Astuti, M. P., Mayasari, L.I., Ratnayanti, G.
Enhancing Learning Outcomes in Rotational Symmetry Through Problem-Based Learning
DOI 10.37640/ice.xx.xxxx-xxxx
In Proceedings of the 3rd International Conference on Education (ICE 2024), pages 206-212
e-ISSN 2964-7479

Enhancing Learning Outcomes in Rotational Symmetry Through Problem-Based Learning

Melyana Puji Astuti[1] , Linda Ika Mayasari[2] , Ginalita Ratnayanti[2]
[1]Early Childhood Education, TK Islam Al Ikhlas, Indonesia
[2]Elementary School Teacher Education, STKIP Kusuma Negara, Jakarta, Indonesia
*melyanapuji123@gmail.com

Abstract

This Classroom Action Research was conducted on second-grade students at MI Al Islam Depok, focusing on the low mathematics learning outcomes in the topic of Rotational Symmetry, with an average score of 70, below the Minimum Completeness Criteria (KKM) of 75. To improve learning outcomes, the Project-Based Learning (PBL) model was implemented. The aim of this research is to enhance the mathematics learning outcomes of third-grade students at MI Al Islam Cimanggis Depok through PBL, which involves students in solving real problems using the scientific method.The research was carried out in three cycles, each consisting of planning, implementation, observation, and reflection, with 15 students as subjects. Data were collected using both qualitative and quantitative methods. Students' learning outcomes in the topic of spatial figures improved in each cycle, with average scores of 68.6 in cycle I, 74 in cycle II, and 78 in cycle III, all exceeding the KKM. The application of the PBL model has proven to enhance learning outcomes and student activity through interactive learning, thereby increasing the completeness of learning outcomes.

Keywords: Learning Outcomes, Mathematics, Problem-Based Learning

1 INTRODUCTION

Learning today is no longer centered on the teacher but rather on the students, known as Student-Centered Learning. Students are required to be active participants in the learning process and are encouraged to learn from various sources. Information does not solely come from the teacher, who acts as the information provider. Thus, teachers are not the only sources of information; students can also gain knowledge from multiple sources, including their own experiences. By involving students in the learning process, it is hoped that they will achieve optimal learning outcomes.

Learning outcomes refer to the assessment of students, encompassing cognitive, affective, and psychomotor factors after they engage in the learning process. Therefore, learning outcomes are the results of the evaluation of the learning efforts achieved by each student over a specific period. Learning outcomes are inseparable from learning activities, as these activities constitute the process (Teresya, F., & Rahmad, I. N., 2023).

Nana Sudjana argues that the cognitive domain relates to intellectual learning outcomes, which consist of six aspects: knowledge or recall, understanding, application, analysis, synthesis, and evaluation. This domain emphasizes the ability to think logically and rationally. Oemar Hamalik states that learning outcomes occur when an individual experiences a change in behavior after learning.

Similarly, Tohirin asserts that learning outcomes are what students gain after engaging in learning activities. Dimyati and Mudjono suggest that learning outcomes are the results of the interaction between teaching and learning activities. Teaching concludes with the evaluation of learning outcomes, which signifies the end of the learning process. Mulyono Abdurrahman states that learning outcomes represent the abilities acquired by students after participating in learning activities.

Syaiful Bahri Djamarah and Azwan Zain, as cited by Supardi, believe that learning outcomes are achievements measured against established criteria or standards. According to Suprijono, as referenced by Thobroni, learning outcomes include patterns of behavior, values, understandings, attitudes, appreciation, and skills. Soedirjato adds that learning outcomes encompass the cognitive, affective, and learning speed capabilities of an individual.

Mathematics is a distinct discipline that plays a significant role in education because it is encountered in daily life. By studying mathematics, students can apply their knowledge to solve everyday problems. The main goal of mathematics education is to train students' thinking and reasoning skills in drawing conclusions, fostering creativity, and engaging their imagination and curiosity to make predictions and hypotheses, followed by experimentation. Knowledge of mathematics enhances students' analytical abilities, problem-solving skills, and critical and imaginative thinking.

The standards for mathematics competency are designed to enhance logical, analytical, systematic, critical, and creative thinking skills. Overall, the objectives of mathematics education are for students to develop creativity and the art of working with mathematics, use mathematics to solve real-life problems, enhance logical thinking, and possess problem-solving skills in mathematics.

Learning media refers to tools that can assist in the teaching and learning process and serve to clarify the material being presented, thereby helping to achieve educational objectives. Learning media are means to enhance teaching and learning activities. Given the various forms of learning media available, teachers need to carefully select the appropriate media for their instruction.

According to Erman Suherman, several types of media are recognized in education, including: (1) non-projected media such as photography, diagrams, and displays; (2) projected media such as slides, filmstrips, transparencies, and computer projectors; (3) audio media such as cassette tapes and compact disks; (4) motion media such as videos and films; (5) computers and multimedia; and (6) media used for distance learning such as radio, television, and the internet (computers). Erman Suherman also categorizes learning media into two parts: media that serve as carriers of information (knowledge) and media that simultaneously act as tools for instilling concepts, such as educational aids in mathematics.

Based on the explanations above, it can be stated that learning media and educational aids are often regarded as the same thing. Both learning media and educational aids function to optimize the learning process and outcomes for students. Based on observations conducted by the researcher in August 2023 in Class III MI Al Islam, which included 15 students (10 boys and 5 girls), issues were identified in the learning process. Students were not actively participating as the teacher primarily used a lecture method and assigned tasks from the textbook. Observations and interviews with the teacher revealed that several students scored below the minimum competency criteria (KKM) of 7.5, with only 3 students (20%) passing and 12 students (80%) failing.

One reason many students scored below the KKM is that the material delivery focused on cognitive learning with a limited variety of teaching methods, primarily listening and assigning tasks. During mathematics lessons at MI Al-Islam, the teacher rarely employed engaging, creative, or innovative teaching methods. The learning activities were monotonous and lacked variety. Many students were observed to be disengaged, preoccupied with their own activities, or chatting with peers. Additionally, the school facilities were inadequate to support classroom learning, and some students still struggled with reading.

One approach the researcher plans to implement to enhance the mathematics learning outcomes of Class III MI Al-Islam students is the Problem-Based Learning (PBL) model. The PBL model engages students in solving real problems through collaborative group work to find solutions and build new understanding. This model can increase student motivation and curiosity while developing critical thinking skills and higher-order thinking abilities.

2 RESEARCH METHODS

The research to be conducted is classroom action research (CAR) implemented in Class III. Action research focuses on applying actions aimed at improving quality or solving problems within a specific subject, while observing the success or impact of those actions, followed by subsequent actions that refine or adjust the approach based on the conditions and situations to achieve better results. Arikunto defines Classroom Action Research (CAR) as an examination of teaching activities that involves intentional actions occurring collectively within a classroom. According to Hopskin, as cited by Masnur, Classroom Action Research (CAR) is a reflective study conducted by practitioners to enhance rational abilities and actions in carrying out their tasks and to deepen their understanding of conditions in learning practices. This research will take place in Class III Al Islam Cimanggis, Depok, with 15 students as subjects. The model used is the Problem-Based Learning model.

The CAR model based on Problem-Based Learning consists of four steps in each cycle: Planning, Acting, Observing, and Reflecting. The research will be conducted over three cycles, with each cycle comprising two meetings.

Rotational symmetry is the number of rotations that can be performed on a flat shape such that the resulting image forms the same pattern as before the rotation, but does not return to the original position. A shape has rotational symmetry if there is a center point. The flat shape can be rotated less than one full turn, so its shadow aligns perfectly with the original shape. A flat shape is said to have no rotational symmetry if it can only be rotated one full circle. Rotational symmetry is a type of symmetry in mathematics and geometry where an object or image appears the same after being rotated around a specific point. This point is referred to as the "center of symmetry" or "center of rotation." Marini argues that rotational symmetry involves the rotation of a flat shape determined by the center of rotation, the angle of rotation, and the direction of rotation, where the rotation is defined by a specific center point with a certain direction of rotation.

Data collection techniques and instruments will involve four stages: tests, interviews, documentation, and observation. Tests will be administered to students after the second meeting in each cycle. The tests will be individual assessments consisting of 20 multiple-choice questions. Data analysis in this Classroom Action Research will occur in three stages: data reduction, data description, and data verification. Indicators for assessing

students' learning success will utilize the Minimum Completeness Criteria (KKM), set at above 75, or a minimum classical completeness achievement of 80%.

3 RESULT AND DISCUSSION

From the research that has been conducted, the results regarding the mathematics learning outcomes on the topic of the volume of solid figures for Class III students in the second semester of the 2023/2024 academic year at MI Al Islam Cimanggis, Depok, are as follows:

3.1 Sub Result

Based on the results obtained in the pre-cycle, the average mathematics score of the students was still below the Minimum Completeness Criteria (KKM), with a score of 63. The breakdown of the students' scores is as follows: three students scored 55, one student scored 60, three students scored 65, two students scored 70, three students scored 75, two students scored 80, and one student scored 85. The KKM is set at 75. This indicates that 80% of the students struggled to understand the material, while only 20% were able to grasp it.

In Cycle I, which consisted of two meetings, the average class test score for mathematics on the topic of rotational symmetry remained below the KKM, with 9 students (60%) not achieving completeness. The class average was 68.6, while the KKM is 75.

In Cycle II, also conducted over two meetings, there was an improvement in learning outcomes, with the average class score rising to 74, and 6 students (40%) still not achieving completeness. The change in learning media to concrete materials resulted in a notable improvement in learning outcomes, along with an increase in student enthusiasm.

Cycle III was conducted over two meetings as well. In this cycle, there was a significant improvement in learning outcomes using the PBL model with concrete media, which proved to be much more effective than using images drawn on the board. The data indicated that the average class score for the mathematics topic of rotational symmetry in Cycle III was above the KKM, at 78, with 2 students (13.33%) not achieving completeness, while 13 students (86.67%) were successful. This data shows that 86.67% (13 students) were able to understand the material.

3.2 Sub Discussion

From the research conducted on Class III students at MI Al Islam, which consisted of three cycles, there was an improvement in mathematics learning outcomes during each successive learning process in the first, second, and third cycles, through the PBL learning model. This is evident in the percentage of student learning achievement. The average scores of the students, along with the observation scores of the teacher and students, between the first and second cycles are shown in the table below:

3.3 Table

Table 1. Learning Outcomes in Mathematics Rotational Symmetry

Category	Siklus I	Siklus I	Siklus II
Learning Outcome	68,6	74	78
Teacher Observation	60	80	100
Results	40	60	100

The table above shows an increase in the percentage of student achievement in learning, with the average scores of students rising consecutively from Cycle I, Cycle II, to Cycle III. In Cycle I, the achievement percentage was 40% with an average score of 68.6. This improved in Cycle II to 60% with an average score of 74, and further increased in Cycle III to 86.66% with an average score of 78.

The increase in student learning outcomes, reflected in the average scores, aligns with improvements in the learning process for both teachers and students. In Cycle I, the teacher's activity score was 60, categorized as good; in Cycle II, it increased to 80, still categorized as good; and in Cycle III, it reached 100, categorized as very good. Meanwhile, student activity scores were 40 (good) in Cycle I, 60 (good) in Cycle II, and 100 (very good) in Cycle III.

Based on the comparison of student learning outcomes from the pre-cycle, Cycle I, Cycle II, and Cycle III, it can be concluded that the use of the PBL learning model effectively improves mathematics learning outcomes for Class III students at MI Al Islam. This can be seen in the following graph.

3.4 Figure

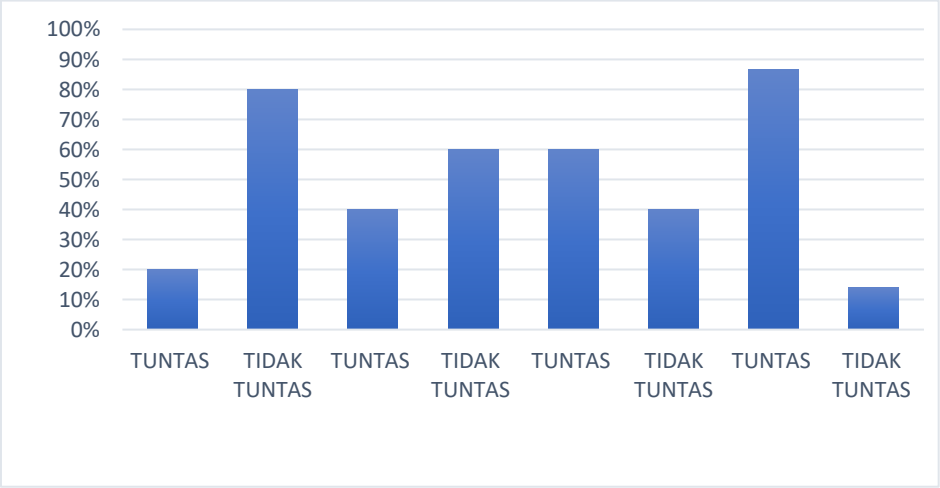

Figure 1. Presentation of Completeness from Pre-Cycle to Cycle III

The graph above shows that there has been an increase in student learning outcomes in a sequential manner according to the comparison of learning outcomes data from the pre-cycle, Cycle I, Cycle II, and Cycle III. The pre-cycle achieved 20%, which increased to 40% in Cycle I, 60% in Cycle II, and further increased to 86.66% in Cycle III. This improvement in student learning outcomes indicates that the implementation of the PBL model effectively enhances student learning, particularly in the topic of rotational symmetry in mathematics at MI Al Islam Cimanggis, Depok.

Based on observations in Cycle III, it can be concluded that the learning outcomes in mathematics for the topic of rotational symmetry were better compared to Cycle I and Cycle II. The learning process has also met the success criteria target. Observers noted that the teacher was able to guide students in the learning process. Observations regarding students included aspects such as enjoyment, student engagement in answering the teacher's questions, and their ability to recall previously learned material. The overall percentage of assessments from Cycle I to Cycle III demonstrates that the use of teaching aids for learning mathematics on the topic of rotational symmetry has been more effective.

Various studies have shown that the PBL model places students in situations where they face real problems requiring solutions. In the context of the Merdeka curriculum, which offers a more open learning approach and allows students greater freedom to explore, PBL can be a highly effective method. Based on previous research, the study on improving mathematics learning outcomes on the topic of rotational symmetry for Class III students at MI Al Islam in the second semester of the 2023/2024 academic year is relevan.

4 CONCLUSION

The implementation of the PBL learning model in Class III at MI Al Islam, Cimanggis District, Depok, during the second semester of the 2023/2024 academic year has improved student learning outcomes. This is evident in the scores for each cycle, where the completion rate at the beginning of the learning process (pre-cycle) was 20%, increasing to 40% in Cycle I. The percentage continued to rise to 60% in Cycle II and reached 86.66% in Cycle III, with the Minimum Completeness Criteria (KKM) set at 75.

5 REFERENCES

Ahmadi, A. d. (2020). *Psikologi Belajar. Peningkatan Hasil Belajar*, hal. 468.

Abdillah, L. A. et. al. (2021). *Penelitian Tindakan Kelas: Teori Dan Penerapannya*. Indramayu : CV. Adanu Abimata.

Aslan, A. d. (2021). Problem Based Learning in Live online Classess. *Jurnal Ilmiah Pendidikan dan Pembelajaran,* hal. 354.

Djamarah, S. B. (2019). Psikologi Belajar. *Jurnal Ilmiah PGSD*, hal. 115.

Malluru, A. R. (2023). *Meningkatkan Hasil Belajar Matematika Melalui Penerapan Media Papan Simetri Putar Kelas V SDN 118 Inpres Bontolebang. Optimalisasi Pengembangan Keprofesian Berkelanjutan Melalui PTK*, hal. 12.

Mudjiono, D. d. (2021). Belajar dan Pembelajaran. *Prosiding Seminar Nasional Pendidikan Dasar*, hal. 297.

Nurrohma, R. I., & Adistana, G. A. Y. P. (2021). Penerapan Model Pembelajaran Problem Based Learning dengan Media E-Learning Melalui Aplikasi Edmodo pada Mekanika Teknik. *Edukatif: Jurnal Ilmu Pendidikan*, 3(4), hal. 1199-1209.

Zubainur, C. M. (2020). *Perencanaan Pembelajaran Matematika*. Syiah Kuala University Press.

Pahleviannur, M. R., et. al. (2022). *Penelitian Tindakan Kelas*. Pradina Pustaka.

Muliawati, N. P. (2019). *Pembelajaran Matematika: Untuk Guru SD dan Calon Guru SD*. Bandung: Remaja Rosdakarya.

Argaruri, Y., & Subekti, E. E. (2023, July). 211. Meningkatkan Hasil Belajar Matematika Materi Simetri Putar Melalui Model Problem Based Learning (PBL) Berbantuan Media Papan Siput Kelas III SD 1 Samirejo. In *Prosiding Seminar Nasional Pendidikan Profesi Guru*. Vol. 1, No. 1, pp. 1888-1897

Rahayu, s. d. (2021). Perbedaan Pengaruh Penerapan Model Pembelajaran Project Based Learning dan Problem Based Learning Berbantuan Media Monopoli. *Jurnal Ilmiah Pendidikan dan Pembelajaran*, hal. 354.

Sani, R. A. (2022). *Inovasi Pembelajaran*. Bumi Aksara.

Teresya, F., & Rahmad, I. N. (2023). Improving Science Learning Outcomes Through Environment Based learning Models Environment-Based Learning. In *Proceeding of International Conference on Education* (Vol. 2, pp. 342-348).

Ricardo dan Meilani, R. I. (2021). Dampak Minat dan Motivasi Belajar terhadap Hasil Belajar Siswa. *Jurnal Administrasi Perkantoran* , hal. 328-329.

Slameto. (2020). Belajar dan Faktor yang Mempengaruhinya. *Jurnal Pendidikan dan Dakwah*, hal. 284-287.

Juniarsih, W., Maftuhah, Y., & Syamsiyah, S. (2022). Peningkatan Motivasi Belajar Matematika Simetri Lipat Dan Simetri Putar Melalui Media Sparkol. *Educatif Journal of Education Research*, 4(1), hal. 8-17.

Suniasih, A. d. (2021). Development of Learning Videos Based and Problem Solving. *Jurnal Ilmiah Pendidikan dan Pembelajaran*, hal. 354.

T, A. (2020). Karakteristik Pembelajaran Berbasis Masalah. *Jurnal Edukasi*, hal. 5-11.

Watson. (2019). The Role and Integration Of Learning Outcomes Into The Educational Process. *Jurnal Pendidikan Manajemen Perkantoran*, hal. 81.

Zakaria, M. (2022). *Penelitian Tindakan Kelas*. Sukoharjo: Pradina Pustaka.