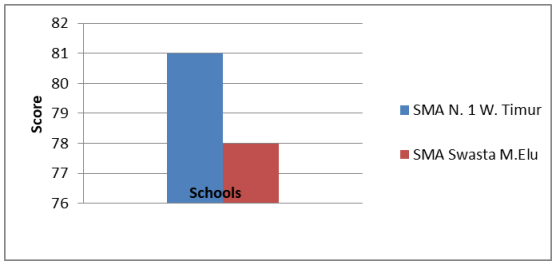


**Figure 1.** The Graphic of Comparison between the Observation of Science Processing Skills in Both Schools

***The Result of The Written Test for Science Processing Skills***

There were three test for science processing skills for XI IPA$^2$ in SMA N.1 Wewewa Timur and XI IPA$^4$ in SMA Swasta Manda Elu Kab. Sumba Barat Daya, NTT. The tests were given to know the graphic of improvement by the students after the implementation of project-based learning.

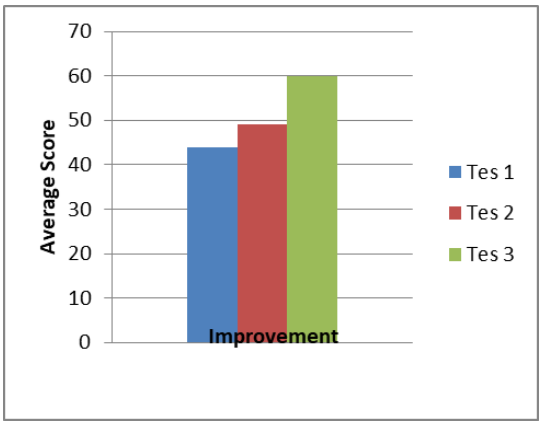


**Figure 2**. The recapitulation of students test score from the frist test to the third one

In SMA N 1 Wewewa Timur, the students obtained the average score of 46 for the first test, 53 for the second test, and 62 for the third test. The result shows that there is an improvement between test one and test three. Meanwhile, SMA Swasta Manda Elu obtained the score of 42 for the first test, 45 for the second test, and 58 for the third test. These things show that there is an improvement in each test. Based on the interview between the researcher and the students, there are some obstacles faced by the students during the learning process. One of the obstacles is the absence of the reference book for students to read.

The result of the gained score test for students' science processing skills in the second test was 0.2 t which was categorized as low. In this case, there were a lot of students who got low scores since the first to the third test.

The students' test score between the first and the third test were increased. The improvement can be seen in Figure 3 as follows. Based on graphic 2, project-based learning can improve students' science processing skills.

***The Data for Students' Creativity***

Students' creativity was obtained from their product from their project. The product consists of report and poster. The scored aspects from the products are the indicators of creativity which is included in the instrument of scoring for creativity. Based on the recapitulation of students' creativity, students in SMA N 1 Wewewa Timur got 68 while SMA Swasta Manda Elu got 70. From the recapitulation, it is known that the learning equipment can develop students' creativity. The score of each product can be seen in the table as follows.

Table 3 Score for Students' Produc

| No | School Name | | | |
|---|---|---|---|---|
| | SMA N.1 Wewewa Timur | Score | SMA Swasta M. Elu | Score |
| 1 | Product 1 | 71 | Product 1 | 73 |
| 2 | Product 2 | 70 | Product 2 | 72 |
| 3 | Product 3 | 62 | Product 3 | 65 |
| Average | | 68 | Average | 70 |
| Average Score | | 69 | | |

Based on table 3 above, it can be concluded that project-based learning is effective to improve students' creativity. It can be seen from the score of students creativity in both school which are in the criterion of effective which are 68 for SMA N 1 Wewewa Timur and 70 for SMA Swasta Manda Elu. Project-based learning for the product can improve students' learning outcome ( Lestari, et al, 2015).

## CONCLUSION

Based on the research and analysis, it can be concluded that project-based learning is effective in developing students' science processing skills and creativity, specifically for students in XI IPA$^2$ of SMA N.1 Wewewa Timur and XI IPA$^4$ of SMA Swasta Manda Elu.

The research shows that the implementation of project-based learning obtained the score of 79.5% for the effectiveness and 69% for creativity. The result of the written test was also improved as 44 in the first test, 46 in the second test, and 46.5 at the third test. Meanwhile, the average gained score for both schools are 0.2 which was categorized as low.

There are some suggestions proposed by the researchers 1) the implementation of project-based model can help students improve their understanding of biology, especially on human digestive system. Thus, teachers should use the approach as an alternative learning method; and 2) project-based learning is also proven able to improve students' creativity and science processing skills. Thus, teacher should be able to use the method for other materials.

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