



The Effectiveness of Pjbl by Using Reused Paper on Nervous System Concept

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Article Info

History Article:

Received : June 2019

Accepted : August 2019

Published : August 2019

Keywords:

*learning outcomes,
neuron system, project
based learning, reused
paper,*

Abstract

This study aims to determine the effectiveness of project based learning model by using reused paper on neuron system lesson to students learning outcomes in SMA Negeri 1 Pemalang. This study used pretest-posttest control group design. The samples that were used were students of class XI MIPA 3 (control class) and class XI MIPA 4 (experimental class). The samples were taken by cluster random sampling technique. The results show that the learning outcomes in the experimental class are better than control class. The average of students' N-gain score in the experimental class was significantly different with control class and it was higher than control class ($0,72 > 0,58$), the average of experimental's class psychomotor learning outcomes was classified in the very good category, the experimental's class affective learning outcomes (environmental care attitude) was significantly different with control class and it was greater than the control class ($82 > 63$). This result is supported by students' and teachers' positive responses of project based learning model by using reused paper. Based on this study results, it is concluded that the implementation of project based learning model by using reused paper was effectively optimizing students learning outcomes on neuron system material.

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p-ISSN 2252-6579

e-ISSN 2540-833X

INTRODUCTION

Education in the nation and state life has been regulated in Law Number. 20 of 2003 concerning the national education system which states that education is a conscious and planned effort to realize a learning atmosphere and learning process so that students can develop their potential effectively to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills that are needed to himself, society, nation, and state (Rusman, 2015).

Education is an important factor that determines the development and progress of a nation. Therefore, education needs to be considered in order to be able to generate quality human resources from time to time. The changes and improvements of education are conducted continually until now. It is including the enhancement of the professional teacher competence, improving the learning quality and the assessment of student learning outcomes, the learning media that facilitate the learning process, and the curriculum that is being improved constantly (Mukharomain, 2015).

The curriculum that applies in the education system in Indonesia until now is the 2013 curriculum. The variations of learning models that can be used in the 2013 curriculum include inquiry learning models, discovery learning, project based learning, and problem based learning. The variation of the learning model in curriculum 2013 is expected to be able to encourage students to be active in the learning process (Rusman, 2015).

The learning model that can improve students learning motivation, improve problem solving skills, enhance collaboration, improve managing resources skills, provide learning experiences that involve students in a complex way, involving students to learn to take information and make the fun learning atmosphere is a project-based learning model. Project-based learning model is a learning model that involves project work that can be done by students independently or in groups. Project work contains the problems that are given to students as a step in collecting and integrating knowledge through designing activities, conducting activities / investigations, solving problems, and making decisions (Mulyadi, 2015).

Based on the preliminary observations results with Mr. Azzam F, S. Pd as a biology subject teacher at SMA Negeri 1 Pematang, it is known that in biology learning, the teacher is teaching by using the lecture method with the assistance of power point media and interspersed with questions and answers sessions. However, these are not enough to make students participate actively in learning process. In this method, it was found that there were many students who only pay attention silently to the material delivered by the teacher, but they did not ask questions actively, expressed opinions or refuted their friends' opinions.

Furthermore, it is known that in the nervous system material, the teacher faced difficulty in delivering material because there were many concepts, terms (Latin) and the mechanisms that must be conveyed. The monotonous learning without any variations in learning models in delivering the material caused students felt bored. It could be seen from the activities that carried out by students during learning, namely some students only daydreamt, scribbled books, chatted with their peers.

The lack of active students in learning activities caused students learning outcomes in biology subject of mathematics and science study program eleventh-graders was not maximum. It can be seen from the results of daily tests of students of mathematics and science study program eleventh-graders in the 2017/2018 academic year on the nervous system material. It is informing that only 64% of students who were able to achieve the minimum

completeness criteria (MCC). Students are classified to reach MCC if the results of tests on biology receive a score of more than or equal to 70.

The nervous system material is one of materials in biology subjects in eleventh-graders. This nervous system material is a sub material of the main subject of the coordination system. This material is very important for students. Learning completeness in nervous system material can affect the completeness of learning in biology subjects in eleventh-graders. The nervous system material is categorized as material that is quite complicated to learn because it contains the abstract concepts or it cannot be seen in plain view, so it caused students difficulties in learning the material (Sari, 2016). Evriyani *et al.* (2016) supported the existence of several factors that caused students difficulties in learning biological material, including too much memorization, there were many foreign terms, and the unattractive learning.

The material that contains abstract content will be very good if it is delivered in the form of projects that involve students actively. The project based learning model in teaching and learning activities is effective in improving students learning outcomes (Kadir & Setiawati, 2019). This is in line with the research results by Yance *et al.* (2013) which explained that the implementation of the project based learning model in the learning process has a positive impact on students learning outcomes in the cognitive, affective, and psychomotor domains. Siwa *et al.* (2013) also added that the project-based learning model is an effective tool for teaching students actively. Project-based learning model is a learning model that involves project work. The final result of the project work is a product that includes a report on the results of the project in writing, a presentation, or recommendation (Mulyadi, 2015).

Furthermore, to support UNNES as a conservation vision university, with a strong determination to implement a waste management policy, the researcher intend to implement conservation principles to the model under study. As a manifestation of the conservation attitudes implementation, researcher will ask students to print their reports on project results that will be collected by using the other side of used paper that can still be used (using paper back and forth).

Based on the above explanation, the researcher understand the importance of conducting a research on the effectiveness of project based learning model learning by using reused paper on nervous system material to students learning outcomes.

RESEARCH METHOD

The design of this study uses a pretest-posttest control group design. The sampling was conducted by using probability sampling which is sampling that provides equal opportunities for each element (member) of the population to be selected as members of the sample. The sampling technique that was conducted by cluster random sampling is a random sampling technique (Sugiyono, 2016). The sample was used in this study is the third mathematics and science major of eleventh-graders as a control class in the amount of 36 students and the fourth mathematics and science major of eleventh-graders as an experimental class in the amount of 34 students.

The procedures that is compiled in this study are as follows: (1) Conducting the initial observations through interviews with biology teacher of the eleventh-graders in SMA N 1 Pemalang; (2) Determining the research sample class through cluster random sampling technique; (3) Carrying out the literature studies on relevant theories; (4) Preparing the

learning instrument; (5) Coordinating with schools and teachers; (6) Compiling data collection instruments; (7) Testing the questions of the pretest-posttest that will be used to measure the analytical skills of students in the third mathematics and science major of eleventh-graders in SMA N 1 Pematang; (8) Analyzing the results of the test questions which include validity, reliability, different power, and the level of question difficulty; (9) Carrying out the learning with a project based learning model by using reused paper; (10) Analyzing students learning outcomes data as well as student and teacher responses; (11) Compiling results and discussion of the research.

RESULT AND DISCUSSION

The research that has been carried out was obtained the learning outcomes that include learning outcomes of cognitive field, learning outcomes of psychomotor field, and learning outcomes of affective field (environmental care attitude) and also student and teacher responses. The results of the research that were obtained are presented as follows.

Learning outcomes of cognitive aspect

The learning outcomes of cognitive field was obtained from the pretest and posttest scores and then the difference is calculated to determine the increase in learning outcomes through the N-gain test. The N-gain score is calculated from the pretest score and the posttest score were obtained from the control class students and the experimental class students. The results of the N-gain control class and experimental class are presented in the following table.

Table 1. The results of the N-gain control class and the experimental class on nervous system material

Categories	Control Class		Categories	Experiment Class	
	Σ	%		Σ	%
High	9	25	High	22	64,71
Moderate	25	69,44	Moderate	12	35,29
Low	2	5,56	Low	0	0

From Table 1, it can be seen that the experimental class has a score in the high category which is reaching 64.71%, while in the control class it is only reaching 25%. In the experimental class, the score is in the moderate category which is reaching 69.44%, while in the control class it is only reaching 35.29%. In the experimental class, it is obtained in the amount of 0% or none of the students reached the N-gain score in the low category, while in the control class there were 5.56% of students who have the N-gain score in the low category. In addition, it is discovered that there are differences in the average of N-gain score between the experimental class and the control class and the average of N-gain score of the experimental class is greater than the control class (0.72 > 0.58).

Based on the analysis of the average differences in N-gain data by using the Independent T-test Samples test assisted the SPSS version 20 application. It is known that an improvement in learning outcomes of cognitive field between the control class and experimental class has a significant difference in the average of Sig score. (2-tailed) $\alpha (0.05)$ which is equal to 0,000.

Both of these aspects are the average N-gain score of the experimental class that higher than the control class and the significant difference average between the control class and the

experimental class, it states that learning in the experimental class with the PjBL model by using reused paper is stated to be effective against learning in nervous system material when it was compared to learning in a control class that used discussion and presentation methods. The findings in this study are in accordance with the results of the previous studies by Indarti & Purwanto (2017) which explained that the project-based learning model is stated to be effective if there is an improvement in learning outcomes through final evaluation tests and fulfill the specified criteria. This opinion is supported by Baran *et al.* (2018) that in the learning activities of the project based learning model can improve the cognitive learning outcomes of students because they are given the opportunity to be active in participating in learning process.

Learning outcomes of psychomotor aspect

Students' learning outcomes of psychomotor field are obtained through observation that was conducted by the teacher on the results of student work. Psychomotor learning outcomes in the control class were obtained from presentation charts and chart results, while learning outcomes of psychomotor field in experimental classes were obtained from material review presentations, project presentations, and project report results by using reused paper. The students' learning outcomes of psychomotor field can be seen in the following table.

Table 2 The Students' Learning Outcomes of Psychomotor field in the Control and Experimental Classes

Class	Highest Score	Lowest Score	Average	Criteria
Control	86	73	80	Good
Experiment	94	84	89	Very good

Based on the results of descriptive data analysis of the percentage in Table 2, it is known that the learning outcomes of psychomotor field average of the experimental class are greater than the control class. The learning outcomes of psychomotor field average of the control class were 80 and it was categorized in good categories, while the average of learning outcomes of psychomotor field of the experimental class were 89 and it was categorized in very good categories. It is reviewed from these aspects that the average of students' learning outcomes of psychomotor field of the control class is classified in very good categories, so the implementation of the PjBL model by using reused paper on the students' learning outcomes of psychomotor field in the experimental class is effective.

The average difference occurs because there are differences in treatment between the control class and the experimental class. The learning of control class used discussion and presentation methods, while the learning of experiment class used the PjBL model by using reused paper. The implementation of the PjBL model by using reused paper in the experimental class provides an opportunity for students to develop skills possessed by students through activities that take longer time than the control class when it is compared. It is supported by the research of Falahudin (2016) who said that the implementation of the PjBL model had a positive influence on students' learning outcomes of psychomotor field. This opinion is in line with the opinion of Chiang & Lee (2016) that the characteristics of PjBL are able to develop students' thinking skills, think creatively, cooperation, find information

independently, and skills in delivering information. Hapsari *et al.* (2016) added that the implementation of the PjBL model can improve students' understanding, encourage students' science skills, explore knowledge to be applied in the real life, thus it can make students active during the learning process.

Learning outcomes of affective aspect (environmental care attitude)

The environmental care attitude score is obtained from the results of the environmental care attitude questionnaire that was given to students after the learning was conducted in the control class and experimental class. The summary of the environmental care attitude score is presented in the following table.

Table 3 The environmental care attitude score of the control class and the experimental class

Class	Highest Score	Lowest Score	Average
Control	80	44	62
Experimental	91	71	81

Based on Table 3 it is known that there are differences in the average of environmental care attitude in the control class and the experimental class. The average of the environmental care attitude score of the control class environment is 62, while the students' average of the environment care attitude score of the experimental class is 81. It is known that the results of the average score of environmental care attitudes that is obtained in the experimental class that is higher than the control class .

The low level of environmental care attitude is due to the lack of understanding of students about the behavior of environment caring and its benefits in the future. The implementation of caring attitude towards the environment should be applied early. This is in line with Susilo *et al.* (2016) who explained that the development of environmental care at a young age is expected to generate people who behave positively towards the environment in the future.

The results of statistical tests on the score of the environmental care attitude of the control class and the experimental class are known that there are differences in the average score of environmental care attitude between the experimental class and the control class ($55 > 0.06$). Based on the results of the analysis of the average difference in the environmental care attitude score, it is known that there is a significant difference in the score of environmental care attitude between the control class and the experimental class. This is evidenced by the results of the data analysis by using the Mann Whitney test with assisted with the SPSS version 20 application which shows that the Sig score. (2-tailed) $< \alpha$ (0.05).

The difference score of the environmental care attitude between the experimental class and the control class is due to the differences in the learning process between the experimental class and the control class. The learning process in the experimental class used the PjBL model by using reused paper which includes assignments that require students to apply the use of reused paper as a form of waste management conservation behavior. It motivates students to increase their awareness of the environment. While in the control class, there were few variations relatively in learning activities but there was no reuse of reused paper as a waste processing effort. It causes students to care less about the environment. This is in line with the opinion of Haniyya & Bintari (2017) who said that giving motivation on continuous

environmental issues is expected to be able to shape students' awareness in caring the environment.

Student responses to nervous system learning by using a project based learning model by using reused paper

Learning outcomes data can be supported by responses from students regarding learning with a project based learning model using reused paper. Student responses are feedback that is given by students to the learning that is carried out by the teacher, which is obtained based on questionnaires distributed to students at the end of the learning process.

From the results of the questionnaire sheet, it is known that students give a positive response. The questionnaire of student responses regarding project based learning models by using reused paper containing questions that students must answer. Based on the results of the questionnaire analysis, the average that is obtained was 88% with very good criteria. So, it can be concluded that the learning of nervous system material with a project based learning model by using reused paper get good responses from students.

Teacher's response to nervous system learning by using a project based learning model by using reused paper

The teacher response data is obtained from interviews with Biology teacher of mathematics and science of eleventh-graders in SMA Negeri 1 Pematang through guidelines that have been arranged. The teacher's response interview aims to find out the biology teacher's opinion on learning with the PjBL model by using reused paper on nervous system material.

Generally, teachers give positive responses and good impressions of learning. It can be seen from the results of the teacher's response stated that during learning students became more creative, active, and confident in expressing opinions. This opinion is supported by Indarti & Purwantoyo (2017) that the PjBL model can create a more pleasant learning atmosphere and encourage students to play an active role during learning activities. Active students will understand more about the material, so that the learning outcomes increase.

The difficulty of the teacher in applying the PjBL model by using reused paper is the difficulty in time management when conducting presentation activities. The teacher gives advice so that at the learning stage the experience evaluation section needs to be maximized to determine how much students understand about the nervous system material.

Generally, the implementation of the learning process with the PjBL model by using reused paper that was conducted at SMA Negeri 1 Pematang can improve students learning outcomes.

CONCLUSION

Based on the research results and data analysis, it can be concluded that the implementation of the project based learning (PjBL) model by using reused paper on the nervous system material is effective on students learning outcomes.

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