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THE INFLUENCE OF PROBLEM-BASED LEARNING MODEL IN IMPROVING STUDENT ENGAGEMENT IN MATHEMATICS

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Abstract

The purpose of this research is to determine the effect of the problem-based learning model in improving student engagement on mathematics subjects. This type of research is an quasi-experimental with the pretest-posttest control group design approach. The independent variables of this research are Problem-Based Learning and student engagement models in mathematics as the dependent variable. Participants in this research were 60 elementary school students who were divided into 2 groups, first were 30 elementary school students K1 as the experimental group who received learning with problem-based learning model and 30 elementary school students K2 as the control group that received the conventional learning model. Data collection techniques in this research using non-test techniques consisting of observation, questionnaires, and documentation. The data were analyzed by independent samples test. The results showed there was a significant influence of learning using problem-based learning model could improve student engagement in mathematics.

Keywords: Problem Based Learning; Student Engagement.

A. Introduction

One effort to achieve educational goals is to improve learning in the classroom. Mathematics is one of the important fields of study in education. Mathematics is always taught at all levels of education, from elementary into high school level and even in college. The curriculum in Indonesia has specific objectives that must be achieved through mathematics learning. The objectives to be achieved in mathematics learning are the students' ability to solve problems that include the ability to understand problems, design mathematical models, solve models and interpret the solutions obtained (Ministry of National Education, 2006). According Dreeben (Hamzah, 2001), mathematics is taught in schools in order to fulfill the long-term functional needs for students and the community. Learning mathematics in schools is important because from mathematics learning students will get useful lessons so they can help students join the midst of society effectively. Besides that, the schools learning activities is one form of supporting education and a development task for children at school age. From this activity, children are expected to have provisions for their future lives that accordance with educational goals.

In the basic educational age, students are on the concrete operational stage. At this stage, students generally have difficulty to understand the abstract mathematical concepts or material. Therefore, not a few students in the basic education stage consider mathematics as the most difficult subject compared to other subjects (Yandari & Kuswaty, 2017). In the learning process, the emergence of difficulties to understand a concept is a normal thing. This illustrates that students are doing the thinking process. They try to integrate new information into the cognitive structures that they already have (Sidik, 2016).

Abdurrahman (Indiyani, Widodo & Listiara, 2006) states that from various fields of study taught in schools, mathematics is a field of study that is considered as the most difficult for students. This assumption is already attached to most students, so when they facing mathematics lessons they will become lazy to think. In fact, not a few

students are afraid when faced with mathematics. Mathematics has a very important role in everyday human life, namely in the process of buying and selling, measuring data management and etc. (Asni & Kwilangga, 2020). The above statement is also supported by Kong, Wong, and Lam's (2003) research, when students cannot see the importance of mathematics learning and cannot overcome its level of complexity, they quickly become disinterested, prefer to leave or avoid learning mathematics because of unpleasant impressions which it caused. This behavior shows non-involvement students' behavior with the process of learning mathematics. The involvement behavior in this research will then be referred to as *engagement*, while the contrary behavior of engagement that is non-involvement will be referred to as *disengagement*.

Student engagement is used to determine the extent of student involvement in the learning process at school (Frederick, et al: 2011). The intended involvement here is to describe the willingness to participate in school activities routine, such as attending classes, working on and collecting assignments, and following teachers' direction in class (Hoffman, 2013). Student engagement is defined as the time and effort of students devoted to activities that are empirically related to the desired results of schools and institutions to encourage students to participate in these activities (Kuh, 2009). That definitions usually include psychological and behavioral components. Student involvement is used to discuss students' attitudes toward school. In recent years, especially in America, the concept of engagement appears in many theories, researches, and practices. In general, engagement leads to the quality of a very strong students' relationship with the school, especially with the people, activities, goals, values and facilities within it. Many researchers are interested in the concept of student engagement because student engagement represents a potential that can influence the formation of academic memory, achievement, and tenacity of students (Skinner, Kindermann, & Furrer, 2008). In other literature, student engagement is very

important to be pay attention because of its function as a real form of students' motivation processes. Motivation and interest in learning are naturally present in each student. But when they enter the school, that motivation and interest does not always emerge. Some researchers even say that disengagement has increased along with the increase in education levels pursued by children, ranging from elementary schools to high schools.

Based on the results of preliminary observations in fourth-grade elementary schools in Kudus Regency, researchers obtained the following data; when the teacher explaining the lesson in front of the class, half of students does not seem to pay attention to the teacher. The students are seen doing things out of learning activities. Some are chatting with their friends, and some are playing alone. Then the researchers conducted interviews with the concerned class teacher, the students with good cognitive potential have not shown maximum performance. The students' academic grades obtained is not too far from minimum completeness criteria, there are even some students who get grades below the minimum completeness criteria.

Similar conditions also occurred in students who participated in the experimental group research. Initial observations were made at K1 elementary schoool. This preliminary observation was carried out to find out the students' behavior during math lessons, the students observed were the fourth-grade students. When the teacher is explaining mathematics material on the board, not all students pay attention to the teacher, there are those who seems to be looking at the teacher or blackboard but their views are blank; when the teacher asks about the material being taught to all students, not all students answer, some students just keep quiet or do nothing. When the teacher asks students to do an assignment, not all students show the behavior of doing the task seriously. The same thing happened to students in K2 elementary school, students also showed disregarding behavior when the teacher was explaining mathematics material. The teacher also said the mathematics achievement of these students was lower than other school's students with the same

accreditation. Based on the first semester report card grades, the mathematics achievement scores obtained by students are not too far from the minimum completeness criteria, even some students scored below the minimum completeness criteria.

One of the factors affecting the increase in behavioral involvement (engagement) is setting the structure and the classroom environment. A classroom environment with full of appreciation, fair, safe, and supports positive communication are preferred by students, where in this environment can increase their engagement (Brown, 2009). Students who study in communities that have varied values, encourage social responsibility, support discussion and differences of opinion, recognize abilities and achievements, and encourage a sense of belonging among community members, will learn better. If students are placed in the conditions above, it will indirectly make them involved (engaged) with their learning process (Niemi, 2007).

Cooperative groups are believed to be able to create an environment that can reduce the anxiety and fear of failure in mathematics learning by encouraging them to take appropriate risks while learning mathematical concepts and providing an understanding of those skills that can be achieved by an active process. Problem-Based Learning (PBL) is one of the problem-based learning models that can be an alternative in helping to understand problems in mathematical story problems. As stated by Gunantara, et al (2014: 2) that PBL is a learning model that involves students in solving real-world problems. So learning using real-world problem solving can use the PBL model where the PBL model can emphasize the scientific process of problem-solving so students can think critically and skillfully in solving problems. The students' problem-solving abilities can be optimized through the group work processes that exist in PBL, so students can empower, hone, test, and develop their thinking skills on the ongoing basis. In this case will also affect students' involvement during the learning process and liveliness in the classroom. According to Arends (in Suprijono, 2013: 46) learning models

refers to the approach used that includes learning objectives, learning activities stages, learning environment, and classroom management. According to Arends (2008: 41), PBL is a learning that presents a variety of authentic and meaningful problem situations to students, which can serve as stepping stones for investigation. While Sanjaya (2009: 214) also believes that PBL can be interpreted as a series of learning activities that emphasize the process of solving problems faced scientifically. From the above opinion, it can be concluded that the definition of PBL is a learning that gives problems to students and they are expected to solve these problems by implementing active learning. So in this study students are always active and the teacher only as a facilitator.

Various theories that have been put forward above, shows the influence of Problem-Based Learning (PBL) model towards students' involvement (engagement) in mathematics learning. In the learning environment, students can enjoy the process of mathematics learning, students are given the opportunity to discuss, express their opinions and ideas, explore the material being studied and interpret the results together in groups. Students are also freed to find various relevant learning resources.

B. Research Methodology

This research used a quasy-experimental research with a pretest-posttest control group design using two classes, as an experimental group and a control group. The control group was given treatment only in the form of conventional learning but engagement was recorded in the form of a questionnaire sheet along with the experimental group. While the experimental group was treated using the PBL learning model during the mathematics learning process. The participants in this research were fourth-grade elementary school students based on a sample group obtained from two different elementary schools with a purposive sampling technique by considering several things such as: (1) the curriculum used, (2) the number of students, (3) the average score of final exam I, (4) the

qualifications of the teaching-class teacher. Based on these considerations, two elementary schools were chosen, namely K 1 elementary school and K 2 elementary school with 30 students of each school. The research was conducted in the even semester of the 2017/2018 school year in April 2018. In the research there were independent variables in the form of problem based learning models, the dependent variable was students' engagement in mathematics. Data collection techniques using non-test techniques. Data collection instruments used were questionnaire of pre-test and post-test and documentation. Processing and data analysis in this research using the SPSS Statistics 16.0 program. The data analysis to test the hypotheses in this research was conduct using statistical analysis namely independent samples test.

C. Research Result and Discussion

The results of this research in the form of post-test scores obtained from measuring the instruments of observation sheets (a questionnaire) to determine student engagement during the learning process. Observations were made with the help of class-teachers in filling out the questionnaire sheets. Student engagement questionnaire sheet is calculated as a percentage of the total indicators observed with the total number of overall indicator scores. The results of the questionnaire sheets are presented in Table 1.

Table 1
Observation Result of Student Engagement

Group	Percentage	Criteria
Control	70.70%	Good
Experiment	81.11%	Good

Based on the observation results conducted by fourth-grade teachers obtained classical average scores in the experimental group was 81.11% in the good category, while the classical control group obtained the average score of 70.70% and was in the good category as well. The level of experimental group students' engagement was better than the

engagement of the control group during mathematics learning. There are 4 factors of student engagement namely, the level of academic challenges, active and collaborative learning, student-teacher interaction, and enriching educational experiences. The data on each indicator factor is presented in Figure 1.

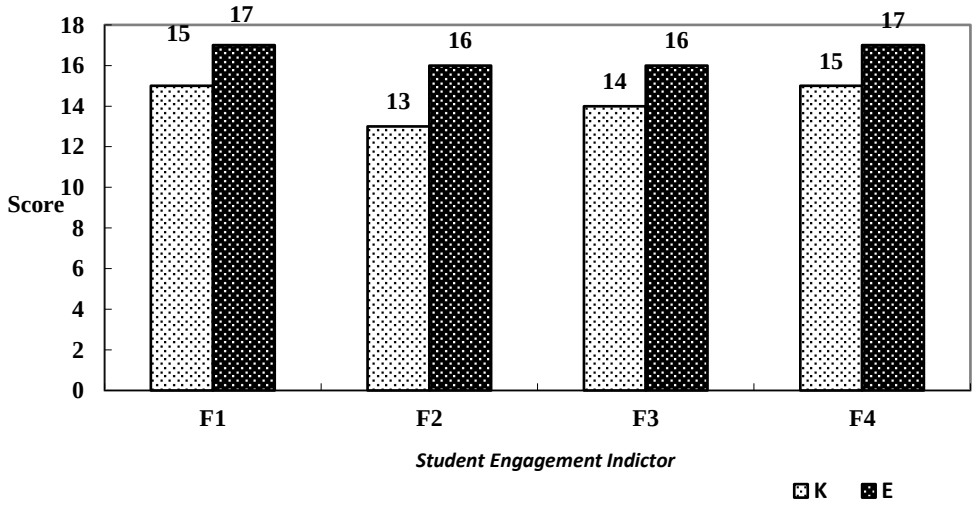

Figure 1. Result of Student Engagement Analysis For Each Indicator

Information:
F1: The level of academic challenges.
F2: Active and collaborative learning
F3: Student-teacher interaction.
F4: Enriching educational experience.

In the control group, the four factors of student engagement are in a good category. The lowest result is shown in the factor of active and collaborative learning. Some students had lack collaboration in doing the assignments given by the teacher and less active in the learning process. There were only a few students who give their opinions when asked by the teacher. This is because the PBL model used in the mathematics learning process does not maximize the students' participation in learning. Students only listen to the material explanation from the teacher without the steps instruction to solve the problem correctly, so many students do not dare to express their opinions during the learning process. The

highest score in the control group is in the factor of the level of academic challenges.

In the experimental group, the lowest score is on the factor of enriching the educational experience. The highest score of the experimental group lies in the student and teacher interaction factor. Students in the experimental group prefer the demonstrating method by the teacher, so students feel more guided in every problem-solving in the story problem. Rini (2014) explained that there was an increase in student learning outcomes after the demonstration method was applied. Because demonstration is a method used by students to interact in the learning process between teachers and students to analyze, solve problems, explore the problem, related to this research, the topic of this research is about the problem-solving ability. Anis (2017) states that PBL learning through demonstration are better for improving verbal skills. The PBL model through the demonstration method is able to help students who have difficulty in understanding story problems, thereby increasing students' understanding of problems in mathematical story problems.

Student Engagement is used to determine the extent of student involvement in the learning process at school (Frederick, et al: 2011). In the learning process, Student engagement can assess students during a learning process, so it is not only seen from the output. Heri Yanto, et al (2011) in the results of his research obtained that Student engagement also has a positive impact on student accounting competence. Ulum (2017) states that overall the achievement motivation variable, cumulative achievement index, student engagement in street vendors, and student involvement in practical subjects has a positive effect on the competence of UNNES accounting students.

Research conducted by Setyadi (2018) shows that problem-based learning models with ethnomathematics nuances by using traditional games are effective in improving students' problem-solving abilities. Lestanti (2016) in the results of her study show that the problem-solving ability of students with the characteristics of an abstract sequential

thinking type is higher than students with the characteristics of concrete, random, and abstract-random sequential thinking types.

In line with the research conducted by Ismawati (2017), the ability to solve mathematical problems in problem based learning in the experimental group is better than the control group. Strengthened by Muntaha's research (2013) which developed learning tools uses a problem-based learning model is more effective in improving creative thinking.

The first factor is the level of academic challenges

Academic challenges and high expectations are related to students' learning and quality of education (Kuh 2009). Students will be motivated if they get the appropriate academic challenge or academic expectations of the school's academic environment. Students will be more serious in learning and put more effort to make sure they will be able to fulfill those expectations and challenges.

The level of student academic challenges measured in this research was obtained based on the results of the pre-test and post-test. From the results of the pre-test and post-test that have been implemented, then conduct further testing using the independent sample t-test. T-test results can be seen in table 2.

Table 2
Observation Result of Students Engagement

Group Statistics					
	Treatment	N	Mean	Std. Deviation	Std. Error Mean
F1	Experiment	30	17.0000	1.14470	.20899
	Control	30	15.2667	2.31834	.42327

Based on the data in Table 2, it is found that the involvement of control group students can be seen from the classical average of only 15.26. While the experimental group received a classical average of 17.

In hypothesis testing, there are several provisions that must be used as guidelines. The provision is that if $t_{count} < t_{table}$ or significance score> 0.05, p 0 is received, and if $t_{count} \geq t_{table}$ or significance score $\leq$ 0.0, then H0 is

rejected. In this research, the researchers used a sample of 60 students, then the degrees scores of freedom (dk) = n - 2 = 60 -2 = 58 and a level of error is 5% for the 2-party test, it can be seen the score = 2.002 (Priyatno, 2010: 113). The calculation results of the hypothesis test using SPSS version 16 the result of the independent sample t-test can be seen in Table 3.

Tabel 3

Independent Samples T-Test				
			the level of academic challenges	
			Equal variances assumed	Equal variances not assumed
Levene's Test for Equality of Variances	F		15.738	
	Sig.		.000	
t-test for Equality of Means	T		3.672	3.672
	Df		58	42.347
	Sig. (2-tailed)		.001	.001
	Mean Difference		1.7333	1.7333
	Std. Error Difference		.47205	.47205
	95% Confidence Interval of the Difference	Lower	.78841	.78092
		Upper	2.67825	2.68575

Based on table 3, it can be seen that the calculation results of the hypothesis test using SPSS version 16 the result of the independent sample t-test show the column of equal variances assumed in column t is 3.672; df of 58; sig. (2 tailed) 0.001; mean difference of 1,733; lower of 0.788; upper of 2,678. Furthermore, the column of equal variances not assumed in column t shows 3.672; df of 42,347; sig. (2 tailed) 0.001; mean difference of 1,733; lower of 0.781; upper of 2.685.

It is known that the data in the research are homogeneous, so to know the hypothesis test results can be seen in the column of equal variances assumed. Conversely, if it is not homogeneous, to find out the hypothesis test results can be seen in the column of equal variances not assumed. Based on the calculation results with SPSS version 16 the column of equal variances assumed, it can be seen that the score of t arithmetic = 3.672 and the significance of 0.001. From the results of these

calculations can be seen that 3,672 > 2,002 or t arithmetic ≥ t table and 0,001 < 0.005 or a significance value <0.05. Based on the provisions that applied to test the hypothesis that the researchers have described above, then H_0 is rejected. So, the conclusion of this research is that there are differences in students engagement between groups using PBL model and groups using conventional models.

The second factor of active and collaborative learning

Learning is not just watching and listening to lectures, but learning should also involve students actively both psychologically and physically. In addition, students must understand what they learn both practically and theoretically. Therefore, students learn more when they are very involved in their education and are asked to think about what they are learning related to daily life.

Cooperative learning is a strategy that consists of small groups of students to learn together and help each other in solving problems to achieve learning objectives. By using cooperative learning, students can learn to solve problems by asking questions or by providing assistance to other members of the group. Students will show greater progress if they study in groups compared to individual conditions.

The third factor is student-teacher interaction

Student-teacher interaction is very important to build the students' effort quality. In this case, student-teacher interactions are not only official interactions in the classroom but also interactions outside the classroom. Therefore, student-teacher interactions include formal and informal interactions. The teacher's role becomes more important because the teacher becomes a role model, a mentor, and a guide for continuous lifelong learning. This student-teacher contact is very important because it can help students increase their motivation and involvement. Students need appropriate and frequent feedback from the teacher to ensure they can assess their knowledge and competence. Feedback also plays a very important role in the teaching and learning process, because feedback can function as a tool to motivate and evaluate students.

The fourth factor is enriches the educational experience

Students need to get the opportunity to develop their potency to improve their personal quality. Students' participation in school activities, student organizations, extracurricular, and so on will help students in their social life in the future. The students' involvement in these various activities also allows students to apply the theories obtained in the teaching and learning process.

D. Conclusion

Based on the results of the research and discussion, it can be concluded that there is an influence of Problem-Based Learning (PBL) model in Improving the Student Engagement in mathematics. This is proved by the result of pretest-posttest of before and after treatment and independent sample of t-test with list distribution of t count 3.672 obtained> t table 2.002 and based on the significance score of 0.01 <0.05. So we can conclude that H_0 is rejected and H_a is accepted which means that there is an influence of PBL model in increasing students engagement in mathematics. Besides that Students engagement in experimental group is better than the control group can also be seen from the observation results made by each teacher and 30 students obtained an average classical result of 81.11% in the experimental group with good categories while 70.70% obtained by the control group with good category. This proves that the use of the PBL model is more effective toward student engagement on mathematics subjects maximally.

Suggestion

The teacher should always apply learning with the material and learning objectives to be achieved. One of them is the PBL model that helpful for student involvement, including the level of academic challenges, active and collaborative learning, student-teacher interaction, and enriching educational experiences. Before conducting student engagement assessments, teachers must consider the observation result, because to assess the involvement of elementary school students requires more than 1 observation factor. For other researchers, there is a need to be conducted on another research about the application of PBL models on learning

material, and different student conditions and the development of this research also need to be developed a comparison of the PBL models application with learning models and other dependent variables.

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