IMPLEMENTATION OF THE PROBLEM BASED LEARNING (PBL) LEARNING MODEL IN INCREASING MOTIVATION AND LEARNING OUTCOMES OF GRADE VIII STUDENTS OF DAARUL QURAN COLOMADU JUNIOR HIGH SCHOOL ON PYTHAGOREAN THEOREM

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ABSTRACT
The low completeness of mathematics learning on the material of the Pythagorean theorem is wavered by the disinteractive interest of students in the process of learning activities. The purpose of this study was to obtain a description of the implementation of the Problem Based Learning model to improve the learning outcomes of grade VIII students of Daarul Quran Colomadu Junior High School on the Pythagorean Theorem material. This type of research is classroom action research that refers to Kemmis and Mc. Taggart's design, namely planning, implementing actions, observation and reflection. The study was conducted in two cycles. The subjects of this study were grade VIII students of Daarul Quran Colomadu totaling 40 students. Data collection techniques are obtained from data from teacher and student observations. This research was conducted in two cycles and each cycle was carried out in two meetings. The results showed that learning using the Problem Based Learning type cooperative learning model can improve student learning outcomes as shown by an increase in the number of students who completed in the first cycle by 31 students (70%) and the number of students incomplete by 9 people (30%). In the second cycle, the number of students who were declared complete increased by 37 students with a percentage of 90% and 3 students declared incomplete with a percentage of 10%.

Keywords: Problem Based Learning Model, Learning Outcomes, Motivation, Pythagorean Theorem

INTRODUCTION
The low score of students' completion in Mathematics is influenced by the disinteractive interest of students in the process of learning activities (Viberg et al., 2023). Learning process activities carried out by teachers using methods that do not involve students in the learning process trigger low student interest in the learning process (Lukmana Sari et al., 2023). This problem is one of the things that can trigger obstacles in achieving learning objectives in the process of learning activities carried out by teachers for students in Mathematics subjects. Mathematics is one of the branches of science that underlies the development of modern technology (Royani et al., 2023). Mathematics has an important role in various scientific disciplines and shows the power of human thinking. Therefore, mathematics lessons need to be taught to all students starting from the basic level to equip them with the ability to think logically, systematically, critically and creatively and be able to work together (Hasanah et al., 2022). This ability is needed so that students can have the ability to obtain, manage and utilize information to survive in conditions that are always changing, uncertain and full of competition. One of the things that needs to be addressed so that the learning process can be carried out well is improving the quality of learning. By reflecting, teachers can organize learning by using learning theories, and designing learning that can arouse interest and motivate students (Sudrajat, 2022).

One of the things that needs to be addressed so that the learning process can be carried out well is improving the quality of learning. By reflecting, teachers can organize learning by using learning theories, as well as designing learning that can arouse interest and motivate students to learn (Sinaga et
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al., 2023). In learning Mathematics, teachers are not focused enough on just one particular model and method. Teachers need to try to apply various models and methods that suit the demands of learning material, including implementing cooperative learning models with group learning methods that involve active student learning (Capone, 2022). Choosing the right model and method will be able to increase the achievement of learning outcomes as expected. The fact obtained at Daarul Quran Colomandu Middle School is that teachers have implemented cooperative learning, but the learning models used are not yet varied. Apart from that, students are less active in participating in mathematics learning, this can be seen from the lack of interaction between students and teachers, which enables students to overcome difficulties in understanding mathematics material in everyday life. In connection with the problem above, it is necessary to strive for a form of learning that is able to activate students and present mathematical material in a more interesting way, so that it can help students overcome learning difficulties.

Daarul Quran Colomandu Middle School is one of the schools in the Central Java Province region, located in Sanggir Village RT 02 RW 07 Paulan Colomadu Village, Karanganyar, Central Java. This school has a vision, namely giving birth to a generation of leaders of the nation and the world who are pious/pious and have Qur'anic Character and an Entrepreneurial Spirit in Building the Islamic Civilization of the Future. All efforts to achieve and realize this vision are carried out by creating superior, competent and disciplined students. Therefore in the process The learning is expected to increase students’ interest in learning mathematics which can make students actively involved in the teaching and learning process. The results to be achieved are students applying their knowledge, learning to solve problems, being competent in discussions with their friends (Chamberlin, 2010), have the courage to communicate ideas and responsibility for their duties. The application of Problem Based Learning learning can be an alternative in overcoming the above problems. This learning model is not an activity that is only filled with practicing questions, but more than that, students can find the answers themselves and communicate with their original group friends (Sugianto et al., 2022). A learning model based on brain abilities or Problem Based Learning because this learning is aligned with the way the brain works which is naturally designed for learning (Lusiana & Andari, 2020). In this method students are divided into several groups. Each group consists of 4-5 members. Each team member has their own tasks that will follow certain rules. Dimas (Dimas Febriansyah Krisna Dwiputra, Waliyyaty Azzahra, 2023) also revealed that Problem Based Learning offers a concept for creating learning that is oriented towards empowering students' brains. Problem Based Learning with Brain Based Learning empowerment efforts are carried out through the following three steps: creating a learning environment that challenges students' thinking abilities, creating a fun learning environment, creating active and meaningful learning situations for students (Putra et al., 2021). These steps provide students with the opportunity to hone their thinking skills, especially mathematical connection skills (Mahendra et al., 2023). By creating a challenging learning environment, a network of nerve cells will connect to each other. The more connected these networks are, the more it will stimulate students' thinking abilities, which in the end will be the greater the meaning students will gain from learning (Thurm & Barzel, 2022).

The Pythagorean Theorem is one of the main mathematics materials taught in class VIII of junior high school in the first semester and always appears in national exams. Learning Pythagorean theorem material requires a good understanding of the concept, especially working on story problems in everyday life. Based on statements from class VIII middle school students at Daarul Quran Middle School Colomadu, when using the principles of the Pythagorean Theorem they often have difficulty writing the formula for the Pythagorean theorem that suits the problem, so students also have difficulty communicating the solution process. In this research, the Pythagorean theorem material was chosen because this material is contextual in nature and it is hoped that students can learn to find formula concepts creatively.
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METHODS

This type of research is classroom action research. The research design refers to the Kemmis and Mc model. Taggart consists of four commonly used components, namely planning, implementation, observation and reflection. Actions and observations are carried out at the same time. The subjects of this research were 40 Class VIII students at Daarul Quran Middle School, Colomadu, who were registered in the 2023/2024 academic year. The types of data in this research are qualitative data and quantitative data. Qualitative data includes teacher and student activity data during the learning process obtained through observation. Quantitative data is learning outcome data obtained through final action tests. The criteria for the success of the action can be seen from the teacher's activities while managing learning in class and students' activities while participating in class learning through observation sheets which are at least in the good category and students are able to solve questions about the Pythagorean theorem in each cycle.

RESULTS AND DISCUSSION

At the beginning of learning, the teacher carries out preliminary activities including greetings, praying before studying, checking student attendance, giving students the opportunity to prepare themselves with all their needs. In the first stage, namely the exposure stage, the teacher conveys appreciation and motivation to students by relating it to everyday life. The teacher conveys the learning objectives by linking previous learning, so it can be seen that there are connections between mathematical topics, for example material regarding checking the truth of the Pythagorean theorem and determining the length of the side of a right triangle if the lengths of two sides are known. At the start of the research, the researcher gave an initial test regarding the area of squares and rectangles and manually determined the square root of a number. This initial test aims to determine students' prerequisite abilities and is used to form heterogeneous study groups. The results of the initial test analysis showed that out of 40 students, 35 students completed and 5 students did not complete. Based on the results of the students' initial tests, heterogeneous study groups were formed based on academic ability. This research consisted of two cycles and each cycle was held in two meetings. The time allocation for each meeting is 2×40 minutes. Cycle I discusses material about using the Pythagorean theorem to determine the side lengths of right triangles and cycle II discusses material about solving problems in flat shapes related to the Pythagorean theorem. At the planning stage in both cycle I and cycle II, researchers had divided students into 5 groups, each group consisting of 8 students. This initial group is called the original group. Next, the researcher prepared a lesson plan as a guide in teaching by applying the Problem Based Learning learning model. Researchers also prepared worksheets consisting of 3 worksheets which were given to each home group. This is because each member of the original group will be divided into three experts, each consisting of two students who are responsible for the tasks given.

In cycle I, LKS 1 contains the task of finding the formula for the Pythagorean theorem by providing a triangle with right sides b and c, then extending it so that it becomes b + c and c + b, then forming a square with sides b + c. Worksheet 2 contains the task of finding the Pythagorean theorem by making a large square on each side of the triangle, then inside the large square making small squares with the same unit length. Meanwhile, LKS 3 contains the task of finding the Pythagorean theorem by dividing a square into four right-angled triangles that are congruent at each corner, then arrange the triangles in another square that is congruent to the first square. In cycle II, LKS 1 contains the task of finding the length of the diagonal of the flat side of a block shape. LKS 2 contains a task to find the length of the diagonal of the flat side of a cube shape and LKS 3 contains a task to find the length of the diagonal of the flat side of a rhombus shape. At this stage, the researcher also prepared student activity observation sheets and teacher activity observation sheets as well as final action test questions for cycle I and cycle II which would be given to students at the end of the lesson.

The implementation of cycle I actions was carried out in two meetings on 20 and 22 November 2023. Meanwhile, cycle II was carried out on 27 and 29 November 2023. Implementation of learning
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was carried out in three stages, namely (1) preliminary activities, (2) core activities, and (3) closing activities. In the preliminary activity, the researcher opened the lesson by saying hello, greeting the students, asking the class leader to lead prayer, checking student attendance, conveying the learning objectives, providing motivation and providing apperception to the students. In the core activity, researchers explained to students about right sides and hypotenuses in right triangles. The material was presented using the lecture and question and answer method between researchers and students. Students are asked to name objects around the classroom that have right angles. The next activity carried out by the researcher was to group students into study groups consisting of 8 heterogeneous people based on the results of the previous initial test. This study group is called the home group. The teacher gives three different worksheets to each original group and then every two students in one group discuss one worksheet each. To solve the questions that are available on the LKS, the teacher directs each student who has a part to work on questions with a certain number to join into a new group. This is what is called an expert group. Next, each member of this group will discuss the material and then work on the questions that are part of it. The teacher goes around observing student activities and providing assistance if there are groups of students who have difficulty working on the worksheet. When the time to work on the given LKS is finished, the teacher asks the students in their respective expert groups to return to their original groups to teach their friends how to solve the problems they have mastered. Then the teacher randomly appoints one of the groups to present all the results of the discussion. Another group is tasked with paying attention to the group presenting in front of the class and can ask questions if there are things that are not clear. The teacher as a mediator is tasked with directing students during discussions and explaining in more depth about solving LKS questions that are still unclear.

In the closing activity, the teacher provides feedback by asking students questions and answers about what they have learned, followed by making conclusions about the Pythagorean theorem. The final activity at this stage, the teacher gives a final cycle I action test to each student which will measure the achievement of students’ understanding of the Pythagorean theorem material. From the results of the analysis of the final action test in cycle I, it can be seen that the majority of students were able to answer the questions correctly. The results of the final action test for cycle I showed that of the 40 students who took the test, 31 people had met the success indicators. The classical learning completeness obtained in cycle I was 70%. However, there are still mistakes made by students in working on the questions on the worksheet and the final test. A common mistake made by students is not being careful in calculating.

Based on the results of the students' work, it can be seen that the expected student learning outcomes have not been achieved optimally, therefore the researchers conducted research in the second cycle as an effort to improve on the first cycle. The researchers emphasized more on students that they had to be careful in working on questions and needed good analysis, in understanding the Pythagorean theorem. The results of the first cycle reflection include that the teacher's preparation is quite mature in implementing the Problem Based Learning learning model and the learning process in class is in accordance with the RPP created. However, things that need to be improved in cycle II include improvements such as equal distribution of guidance in each group, guiding students in writing discussion results, and giving students the opportunity to get used to thinking for themselves in making conclusions at the end of the lesson. The classical learning completeness score obtained in cycle II was 90% or as many as 27 students obtained a score ≥ 65. Thus, the learning outcomes in cycle II had reached the specified indicators of success. The average error made by students when working on worksheets is an error in determining the length of the diagonal of a kite.

The results of the final action test in cycle II were good, although there was still one group of students who made mistakes. This success was due to the implementation of cycle II, students already knew the learning process using the Problem Based Learning learning model. This learning model is more student-centered so that each student learns to be responsible for the material assigned to him when teaching it back to his group of friends. Apart from that, the role of the teacher as a facilitator also influences the success of student learning outcomes. These learning outcomes show that students increasingly understand the Pythagorean theorem material being taught. In this research, observation
activities were carried out during learning activities which included observations of teacher activities and student activities. Aspects observed in teacher observations in cycle I and cycle II include: orienting students to learning, organizing students in study groups, both home and expert groups, guiding students in developing and presenting the results of group discussions, and evaluating the results of group work. Meanwhile, the aspects observed in student activities are students' attention when the teacher explains the material, students' activeness in asking questions about the material being explained, conditioning themselves in groups, enthusiasm in completing the tasks given, expressing opinions in discussions, working together in groups, giving input during presentations, give positive responses to friends' answers and take the final action test honestly. In the first cycle, the percentage of teacher ability in managing learning from the results of observations was 66.5% with the lowest score 2 and the highest score 4. The core activities carried out by the teacher include orienting students in learning, in this case the teacher provides guidance to groups who experience difficulty. The results of observations observed by the observer were that the guidance given by the researcher was not evenly distributed to each group. The teacher provided more guidance to the group that actively asked questions, while the group that tended to be passive only received guidance from the teacher briefly. In the closing activity, the teacher guides students in making conclusions, but the reality in the field is that teachers still dominate learning so that students are not used to thinking for themselves. The percentage of student activity in the learning process is 63% with the lowest score being 1 and the highest score being 4. This is because students still lack confidence and are awkward about working together in groups. Apart from that, there are still students who play and disturb each other so they don't pay attention to the teacher's explanation. This lack of activity in learning in cycle I needs to be improved in cycle II by providing motivational encouragement to students to be serious about doing their assignments. Unite opinions, must not disturb friends, and carry out active discussions and give awards to students for asking and answering questions. The teacher must give equal attention and motivation to each group.

The Problem Based Learning if collaborate with Brain Based Learning model helps students to understand the material independently, trains students' mathematical connection skills in connecting mathematical ideas in writing and learns to adapt in a group (Kusuma et al., 2020). However, it is different from students who receive conventional learning. Students always listen to material from the teacher, giving examples of questions and steps for solving them. Then students are given exercises based on the examples the teacher has given on the board. Students always follow the steps explained by the teacher and when students cannot do the exercises, the teacher immediately solves the problem (Saufi et al., 2020). When in the control class, when students worked on pretest and posttest questions on mathematical connection abilities, the scores obtained by many of these students were still low. This means that there is a difference in the average mathematical connection ability of students using the PBL learning model with the average mathematical connection ability of students using conventional learning (Kusuma et al., 2020). The application of the Problem Based Learning model in cycle II obtained a significant increase in teacher performance in carrying out the learning process with a percentage of 91.5% with the lowest score being 3 and the highest score being 5. Teacher abilities such as orienting students in learning, guiding groups during discussions, directing students during presentations, and making conclusions with students at the end of learning has improved compared to the previous cycle I. Meanwhile, the results of observing student activities were 89.4% with the lowest score being 3 and the highest score being 4 which was included in the very good category.

DISCUSSION

Before carrying out the action, the researcher first gave students an initial test regarding the area of squares and rectangles and determined the square root of a number manually. This aims to see students' knowledge of the prerequisite material before studying the material to determine the validity of an argument. This is in accordance with Hudojo's opinion which states that before studying concept B, someone needs to first understand concept A which underlies concept B. Because without understanding concept A, it is impossible for someone to understand concept B. This research consists of two cycles, and each cycle consists of from two meetings. Cycle I discusses material about using the
Pythagorean theorem to determine the side lengths of right triangles and cycle II discusses material about solving problems in flat shapes related to the Pythagorean theorem. Researchers carry out actions by making improvements after improvements starting from the implementation of actions in cycle I to cycle II. The results of observation of teacher activities in cycle I showed a percentage of 66.5% with the criteria lacking and the results of observing student activities 63% with the criteria lacking. In cycle II, the results of observations of teacher activity increased by 91.5% and student activity by 89.4%, both of which were included in the very good category.

From the results of the analysis of the final action test in cycle I, it was obtained that 31 students completed the total number of students out of 40 with a classical completion percentage reaching 70%. These results have increased compared to the student learning outcomes before the action using the Problem Based Learning model, although classical completeness has not yet reached 75% so researchers need to continue to cycle II. Meanwhile, the results obtained in cycle II were much better than the results obtained in cycle I. From the analysis of learning results in cycle II, there were 3 students who did not complete out of 40 students. The classical completion percentage reaches 90%. This shows that the achievement of learning objectives and learning outcomes have met the specified performance indicators. Therefore, it can be concluded that the implementation of the Problem Based Learning model can improve the learning outcomes of class VIII students on the Pythagorean theorem material. This is in accordance with the opinion of Rejeki (2009) that the Problem Based Learning learning model is a cooperative learning model that encourages students to be active and help each other in mastering learning material to achieve maximum achievement (Lavidas et al., 2022).

CONCLUSION

Based on classroom action research that has been carried out on class VIII students at Daarul Quran Middle School Colomadu in mathematics learning by applying the Problem Based Learning type cooperative learning model, it can be concluded as follows:

1. Implementation of the Problem Based Learning learning model can increase student learning activities and foster student interest in learning mathematics. This is proven by an increase in the average student activity per cycle. The average in cycle I was 63% in the poor category, then increased in cycle II to 89.4% in the very good category.

2. Implementation of the Problem Based Learning learning model can improve the learning outcomes of class VIII students at Daarul Quran Middle School, Colomadu, which can be seen from the number of students who complete each cycle. In cycle I there were 31 students who completed the test out of 40 students who took the final action test with a percentage of 70% and in cycle II there was an increase, namely 37 students were declared complete with a percentage of 90%.

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