International Conference on Education
Vol. 1, June 2022, pp. 303-308
Faculty of Teacher Training and Education, Universitas Ahmad Dahlan

Problem-based learning: Improving student achievement and self-efficacy in mathematics learning

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Abstract

This study aimed to determine the student achievement and find out the increased self-efficacy of grade VIII students in SMP Negeri 1 Wiradesa that applied the problem-based learning model. This research is class action research, with the research subjects being grade VIII class 1 students in SMP Negeri 1 Wiradesa which consists of 32 people. The research design used in this study was Kemmis and McTaggart model. The study was carried out in three cycles with two meetings in each cycle. Data were collected by observation techniques, tests, and documentation. Based on the results of the questionnaire, the data analysis technique is descriptive and quantitative with success criteria for the average score of student achievement of more than 75 along with more than 70% of the students who have minimal confidence in the high category. The results showed that the application of the problem-based learning model can improve student achievement and self-efficacy and the trust of grade VIII students of SMP Negeri 1 Wiradesa. The increase can be seen from the written test results in each cycle, student achievement increased from the first cycle 74.7, cycle II 75.9, and cycle III 80.5. As well as for the confidence of students increased from each cycle by meeting the criteria of success in cycle III, in which 78.125% of students have at least high self-efficacy.

Keywords: problem-based learning, self-efficacy, student achievement

How to cite: Pratiwi, Y., & Prasetyo, P. W. (2022). Problem-based learning: Improving student achievement and self-efficacy in mathematics learning. *Proceedings of the International Conference on Education, 1,* 303-308.

INTRODUCTION

Education has an important role in the process of improving the quality of human resources, to support this, it is also necessary to continuously improve the quality of education. Improving the quality of education is closely related to students as learners and teachers as educators. The success of learning in schools can be seen from the student achievement obtained by students. According to Rusmono (2017: 18), the student's achievements are changes in individual behavior which include the cognitive, affective, and psychomotor domains. Changes in behavior are obtained after students complete their learning program through interaction with various learning resources and learning environments.

Mathematics is a subject that is closely related to other scientific subjects. Therefore, mathematics is one of the subjects contained in every educational curriculum, from low-level education to high-level education (Law No. 20 of 2003 Article 37). Thus, student achievement in mathematics is very important in the learning and teaching process. However, the results of learning mathematics have not been in line with expectations, this is indicated by the results of the 2015 Program for International Student Assessment (PISA) study which showed that Indonesia was only able to rank 69 out of 76 countries. Meanwhile, the results of the Trends in International Mathematics and Science Study (TIMSS) study in 2015, shows that Indonesian students are ranked 46th out of 51 countries in terms of carrying out scientific procedures. In the study of the last 10 years, the results of PISA and TIMSS are always sided by side and not even

Received May 28, 2022; Revised June 15, 2022; Accepted June 27, 2022

getting better. Meanwhile, based on the results of short observations made by researchers at SMP Negeri 1 Wiradesa, it is known that the student achievement in mathematics subjects during Semester II in the 2021/2022 academic year is relatively low, with an average score of 46.67.

According to the results of research conducted by Khairiah, et.al in 2015, there is a positive relationship between the level of self-efficacy of students and the student achievement obtained in physics subjects. Students' self-efficacy in learning is defined as a confidence of a person in the ability to present and solve mathematical problems, how to learn or work in understanding concepts, and completing assignments. Based on the preliminary research that the researcher has done in grade VII of SMP Negeri 1 Wiradesa, it shows that 27% are excellent, 24% are good, 31% are moderate, and 18% are poor. The indicators of self-efficacy used in this study are 1) belief in self-ability, 2) optimism, 3) objective, 4) responsible, and 5) rational and realistic.

Based on the description above, this research was conducted to improve students' student achievement in mathematics and increase the self-efficacy of grade VIII students of SMP Negeri 1 Wiradesa. With the hope of improving students' achievement in mathematics and also students' self-efficacy which is still low.

RESEARCH METHOD

This type of research is Classroom Action Research (CAR). The Classroom Action Research (CAR) model used is the research developed by Kemmis & Mc. Taggart consists of planning (planning), acting (implementing actions), observing (implementing observations), and reflecting (performing reflection), the results of these reflections will then be used to improve planning in the next cycle (Kunandar, 2014:45).

The subjects in this Classroom Action Research (CAR) are students from grade VIII class 1 of SMP Negeri 1 Wiradesa, Pekalongan Regency, in the 2022/2023 academic year, with a total amount of students is 32. The research instrument used in this CAR is an observation sheet on the implementation of learning, written tests, interviews, and student efficiency questionnaires with a Linkert scale of 1-4. Analyzing students' achievement in mathematics can be done by calculating the average of the values obtained by students and for the student self-efficacy questionnaire is calculated by obtaining a score, which is a minimum score of 30 and a maximum of 120 after that analyzed and categorized using formulas.

RESULTS AND DISCUSSION

This research was carried out in three cycles, which are; cycle I, cycle II, and cycle III where each cycle consisted of two meetings. Each cycle consists of 4 stages, where the stages are; planning, action, observation, and reflection. The implementation of cycle II is an improvement from cycle I and cycle III is an improvement from cycle II. The plan is carried out based on the results of pre-action or reflection of the previous cycle. The next stage of implementation is carried out with the PBL model. Observations were carried out by the observer with the guidelines for the learning implementation of the observation sheet that had been prepared by the researcher. In the final stage, reflection is done and tests are carried out for student achievement in mathematics and students' self-efficacy.

Pre-action is carried out before conducting research, to know the initial conditions of students. The students' efficacy based on the results of the pre-action shows the following Table 1.

Judging from the pre-action data in Table 1, there are 6.25% of students have a very high level of self-efficacy, 25% in the high category, 53.125% in the moderate category, and 15.625% in the low category. A total of 31.25% of students' self-efficacy is in the high category so students' self-efficacy still needs to be improved to achieve the success criteria that the researchers have determined.

Table 1. The result of self-efficacy

Criteria	Amount of Students	Percentage
Very High	2	6,25%
High	8	25%
Moderate	17	53,125%
Low	5	15,625%
Very Low	0	0%
Total	32	100%

Improvements continue to be made based on the reflection results, which will be used to design learning in cycles II and III. The following are the results of the questionnaire for students' self-efficacy from pre-action to cycle III.

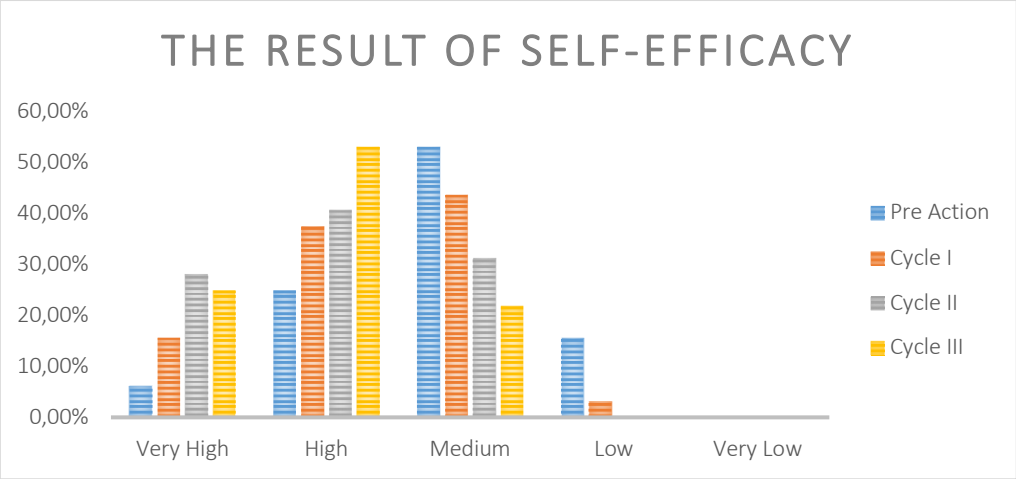

Figure 1. Students' self-efficacy questionnaire result

Based on the data in Figure 1, it is known that in the third cycle, there were 8 students or 25% reached the very high category, 17 students or 53.125% were in the high category, 7 students or 21.875% were in the moderate category, and no students were in a low category. low or very low. Thus, the results of the student self-efficacy questionnaire have reached the criteria for success in this study with 78.125% of students having a high self-efficacy.

During the implementation of learning, the level of self-efficacy of students is influenced by several factors. In the first cycle, it did not meet the criteria for success, but after analysis and reflection during learning, the cause was found. First, students are not used to doing learning that emphasizes student-centered. Because usually learning is done by using the old method, which is teacher-centered. This is feared to be the main cause of students having low levels of self-efficacy. Students are not accustomed to being given space to communicate what is on their minds and are only glued to the teacher and only the teacher's answer is considered the most correct. In addition, students are not accustomed to presenting what has been discussed, because so far, the students have only received it from the teacher without getting space for expression.

The next problem arises from the learning resources that are used. So far, students only receive formulas that will be applied to solve problems without knowing where the formulas are obtained. This will affect students' self-efficacy, for example, they are hesitant when doing assignments whether the formula used is correct or not, so when they are allowed to present the results of their work, students do not have a sense of responsibility for what they were doing.

The last one is related to the COVID-19 pandemic, where students study remotely for almost 2 years. When they return to learning at school, students are like anti-social people, not knowing each other, not chatting with others, and even silent when the teacher asks questions during learning.

By using the PBL model, it can solve the problems above. Over time from cycle I to cycle III, the student-centered learning model was able to increase students' self-efficacy. This is in line with what was stated by Murray and colleagues (Baker & McNulty, 2013) that self-efficacy is connected with a person's need to adapt and develop in an environment, where humans imply acceptance in a particular society. If the environment has been changed and the learning climate has changed, it can increase the confidence of students.

The PBL model used a problem that is close to the student's daily life. These problems are the triggers for an optimal learning process. This is reinforced by Isrok'atun & Amelia (2018:43) the problem-based learning (PBL) model is learning that begins by exposing students to the problem that exist in the real world and being able to solve them through activities and learning experiences carried out during the learning process. Thus, students' self-efficacy can increase by using the PBL model.

Student achievement is used to determine the initial condition of students, it is the value of the End of Year Assessment when students are still in grade VII. The results of the PAT show that the average value of students' achievement in mathematics is 46.67, this result is far below the KKM of SMP Negeri 1 Wiradesa which is 75. The results of these observations, it is used as the basis for preparing a learning design in the first cycle, then the results of the reflection cycle will be used to develop learning plans in the second cycle and the third cycle is the result of improvements in the second cycle of learning. The following are the results of mathematical learning obtained by students in cycle I, cycle II, and cycle III.

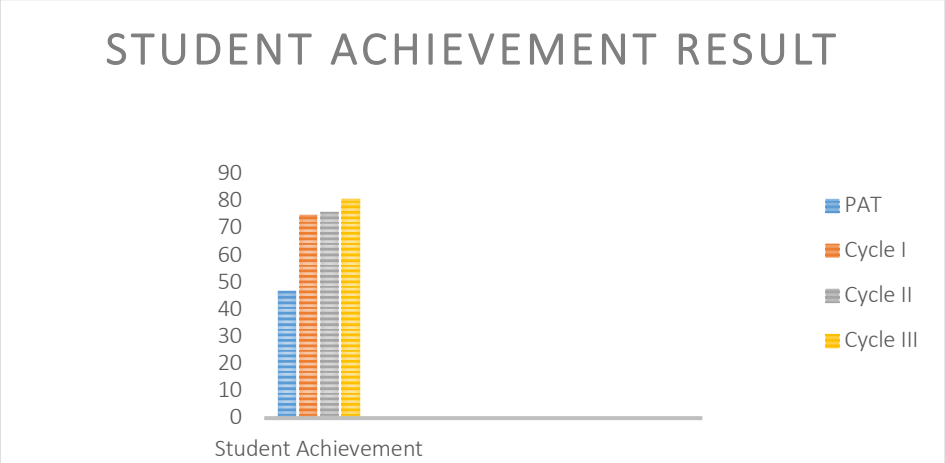

Figure 2. Students achievement results

Based on the data above, it is known that in the first cycle the average student achievement in mathematics is 74.7, this result has increased from the PAT results when students are still in grade VII. even though it has not exceeded the KKM, which is 75. Learning improvements are made to design learning in cycle II, and the result is 75.9. In cycle II the student achievement in mathematics has exceeded the KKM or more than 75, however, the learning continues for the third cycle because in the second cycle the students' self-efficacy level has not met the success criteria. In the third cycle, the student achievement in mathematics obtained an average of 80.5 and the level of self-efficacy of students increased, namely 78.125% of students have a high self-efficacy, so the research has met the success criteria.

During the first cycle, the average student achievement did not exceed the KKM because there were several influencing factors. Among them, the reduced learning time due to the LCD being used is a little problematic, here of course the focus of students has been reduced and this has resulted in the learning materials received by students. This problem is reinforced by Slameto (2015: 54) that student achievement can be influenced by school factors, these school factors include the facilities used during learning.

Student achievement in the second cycle has exceeded 75 although only slightly higher, which is 75.9. In cycle II the problems that arise are the lack of literacy of students in understanding the instructions and steps contained in the LKPD so that there is a misunderstanding during the discussion, this results in receiving and processing information is not under the learning objectives that have been set. Several factors influence the lack of literacy of students, one of which is a psychological factor, which is self-efficacy. Students are not confident in what they have read, so the discussion process does not run optimally. This is also reinforced by Rusman (2017:130) that student achievement is influenced by internal factors, one of which is student self-efficacy.

The PBL model used in this study has a considerable influence on improving students' student achievement in mathematics. By using the PBL model, students actively discuss to find the information needed. Thus, learning will be more meaningful for students, besides students can use any formulas that are found correctly when they working on assignments. Because previously students knew where the formula was found. Problems that can be done by students are not only questions related to the application of formulas, but also related to the application of formulas in daily life. Why is that? Because students are used to solving problems related to their daily life on the LKPD sheets that have been discussed.

Based on the results of the analysis, it is found that the level of self-efficacy of students will affect student achievement in mathematics obtained by students. The higher the level of self-efficacy of students, the higher the student achievement in mathematics.

CONCLUSION

Based on the data analysis and discussion results, it can be concluded that students' self-efficacy will align with the student's achievement in mathematics. The higher the level of self-efficacy of students, the higher the student achievement. Any recommendations in this study are: 1) The teacher gives a per-test just before the research is carried out to know the initial state of the students more accurately, 2) If the teacher provides new material to the students, the teacher can use the PBL model to improve student achievement and efficacy. students themselves, and 3) Before using the PBL model, it needs to analyze the characteristics and environment of students first.

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