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THE IMPLEMENTATION OF PROJECT BASED LEARNING TO IMPROVE STUDENTS' MATHEMATICAL UNDERSTANDING AND LEARNING INTEREST ON JUNIOR HIGH SCHOOL

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ABSTRACT

Mathematics is a lesson regarded regularly, logically, tiered from the easiest to the most complicated. Mastery and students' understanding of a material can be seen from student mathematical abilities. Analyze the student's error in completing the problem can know the students master a matter or not. The purpose of this research is 1) to describe students' understanding of transformation material after following the Project Based Learning model, 2) to find out whether there is an increase in understanding of transformation after implementing the Project Based Learning process, 3) to find out how effective the approach method (Project Based Learning) is about the learning process on transformation material, 4) find out how to increase students' understanding skills after implementing a project-based learning model. This research method uses classroom action research. Students can participate in learning activities using the PJBL approach very well, so that teaching and learning activities are conducive when implemented and the results from cycles 1 and 2 increase.

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INTRODUCTION

According to Wahyuni (2019) project based learning is a learning model that provides opportunities for educators to manage learning in the classroom by involving project work. Project work contains complex tasks based on problems such as: the initial step in gathering and integrating new knowledge based on experience in real activities and guide students to do it designing activities, solving problems, making decisions, carrying out investigative activities, and provide students with opportunities to work independently or in groups. Results The end

of the project work is a product which includes, among other things, a written report or oral, presentation or recommendation. In life, every day humans never stop learning. Learning is a change that is the result of practice or experience that tends to settle; and the nature of the change is relatively permanent (Setiawati, 2021; Sirait, 2016). In fact, every activity carried out by individuals is learning. Learning becomes something important, especially learning in academic activities. One of the factors for student success in academic activities is interest in learning.

In line with that, according to Hosnan (in Nurjanah & Esa, 2019) states that Project-based learning is a learning strategy that uses projects/activities as a learning tool to achieve competency in attitudes, knowledge and skills. Another opinion was also expressed by Mayuni, et al (2019) who expressed the project model based learning (PjBL) is a learning model, strategy or method that is centered on student. Where students are invited to develop their own abilities by creating learning projects (activities), so that it is hoped that they can develop Their creativity and critical thinking abilities will be awakened by using this model where to complete a project requires effort and hard work and working together cooperative with the group. Based on this explanation, it can be concluded that the model Project based learning is learning which in its application involves students to be active and participate in the work on a project which will later produce a work which will later be presented. Hidi, Berndoff, and Ainley (Awaliyah & Fitrianna, 2018), argue that interest in learning has a positive influence on learning activities. Interest in learning also provides 3 (three) important aspects in one's academics, including attention, goals, and level of learning (Awaliyah & Fitrianna, 2018).

The importance of interest in learning because interest in learning supports students in carrying out learning activities. This was stated by Karina and Rusmiati (Rozikin et al., 2018), that interest in learning is proven to have a large influence on learning activities because if there is no interest, students tend not to study well.

In addition, mathematical understanding is important because it provides an important goal in learning activities, namely understanding the concepts of the material provided (Karim & Nurrahmah, 2018).

The Project Based Learning learning model requires students to learn and produce a work, therefore this model can increase student motivation to learn, improve students' skills in problem solving and improve student cooperation in group work (Saputro & Rayahu, 2020). Meanwhile, according to Devi, (2019) Model steps Project Based Learning includes: (1) basic questions, namely the provision of learning stimuli in the form of questions to students so that students arise curiosity to do investigation; (2) designing project planning, namely providing opportunities for students to identify problems and formulate them in the form of hypotheses and project work plans; (3) compile a schedule, namely determining the time of project work; (4) monitoring students, namely action monitoring to reduce the risk of project errors; (5) testing the results, namely proving that they are correct whether or not the hypothesis has been established; (6) draw conclusions (generalization), namely the process drawing conclusions from what has been done.

The characteristics of Project-Based Learning (PjBL) learning are developing students' thinking abilities that enable them to be creative, skilled, and encourage them to work together (Indriyani & Wrahatno, 2019). As for the advantages of the model Project Based Learning namely: 1) provide learning opportunities for students to develop according to real world conditions; 2) involve students to learn to collect information and apply this knowledge to solve real-world problems; and 3) make the atmosphere fun. While the weakness of the Project Based learning model Learning, namely 1) requires teachers who are skilled and willing to learn; 2) need

facilities, adequate equipment and materials; 3) difficulty involving all students in group work (Sunita et al, 2019).

METHOD

The research used, namely Classroom Action Research (CAR) or classroom action research, is research that aims to find out how appropriate treatment is when learning practices. The Research Model from Kemmis and McTaggart is suitable for use in research (Syamsudin et al., 2018). The stages carried out in each cycle consist of plans, actions, observations and reflections. The research was stopped when the objectives of the research had been achieved. The data analysis technique used is a qualitative descriptive method, for the use of instruments including tests, interviews, and observation sheets of teachers and students during the learning process.

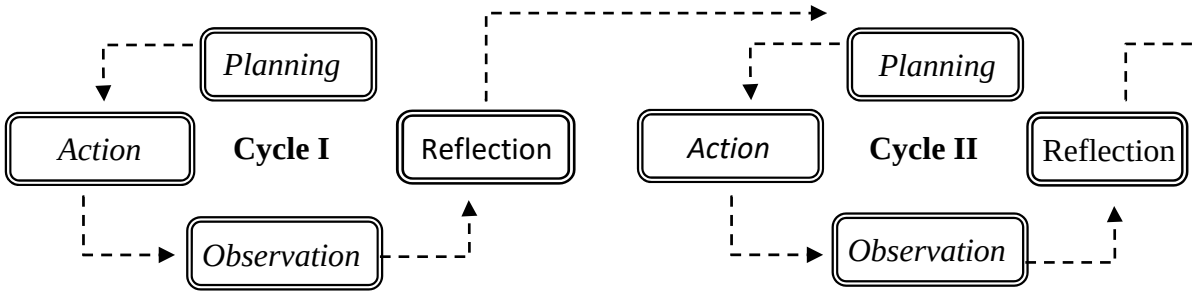

Figure 1. Model Kemmis and Mc. Taggart

RESULTS AND DISCUSSION

Results

Cycle I

a. Planning

Learning in cycle I had 2 meetings namely learning and cycle I tests, apart from that previously prepared lesson plans for Transformation material using the PjBL approach, also prepared for teachers and students namely learning observation sheets, then discussed using a scientific approach during the implementation of learning.

b. Action

In conducting learning in class, the researcher and the teacher exchange positions, where the math teacher will be the observer while the researcher will be the teacher. The first meeting learning activities began on November 15, 2022 using the pjbl approach in learning for the material was Transformation.

c. Observation

In the first cycle, before the pretest was carried out, I conducted an interview first to find out the students' difficulties in learning mathematics in class 9F of SMPN 6 Cimahi. I conducted interviews with 3 students and 1 math teacher. Interviews were conducted to find out what the students' difficulties were when learning mathematics. The following are the results of the interviews I have conducted:

Table 1. Teacher Interview Results

THAT PROBLEM IDENTIFIED	ROOT CAUSE OF THE PROBLEM	EXPLORATION OF THE ROOT CAUSE OF THE PROBLEM	ROOT CAUSE ANALYSIS OF PROBLEMS
Student comfort during KBM	Teachers who are too strict in talk and always serious when spoken to	Sometimes the teacher's intonation is higher even though the students speak well, this is usually due to conditions classrooms that are less conducive or less able to adapt quickly regarding the response must be given	More focus on the teacher's writing on the blackboard rather than what the teacher explains orally
Focus	The atmosphere of the class and the material being studied	Materials that are long in length make it difficult for students focus and sometimes the concepts get mixed up	Re-study the material at home
Interactive	Lack of interaction between teachers and students in teaching and learning activities	Student seating which makes the teacher rarely appoint students to answer questions	More initiative to answer questions first, instead of waiting to be pointed out by the teacher
Utilization of gadgets, computers, and application Geogebra during learning	Internet network that is not sufficient and ignorance of the application mathematics	Not because there is no wifi, but because the location of the class is difficult to catch a signal	To the computer lab, ICT-based learning
Question story	Complicated and lacking literacy skills	Questions that are too long make students lazy to read and Summarize what is known from the problem	Make the solution into several points/steps

Table 2. Student Interview Results

THAT PROBLEM IDENTIFIED	ROOT CAUSE OF THE PROBLEM	EXPLORATION OF THE ROOT CAUSE OF THE PROBLEM	ROOT CAUSE ANALYSIS OF PROBLEMS
Student comfort during KBM	No interest in the material	A sense of pride if you succeed in doing the questions (material) correctly; However end up being lazy if failed to answer questions from different materials	Practice a lot and try to find things to like about the problem (material).

Focus	Too many formulas	There are some materials that have different steps long to find settlement	Re-understand the material written during the KBM and look for other references from various media (youtube, blog, books, etc.)
Interactive	Unequal student participation at the time KBM	Confidence and student seats that make teachers rarely appoint students to answer questions	Encouraging & rewarding friends who don't dare to be active in class
Utilization of gadgets, computers, and application Geogebra during learning	Inadequate internet network and ignorance of mathematical applications	Not because there is no wifi, but because the location of the class is difficult to catch a signal	To the computer lab, ICT-based learning
Direct questions (not stories)	Not feeling challenged	Mathematics is a challenge and sharpens thinking skills, if to-the-point questions, not math	More practice but at a different level

In addition to conducting interviews, in the first cycle I conducted a pre-test in class 9F to measure students' abilities and understanding. The following are the results of the class 9F students' pre-test with the questions that I have made through quizizz media.

Table 3. Cycle I Pre Test Results

No	Question	Question Type	Results
1	which is the correct picture which states reflection?	multiple choice	74%
2	Which is the correct image which states reflection?	multiple choice	77%
3	which picture is correct about reflection?	multiple choice	74%
4	which picture is correct about reflection?	multiple choice	9%
5	which picture is correct about reflection?	multiple choice	45%
6	Which picture is correct about translation?	multiple choice	51%
7	Which picture is correct about translation?	multiple choice	67%
8	Which image is correct about rotation?	multiple choice	80%
9	Which picture is correct about dilatation?	multiple choice	67%
10	which picture is correct about dilatation?	multiple choice	70%
			61%

d. Reflection

In the reflection stage, researchers and teachers analyze what is lacking using the PJBL approach during learning, which can be seen from the pre-test completeness of only 60%.

At this stage the researcher can reflect on the learning activities that have been carried out for evaluation.

Cycle II

a. Planning

From the implementation of learning during cycle I, then the researchers together with the mathematics teacher began making plans to correct deficiencies to achieve appropriate results. In this stage the teacher gives more tips on how to solve the questions step by step well and encourages students who were passive in the previous cycle more and how to manage time well in the implementation of cycle II.

The stages in cycle II are the same as the previous cycle which of course makes a lesson plan in advance which will be used in learning. Don't forget the observation sheets in learning, both observations on teachers and students.

b. Action

At this stage students carry out activities as usual, continue the material and each group makes a presentation with the material that has been distributed. Here students are given independence and a little direction from the teacher, this activity is carried out on November 22, 2022. I am here as an observer conducting group assessments that are presenting.

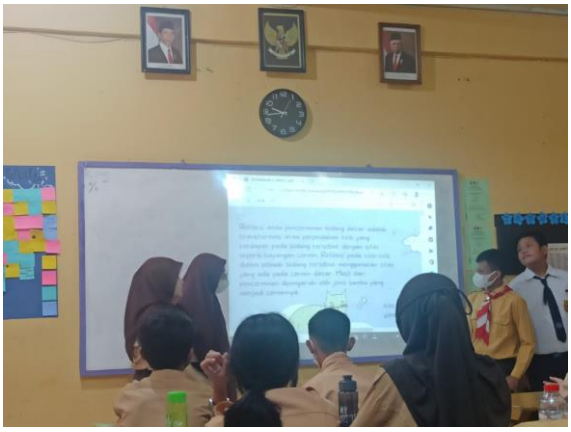

Figure 2. Group Presentation

c. Observation

When the learning activities take place, the researcher conducts observation activities, namely assessing the group that is making a presentation. The following presents the results of aspects observed in students:

Table 4. Observation results of student activities during Cycle II

Observation on Students	
Interactive	Students focus on paying attention when conveying the goals and benefits of learning
Material Mastery	The material described is sufficiently mastered
Presentation Method	Read slides, back to other students
Technology Utilization	Using power point
Audiens	Students are active when the teacher asks questions about the material provided

From the table, it can be seen that the implementation of learning has been carried out very well. The average value of the second cycle of test work has also increased more than the previous cycle test work, many have a better understanding of the learning material. The following are the results of the tests in cycle II:

Table 4. Cycle II test results

No	Question	Question Type	Results
1	Point P (2, 1) is reflected about the Y axis, ther P' is	multiple choice	84%
2	Point B (3, 2) is reflected about the X axis, then B' is	multiple choice	77%
3	The point (-4, 2) is reflected over the line y = -x. The coordinates of the shadow point are	multiple choice	80%
4	If point Q (7, 5) is reflected on the line x = 3 then the coordinates of the image point are	multiple choice	70%
5	Point A (7, -6) is translated by T = (-2, 4), then the coordinates of point A' are	multiple choice	51%
6	If the point (2, -1) is translated by T = (3, 2) then the image is	multiple choice	67%
7	If point G'(4, -1) is the image of the point from G (7, -5) by translation T, then the value of T is	multiple choice	80%
8	The coordinates of the image point A(-3, 4) by translation T = (3, 6) are	multiple choice	80%
9	Point P (8, 5) is rotated 900 with respect to center point O (0, 0) counterclockwise. The value of P' is	multiple choice	70%
10	The image of point A(-2, 3) rotated 900 counterclockwise is	multiple choice	80%
			73%

d. Reflection

In cycle II, after reflection, it showed that the pjbl approach that the teacher applied to learning in class IX F of SMPN 6 Cimahi had shown satisfactory results. This can be seen from the increase in students' mathematical understanding abilities. group discussion work.

Table 5. Recapitulation of Completeness of Learning Scenarios

Observasion	Results		Enhancement
	Cycle 1	Cycle II	
Σ Mastery of Learning Scenarios (Student)	61%	73%	12%

Seeing from these percentages, it can be concluded that the research conducted has been successful. Therefore, the researcher and the teacher agreed that the implementation of learning would be limited to cycle II because the research target had been achieved.

Discussions

Based on research that has been carried out during learning in the Transformation material class in cycle I, the implementation of learning using the Pjbl approach has not met expectations with the learning scenarios that have been prepared. The students felt the application of learning using the Pjbl approach for the first time. It was found that subjects with high abilities experienced errors, namely not being careful in doing the questions, and also experienced errors, namely not being careful in doing the questions. This can be seen in what will happen to students who are less than perfect, allegedly because they are in a hurry to solve the questions.

According to Prabandari in Suryana, Rosmaya, Sudarsono, & Sandawan (2019) there are 4 mistakes that students can make when working on mathematics problems, including (1) factual errors, namely not writing down and not completely writing down the symbols used; (2) conceptual error, namely incorrect use of the theorem; (3) principle error, namely using the wrong solution steps and not writing down the procedure for working on the problem, and (4) operational error, namely making a mistake in using arithmetic operations.

Understanding the concept has a relationship which is closely related to students' interest in learning (Höft & Bernholt, 2019:622). The relatively small increase in student learning outcomes in Cycle I was due to the fact that learning with PjBL was new for students. Based on this, improvements were made in the implementation of learning in Cycle II, including adding variations in activities to overcome a problem that had been taken up by the class and dividing the class into several small groups. From the results of the implementation of cycle II, researchers continued to try to improve what was lacking in cycle I, in cycle II students had begun to adapt to learning using the pjbl approach. Students already understand the concept of Pjbl, so there is an increase in learning in cycle II.

Implementing learning using the PjBL model helps students discover new concepts, new experiences, and can increase interest and learning outcomes (Nurhadiyati et al., 2020). Thus, using project-based learning can provide students with experience in organizing projects, allocating time, and managing them. Dharmayani Research (2021); Dewi (2020); and Sumarni (2020) show that implementing the PjBL model can increase student motivation and learning outcomes.

As we already know, several indicators of learning motivation are related to student assignment completion. Therefore, the application of project-based learning (PjBL) in learning is the right solution to increase students' understanding and interest in learning activities. The results of this research are in accordance with what was conveyed by Furi (2018) regarding the use of the Collaborative PjBL learning model with various learning media which is able to increase student motivation because students will be motivated to know how scientific theories are applied in real life. For the implementation of learning, it is known that cycle I has not been fulfilled.

However, in cycle II the average learning implementation showed 73%. Based on the results of cycle I and cycle II, both student activity and teacher activity increased. This increase is clearly visible in student activity from 61% to 73%. This shows that learning with the pjbl approach increased in cycle I and cycle II. This is caused by several factors, namely by teachers using a more interesting and interactive learning model, namely PJBL, it will make students more enthusiastic about learning so that the grades obtained by students tend to increase.

So, learning activities using PJBL are very effective. The results of research conducted by Chasanah et al (2019) stated that there are differences in student learning outcomes who use the module based on Project Based Learning is higher than the control class which is not using Project Based Learning based modules.

CONCLUSION

Based on the results and discussion that have been presented above, it can be concluded that there are several mistakes made by students, including conceptual errors, namely not being careful in working on questions, and also making mistakes, namely not being careful in working on questions, this can be seen in what will happen to students. It is thought that it is less than perfect because of the rush to solve problems, students' lack of understanding when learning activities use a project based learning approach, students' lack of understanding of mathematical concepts, therefore research was conducted using a project based learning approach to increase students' understanding and interest in learning.

From the results of the research that has been carried out, there are several things that can be further developed as ideas for further research. For example, a more in-depth assessment of student abilities and students should be braver in exploring and actualizing in the learning process and not be embarrassed to discuss with the teacher efforts to actualize in the learning process.

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