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THE EFFECT OF PROJECT-BASED LEARNING MODELS ON STUDENT MOTIVATION AND LEARNING OUTCOMES

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Abstract: This study was conducted at SMP Negeri 2 Pontianak to test the effect of project-based learning (PjBL) on students' motivation levels and learning outcomes, and to understand the extent to which perceptions of mathematics learning are related to motivation and learning outcomes. The method used was an experiment with a posttest-only control design. The analysis showed that applying the PjBL model significantly affected learning motivation (sig value = 0.045) and learning outcomes (sig value = 0.000). In addition, there was a significant positive relationship between students' perceptions of mathematics learning and their motivation to learn (sig value = 0.000), although the relationship was not found with learning outcomes (sig value = 0.933). Overall, the interaction between students' perceptions and motivation on learning outcomes did not show a significant effect (sig value = 0.358). Therefore, it can be concluded that the use of the project-based learning model is effective in improving student's motivation and learning outcomes.
Keywords: Project-based learning, motivation, learning outcomes

1. INTRODUCTION

With the ongoing development of the curriculum, mathematics learning in schools is now increasingly adopting a contextual approach. This can be found at SMPN 2 Pontianak. Based on the results of the author's observations while participating in the MBKM Internship program in the even semester of the 2022/2023 school year, grade VII mathematics teachers at SMPN 2 Pontianak have implemented a problem-based learning model, which is one of the learning models with a contextual approach.

One of the educational strategies that applies a context-based approach is one that focuses on using projects as learning centers (Hapsari & Airlanda, 2018). A project-focused learning method, also known as project-based learning (PjBL), is an approach that prioritizes the creation of works by actively involving students in the learning process. In this approach, students are given the opportunity to apply mathematical concepts in relevant and real situations through a variety of project assignments that are not only challenging, but also directly connected to everyday life.

According to Zumakir, 2022 "There are 8 characteristics of project-based learning, namely: 1) students make decisions about a framework; 2) the existence of problems or

challenges posed to students; 3) students design processes to determine solutions or problems or challenges given; 4) collaborative students are responsible for accessing and managing information to solve problems; 5) the evaluation process is carried out continuously; 6) students periodically reflect on the activities that have been carried out; 7) the final product of learning activities is evaluated qualitatively; and 8) learning situations are very tolerant of mistakes and change."

Refer from Educational Technology Division-Ministry of Education Malaysia (2006) in (Yunizha, 2023) "There are six stages of project-based learning, namely: 1) preparing important questions related to a material topic to be studied; 2) prepare a project plan; 3) create a schedule; 4) monitor the implementation of project-based learning; 5) testing and assessing the projects made; 6) project-based learning evaluation."

The learning steps in this study are implemented in mathematics learning in data presentation materials. In the learning process, students are asked to carry out a project to make a wall magazine made of cardboard. Before making the wall magazine, the students were first asked to collect data that would be analyzed and presented in the format of frequency distribution tables, bar charts, line charts and circle charts. The results of the data analysis are then poured in the form of images or writing on cardboard. In addition, students were also asked to include an explanation of the meaning of data, population and samples, types of data, and data collection methods.

It is expected that the use of the model project-based learning In the process of learning mathematics, it can strengthen the motivation and learning outcomes of students. This is in line with research Chaniago and Dafit (2024), which found that "the application of The project-based learning model significantly improves student motivation and outcomes in Indonesian subjects". In addition, other research by Arianta dkk. (2024) also showed similar results, where "project-based learning models have a positive impact on student motivation and learning outcomes".

According to Dalyono (Asrori, 2020), "Learning motivation is one of the internal factors that affect student learning outcomes. Motivation, both from within (intrinsic) and from outside (extrinsic), encourages students to learn optimally". With great enthusiasm, students will show a deeper interest in learning activities, have the ability to concentrate and focus more sharply, and can achieve superior learning outcomes (Destirasari, 2018).

Motivation is an impulse that encourages the emergence of certain behaviors that are focused on achieving certain goals (Emda, 2018). Motivation is the reason why a person behaves the way they do. Deep Borah (2021) It is said that motivation is the 'heart of learning', 'the golden path to learning', and 'a powerful factor in learning', because all learning is motivated learning.

Borah also said that motivation is the result of the interaction of individuals and situations. Therefore, learning motivation can be understood as an encouragement or stimulus that spurs students to achieve targets in learning activities.

Motivation in the learning process is an important factor that affects the success rate in a learning activity. Wiba Sanjaya (in Emda, 2018) stated that motivation plays a role as a driver of student activities as well as an influence in learning. In general, "motivation is divided into two types, namely intrinsic motivation and extrinsic motivation. Intrinsic motivation comes from within students, while extrinsic motivation is influenced by external factors" (Borah, 2021).

The project-based learning model, according to various previous studies, not only affects students' learning motivation, but also has an impact on the achievement of their learning outcomes. Learning outcomes are behavioral changes due to learning. Learning outcomes according to Benjamin Bloom in (Rahmatillah, 2019), divided into three domains, namely "the cognitive realm, the affective realm and the psychomotor realm. The cognitive domain with respect to knowledge (knowledge, memory), comprehension (understanding, explaining, summarizing), analysis (outline, define relationships), synthesis (organizing, planning, helping new buildings), evalution (assessed), application (apply). The aaffetive realm is related to the response of didi participants involving recieving (attitude of acceptance), responding (responding), Pricing (value), organization (organization), characterization (characterization). Meanwhile, the psychomotor realm is related to learning outcomes intitiatory level, pre-routine level, routinized level".

Factors that come from within the individual and the surrounding environment can affect motivation and learning outcomes in the educational process. One of the elements that comes from within the self that plays an important role in motivation and learning outcomes is the way of perception or perception. Perception refers to the impression that a person obtains through the five senses, then is processed, interpreted, and assessed, thus creating a meaningful understanding for the individual. Students' perception of project-based mathematics learning will arise after the student participates in the learning.

Students' perceptions of mathematics learning can differ from each other (Asrori, 2020). This perception can affect student motivation and learning outcomes. This is supported by research conducted by The DKK is a parading. (2011) which concluded "there is a significant relationship between students' perception and motivation to learn. Similar findings were also obtained from research (Djuarsa dkk., 2017), which shows that "the higher the motivation of students, the more positive and strong their perception of learning".

This study, as previously explained, focuses on the main issues related to the influence of project-based learning on motivation and learning outcomes while also examining the relationship between perception and motivation and learning outcomes. Therefore, the purpose of this study is to assess the extent to which project-based learning can affect motivation and learning outcomes. In addition, this study also aims to explore the relationship between perception and motivation and learning outcomes.

2. RESEARCH METHODS

This study is classified as an experimental category which aims to evaluate the influence of independent variables (treatments) on dependent variables (outcomes) under controlled conditions (Suggestion, 2019). The experimental method applied is the research design true experimental with the approach posttes-only control design. Within this design framework, there are two groups of subjects involved. The first group is known as the experimental group, which is treated in the form of project-based learning on data presentation materials. Meanwhile, the second group served as a control group, which did not receive similar treatment to the experimental group.

This research involved grade VII (7) students of SMP Negeri 2 Pontianak as research subjects. As a group tested from class VII (7) C, while the group that was not given special treatment came from class VII (7) G. To determine the sample, the cluster random sampling method was used, which was chosen because the number of classes was representative enough to describe the entire population.

The data collection tool used is in the form of a closed questionnaire that uses the Likert scale. According to Siregar (2017), "the Likert scale consists of two types of statements, namely positive statements and negative statements". The questionnaire to measure perception contained 20 statements, of which 3 were negative and 17 were positive. Meanwhile, the questionnaire used to measure motivation contained 10 statements, with 1 negative statement and 9 positive statements. The scores for each statement in this questionnaire can be seen in Table 1 below.

Table 1. Questionnaire Answer Alternative Sizes

Choice of Answer	Positive Statement Score	Negative Statement Score
Strongly Agree (SS)	4	1
Agree(s)	3	2
Disagree (TS)	2	3
Strongly disagree (STS)	1	4

The results of the data study using the t-test (t-test) To evaluate the effect of the application of the project-based learning model on increasing learning motivation among students. According to Martono and Isnania (2023), "The formula used in the t-test is as follows.

$$t = \frac{\overline{X_1} - \overline{X_2}}{\sqrt{\frac{{S_1}^2}{n_1} + \frac{{S_2}^2}{n_2} - 2r\left(\frac{S_1}{\sqrt{n_2}}\right)\left(\frac{S_2}{\sqrt{n_2}}\right)}}$$

Information:
$\overline{X_1}$ = Average of the sample data of the control class
$\overline{X_2}$ = Average sample data of the experimental class
S_1 = Standard deviation of control class data
S_2 = Standard Deviation of Experimental ELAS Data
n_1 = Number of control class sample data
n_2 = the number of sample data of the experimental class".

To assess the impact of the use of project-based learning models on learning outcomes, an analysis was carried out using tests Mann-Whitney u-test. This statistical test serves to assess the difference between two independent groups, especially when the data are used in an ordinal shape or not following the normal distribution (Suggestion, 2019). In the implementation of this test, there are two formulas that need to be applied, namely:

$$U_1 = n_1 n_2 + \frac{n_1(n_1 + 1)}{2} - R_1$$

and

$$U_2 = n_1 n_2 + \frac{n_2(n_2 + 1)}{2} - R_2$$

Information:
n_1 = Number of samples 1
n_2 = Number of samples 2
U_1 = Number of 1st Ranks
U_2 = Number of Ranks 2
R_1 = Number of rankings on the sample n_1
R_2 = Number of rankings on the sample n_2

Analysis using simple linear regression was carried out to assess the relationship between student perception and learning motivation, as well as to assess the relationship between student perception and learning outcomes. Meanwhile, to analyze the simultaneous influence of perception and motivation on learning outcomes, multiple regression with two independent variables was used.

Deep (Siregar, 2013)"The formula for simple linear regression is as follows.

$$Y = a + bX$$

Meanwhile, the multiple regression formula is as follows.

$$Y = a + b_1X_1 + b_2X_2$$

Information:

$Y =$ Student learning outcomes
$X_1 =$ Students' perception of mathematics learning
$X_2 =$ Motivation for learning mathematics
$a, b_1, b_2 =$ constant".

3. RESULTS AND DISCUSSION

The study, which examined the effect of the application of the project-based learning model on students' motivation and learning outcomes based on their perceptions, was carried out at SMPN 2 Pontianak involving two class groups. Class VII C acted as a group that was given experimental treatment, while class VII G acted as a comparison group. The data from this study consisted of the results of a questionnaire on students' perception of mathematics learning, the results of a learning motivation questionnaire, and the results of test questions.

The questionnaire that measures students' perception of mathematics learning is compiled based on perception indicators according to Robbins (in Akbar, 2015), i.e. "Acceptance and evaluation". The questionnaire contains 20 statements consisting of 17 positive statements and 3 negative statements. This questionnaire was given to 30 students from the experimental group and 27 students from the control group. In this study, the students' perceptions were classified into two types, namely positive perceptions and negative perceptions, with details of explanations (Table 2) as follows.

Table 2. Categories Student Perception

It	Score	Category
1	20-50	Negative
2	51-80	Positive

Based on Table 2, the results of the study show that all students from the experimental group, consisting of class VII C and following the project-based learning model, have a good perception of their learning experience. On the other hand, in the control group, there were five students who expressed negative perceptions of the learning process they underwent.

The questionnaire used to assess the level of learning motivation was compiled by focusing on two main factors, namely intrinsic motivation and extrinsic motivation. This measuring tool consists of ten statements, of which one is a negative statement, while the other nine are positive. A total of 30 participants from the experimental group and 27 participants from the control group participated in filling out this questionnaire. In this study, students' learning motivation was divided into three different categories (Table 3).

Table 3. Categories Student Motivation

It	Score	Category
1	20-40	Tall
2	14-19	Keep
3	10-13	Low

The results of the evaluation showed that no students were found to have a low level of motivation, either in the group that was given treatment or in the group that was not treated. In the group that was given treatment, there were 5 students with a moderate level of motivation, while in the group without treatment, the number of students with medium motivation was 7 people. Meanwhile, 25 students in the experimental group were highly motivated, and in the control group there were 20 highly motivated students.

Test questions to measure learning outcomes are arranged based on indicators developed in accordance with learning objectives. The test questions consist of 3 questions with a total of 10 items. A total of 30 students from the experimental group and 27 students from the control group were asked to answer the questions that had been provided. The test results obtained can be seen in Table 4 below.

Table 4. Test Result Data

Size	Test Question Results	
	Experimental Group	Control Group
$\bar{x}$ (average)	52,97	33,78
SD (Standard Deviation)	11,19	15,7
$X\ min$ (Lowest Score)	33	0
$X\ max$ (Highest Score)	70	60

Based on Table 4, "the experimental group had higher average scores, lowest scores, and highest scores when compared to the control group.

The purpose of this study is to assess the effect of the application of the project-based learning model on students' motivation and learning outcomes, which is measured from their perception. To achieve this goal, the researcher carried out an experiment at SMPN 2 Pontianak using a posttest-only control design. The experimental group was given treatment in the form of project-based mathematics learning, which focused on the topic of data presentation and was carried out in two sessions. Meanwhile, the control group followed mathematics learning with a problem-based learning model given by the teacher.

The analysis of the effect of the application of the project-based learning model on learning motivation was carried out through the t-test technique with the support of SPSS 26 software. The results of data processing indicated that there was a significant difference in

motivation between the experimental group and the control group, with a significance value of 0.045. This difference is reflected in the average motivation score obtained by both groups. The experimental group obtained an average score of 30.36, while the control group obtained an average of 29.07 out of a maximum total score of 40. The mean difference of 1.56 indicates that the experimental group had a higher level of motivation. Therefore, it can be concluded that the application of the project-based learning model has a positive effect on increasing student learning motivation.

To assess the impact of the use of project-based learning models on student learning outcomes, tests were carried out using the Mann-Whitney test. Based on the test results, a significance value of 0.000 (which is smaller than 0.05) was obtained, which indicates a significant difference between the control group and the experimental group. The difference is also evident in the average test scores obtained. The experimental group obtained an average score of 52.97, while the control group only achieved an average of 33.78, with a maximum test score of 70. In addition, the lowest score recorded in the experimental group was 33, while the control group recorded the lowest score of 0. The highest score obtained by the experimental group was 70, while the control group achieved the highest score of 60. From these results, it can be concluded that the application of the project-based learning model has a significant positive impact on improving student learning outcomes.

The results of the research obtained can be concluded that the use of a project-focused learning approach has a great influence on improving students' enthusiasm for learning and educational outcomes. This finding is in line with research conducted by Chaniago and Dafit (2024), which shows that "project-based learning models have proven to be effective in improving student motivation and learning outcomes." In addition, this study is also consistent with studies conducted by Arianta dkk. (2024), which states that "project-based learning models have a positive influence on student motivation and learning outcomes."

To explore the relationship between students' perception of project-based mathematics learning and motivation and learning outcomes, a regression analysis approach was used. The results of the analysis revealed a significant positive relationship between student perception and learning motivation, with a significance value of 0.000 (which is less than 0.05). On the contrary, no significant relationship was found between student perception and learning outcomes, with a significance value of 0.933. In addition, the relationship between student perception and overall learning motivation and learning outcomes also did not show significance, with a significance value of 0.871.

Based on the description that has been submitted, it can be concluded that the increase in students' perception of mathematics learning tends to be followed by an increase in their learning motivation. On the contrary, poor perception will have the potential to reduce students' motivation to learn. However, student perception is not always directly related to the achievement of learning outcomes. Even though students have a positive perception of the learning they are undergoing, the learning outcomes they get may not be adequate. Various other factors may also play a role in influencing students' learning outcomes, and one of them is their interests. The results of this study contradict the findings presented by Damayanti (2018) which concludes that "student perception has an effect on learning outcomes." In addition, the results of this study are also contrary to the research conducted by Rahmatillah (2019) which states that "perception has a significant relationship with student learning outcomes."

During this study, there are a number of limitations that may affect the results obtained, either directly or indirectly. One of these limitations is that the implementation of project-based learning is not fully carried out under the supervision of the author. The students (experimental group) in this study carried out project activities outside of school so that the author could not supervise or monitor the implementation of the activities as a whole. In addition, this study also did not find significant evidence to show the relationship between perception and learning outcomes and the relationship between perception and motivation together with learning outcomes.

4. CONCLUSIONS AND SUGGESTIONS

CONCLUSION

The implementation of the project model has a positive and significant influence on the motivation and learning outcomes of SMP Negeri 2 Pontianak students.

SUGGESTION

In the implementation of project-based learning, it should be carried out in the school environment so that it can be monitored comprehensively. In addition, the application of a project-based learning model is recommended to increase student motivation and learning outcomes.

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