



## The Effectiveness of Problem-Based Learning on Learning Outcomes Students on Mathematics Subjects at SMP Negeri 17 Seluma

Dely Tresia Putri<sup>1✉</sup>, Ani Rosilowati<sup>2</sup>

<sup>1,2</sup>Postgraduate school Educational Research and Evaluation Semarang State University

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### Abstract

Problem Based Learning is a learning model that emphasizes collaboration between students to acquire and create skills through an active learning process that refers to a process that makes students able to design, solve problems, create research activities, giving students the opportunity to contribute actively. for a short period of time, and publish a product or just for presentations to improve your ability to use the language. Mathematics has become a subject that many students fear, causing many students to have low grades in mathematics and tend to have grades below the minimum completeness criteria. The aim of this research is to find out how effective problem based learning is on mathematics learning outcomes at SMP Negeri 17 Seluma. This research uses a quantitative approach with a quasi-experimental research model without a control class. This research uses pre-test and post-test. The sample in this study was 41 students. There is an average difference before and after problem-based learning is applied, amounting to 24.87805. The difference in lower and upper scores in the pre-test and post-test scores is 25.59154 and the difference in the highest score is 24.16455. The results found that the problem-based learning model can be proven to be effective on student learning outcomes with a significance value of 0.05, which shows that it is proven that problem-based learning is effective in improving student learning outcomes in Mathematics subjects at SMP Negeri 17 Seluma.

✉Correspondence Address :

Educational Research and Evaluation, Postgraduate School,

Universitas Negeri Semarang, Indonesia 50229

E-mail : delytre06@students.unnes.ac.id

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## INTRODUCTION

Variety in education is a key component in ensuring students' educational success. Presenting a variety of learning models that can contribute to students becoming more involved in interpreting the material better, and increasing their motivation. (Yulianingsih et al., 2019). Among the most useful approaches is collaborative learning, where students work together in groups to solve problems or create projects together. This not only develops social skills, but also improves their understanding of the material through discussion and sharing ideas (Susanti & Janattaka, 2020).

When education does not offer a variety of relevant and interesting learning, there are several dangers that can arise, such as the lack of variety in learning models can cause boredom and helplessness among students. When students are continuously exposed to monotonous and uninteresting learning approaches, their motivation to learn can decrease significantly (Pujiasih, 2020). This has the potential to hinder their ability to assimilate and understand lesson material well.

The learning mechanism really requires a number of criteria that must be maximized as a standard for the student's level of academic achievement. In interpreting the results of students' development, they really need tests that are in accordance with The student's background includes and pays attention to the student's personal learning style, the student's character, the student's personal knowledge and also the student's motivation in learning. The position of the measuring instrument is used to combine students' knowledge of learning outcomes which can be influenced by 2 factors, namely factors from within the students themselves (internal) and factors from outside themselves (Internal) (Amrai et al., 2011). Learning outcomes can be the main indicator used to measure the effectiveness of a variation of

learning (Asbari et al., 2019). Learning outcomes are a test as a form of measurement that is able to create a certain model score or value throughout the learning process and until the end of the learning (Bacon, 2011). Learning outcomes include students' understanding of the material, their ability to apply the knowledge gained, as well as the development of skills and competencies they achieve. In the context of learning variations, learning outcomes are important because they reflect the extent to which the model used is successful in presenting information, skills and understanding to students (Sinurat & Bangun, 2019). According to Suparlan (2019), learning outcomes are a key element in the process education and has very important implications for both students and the education system as a whole. In the realm of education, especially in formal education, students' abilities, knowledge and character can be measured using tests or direct observation of students (Sutama et al., 2019). Learning outcomes are an important indicator that describes how deeply students have mastered and understood the learning material (Fathurrahman & Dewi, 2019). This gives teachers and educational institutions an idea of a student's progress and whether the teaching model used is effective. In other cases, teachers are expected to be able to make students more responsible for the learning that students undertake (Achilles & S.P.Hoover, 1996). The presence of results is an activity or product that is very useful for teachers and students to measure their performance (Yusuf, 2002). Learning outcomes play a key role in evaluating the quality of education. At the system level, learning outcomes help in measuring the effectiveness of the curriculum and teaching models used. Learning outcome data can be the basis for improving educational programs and adapting them to student needs and community developments (Rahman, 2022). Solving ability problems in increasing the ability to actively adapt to the environment to become students who are able to solve problems (Delisle, 1997) This helps in

identifying areas that need improvement and ensures that students get quality education.

Based on the results of pre-observations and pre-interviews at SMP Negeri 17 Seluma, it was found that many students had problems when they passed Mathematics lessons. This kind of reason is proven by the number of students who have scores close to the minimum completion criteria (KKM). On the other hand, there are variations of learning models, namely Problem Based Learning (PBL), is an effective learning approach, even in subjects such as Mathematics. Problem Based Learning is a learning model that emphasizes collaboration between students to acquire and create skills through an active learning (Rahmadani, 2019). Problem Based Learning which refers to the process that makes students able to design, solve problems, create research activities, gives students the opportunity to contribute actively for a short period of time, and publish products or presentations that can improve students' ability to use language (Patton, 2012). In this context, PBL allows students to examine mathematics learning theory more deeply and contextually. By providing challenges in the form of real mathematical problems, students are faced with situations where they have to apply mathematical concepts to find solutions. This helps them to connect theory with practice, making learning more relevant and meaningful. Apart from that, Problem Based Learning stimulates the development of students' critical thinking skills. When trying to solve math problems, students need to analyze information, formulate strategies, and conduct repeated evaluations of the approaches they take (Nurkhin & Pramusinto, 2020) This helps them to hone critical thinking skills which are essential in solving complex mathematics' problems. Thus, the value of Problem Based Learning is being able to solve problems, open forums for discussion in order to direct students to gain knowledge according to the context, therefore Problem Based Learning is very effective (Tatar & Oktay, 2011).

Murdani et al., (2022) stated that Problem Based Learning plays an important role in providing a significant influence on mathematics learning outcomes because it provides flexibility in learning mathematics. Each math problem can be tailored to the student's level of difficulty and ability, so they can work at their own level. The problem based learning approach encourages students to conduct studies and discover and also use their creativity in solving problems (Delisle, 1997). The scientific thinking process can be developed and integrated into the curriculum regarding a problem-based model (Chin & Chia, 2005).

However, Sujatmika (2016) stated the opposite, where this problem-based model did not have the influence previously imagined regarding mathematics learning outcomes. This kind of thing is because the effectiveness of PBL is very dependent on its implementation. If teachers do not have sufficient understanding of how to design and manage problem-based learning well, this can result in confusion or confusion for students. According to Joi, there are three main components in the Problem Based Learning environment including teachers as facilitators (Merritt et al., 2017). The role of the Problem Based Learning teacher is to act as a trainer and facilitator who designs student learning by clearing up misunderstandings and providing good instructions and strategies in increasing students' enthusiasm for learning and students' critical thinking abilities rather than just providing direct learning to students (Achilles & S.P.Hoover, 1996). Based on this, this research aims to determine the effectiveness of Problem Based Learning on student learning outcomes in mathematics subjects at SMP Negeri 17 Seluma.

## **METHOD**

This research uses a research and development approach. The population is all subjects in one research area who are used as research subjects, namely all students at SMP

Negeri 17 Seluma, while the sample is a small group belonging to the population studied, namely class VIII students consisting of 2 study groups (Sukmadinata, 2007). Sample used In this research, there were a total of 41 students. This research used a quasi-experimental research model with one experimental class without a control class. In this research, there was a pre-test and post-test. The data in this research was taken through tests or questions in accordance with the applicable curriculum. A test is a collection of questions or exercises as well as other instruments used to measure skills, intelligence, knowledge, abilities, or talents possessed by individuals or learning groups (Pantiwati, 2016). The data was tested with a paired-sample t test using the SPSS V26 application and presented descriptively to determine reliability, different test power, level of difficulty, and also distractor function. Reliability testing is related to the level of

confidence in a test; the differential power test is the test's ability to distinguish between students who have high abilities and students who have low abilities (Zolfaghari et al., 2007). The level of difficulty is the test's ability to determine precisely the number of students who can answer the test questions correctly (Pangesti, 2019). The distractor function test aims to find out that the alternative answers given can function correctly.

**RESULT AND DISCUSSION**

This research was conducted at SMP Negeri 17 Seluma in class VII which consisted of 2 study groups, namely VII A and VII B with a total of 41 students. The research was conducted from 20 November 2023 to 30 November 2023. In the application of the Problem Based learning model focuses on the material on Building Flat Side Spaces. The following are the research results obtained:

**Tabel 1. Paired Samples Statistics**

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Nilai Pre-Test	57.3659	41	7.93964	1.23996
	Nilai Post-Test	82.2439	41	7.62490	1.19081

Based on the calculations in table 1, it can be seen that there is a difference in the average or mean value before and after the implementation of problem based learning

which can be seen from the pre-test and post-test scores. Indirectly, there is an average difference between before and after the implementation of problem-based learning.

**Tabel 2. Paired Samples Test**

		Paired Samples Test							
		Paired Differences			95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Nilai Pre-Test - Nilai Post-Test	-24.87805	2.26048	.35303	-25.59154	-24.16455	-70.471	40	.000

Based on the calculations in Table 2, it is known that the significant value obtained is 0.000 and very less than 0.05, which means that there is a difference between learning outcomes using problem-based learning and learning outcomes that do not use problem-

based learning. Then the mean difference resulting from the pre-test and post-test is 2.87805. This means that the mean difference before and after applying problem-based learning is 24.87805. Based on the lower and upper scores, it can be seen that the difference

in the lowest scores in the pre-test and post-test scores is 25.59154 and the highest value difference is 24.16455.

The researchers also conducted interviews with local teachers who teach mathematics in research classes. The following are the results of interviews with related teachers regarding the implementation of PBL:

*"I started by choosing a problem that was challenging, and relevant to daily life. Stava students were given the freedom to answer and to solve the problem. Where Sava answered the problem with story questions. On the other hand, I started by choosing a problem to solve the problem discussion, and providing guidance as they explore solutions"*

The teacher begins the implementation of PBL by choosing story questions that are challenging and relevant to students' daily lives. There is flat-sided geometric building material. The example that I apply is cube and block buildings which are things that are easily found in everyday life. Students are asked to give an example of an item or building that is around them or where they live regarding items in the shape of cubes and blocks. Through these story problems, students are given a real-world context in which they can determine the mathematical context they have learned. By giving students the freedom to explore their own solutions, teachers act as facilitators. encourage discussion and provide guidance as students explore possible solutions.

*"I use a variety of assessment methods, including practical talent, presentations, and student reflection. In addition to this, I see their progress during discussion and collaboration versions. The evaluation also includes their ability to apply solutions in problem-solving."*

Implementation of PBL consistently increases student involvement in mathematics learning. Students not only see mathematics as a series of formulas that must be memorized but as knowledge that can be used and is useful for solving problems. With the examples they have looked for, they are asked to discuss with examples of cubes and blocks that they have written about whether they

have been able to identify the answer. correctly or otherwise. The teacher stated that the student's active involvement in the learning process had brought positive changes to their motivation and interest in mathematics.

The teacher also observed that there was a significant increase in student learning outcomes after implementing PBL. Students not only master basic concepts but are also able to apply them in real-world situations. Test and project scores show consistent improvement, reflecting the deep understanding students gain through problem-based learning.

Based on the calculation results, it can be seen that Problem-Based Learning is very effective in improving mathematics learning outcomes. PBL is able to have a positive influence on student learning outcomes from an educational perspective because this approach integrates various important elements in the learning process (Merritt et al., 2017). PBL provides contextual learning experiences. In a PBL situation, students are faced with real-world problems that require understanding and application of the concepts being taught (Nuraini & Kristin, 2017). This helps students to see the relevance and applicability of the lesson material in life, and which motivates students to continue studying more seriously (Saenab & Muslimin, 2019).

Lismaya, 2019 revealed that PBL promotes critical thinking skills. In an effort to solve problems, students need to analyze information, formulate hypotheses, and evaluate possible solutions. This develops students to be able to think deeply which is very necessary during the learning process. Students are taught not just to receive information but also to understand, question, and analyze it. PBL also encourages cooperative-based learning. Students work together in groups to identify issues raised and find solutions, which promote collaboration, communication, and social skills. It reflects the importance of teamwork and social interaction in the modern educational context

and prepares students to work in those situations that require cooperation (Sujatmika, 2016). PBL also allows students to develop problem-solving skills that are useful in a variety of contexts. The ability to formulate problems, search for information, and design solutions are important skills in life (Aslan, 2021).

From a psychological perspective, PBL has a positive impact on learning outcomes because it focuses on real experiences that activate cognitive processes and learning motivation (Anatin, 2021). In the context of psychology, PBL stimulates a deep and sustained understanding of concepts. When students face real problems, they engage in deep and critical thinking processes, identifying relevant information, formulating hypotheses, and searching for solutions. This promotes stronger concept connections in students' long-term memory (Septian & Komala, 2019).

Kurniawan, 2023 revealed that PBL also utilizes motivation theory, especially problem-based learning theory and intrinsic motivation theory. When students face challenging problems and feel responsible for finding solutions, they experience higher levels of motivation because they see the relevance of the course material to real-world situations. This creates a sense of belonging, and students more motivated to be passionate about learning because they see the purpose of their learning. PBL promotes action-oriented learning. In psychology, the concept of action-based learning emphasizes that deep understanding occurs when students engage in active action and practical experience. According to Thorndahl & Stentoft, 2020, PBL presents situations that require real action from students in solving problems, which creates a deeper and more relevant learning experience.

## CONCLUSION

Based on the results of research conducted using average differences, it was

found that the problem-based learning model was proven to be effective in improving student learning outcomes in mathematics at SMP Negeri 17 Seluma with a significance value of less than 0.05.

## REFERENCES

- Achilles, C. M., & S.P.Hoover. (1996). Exploring Problem-Based Learning (PBL) in Grades 6-12. *PBL/PBExplore*, 9(16), 2–29.
- Amrai, K., Motlagh, S. E., Zalani, H. A., & Parhon, H. (2011). The relationship between academic motivation and academic achievement students. *Procedia - Social and Behavioral Sciences*, 15, 399–402.
- Anatin, A. (2021). Keefektivan layanan bimbingan klasikal moda daring metode problem based learning untuk meningkatkan motivasi belajar siswa. *Prosiding Seminar Nasional Bimbingan Dan Konseling Universitas Ahmad Dahlan*, 1.
- Asbari, M., Wijayanti, L. M., Hyun, C. C., Purwanto, A., Santoso, B., & Article, H. (2019). *Dinamika Pendidikan*. 14(2), 227–243.
- Aslan, A. (2021). Problem-based learning in live online classes: Learning achievement, problem-solving skill, communication skill, and interaction. *Computers & Education*, 171, 104237.
- Bacon, L. S. C. (2011). *Academic self-concept and academic achievement of African American students transitioning from urban to rural schools* [University of Iowa].
- Chin, C., & Chia, L.-G. (2005). Problem-based learning: Using students' questions to drive knowledge construction. *Science Education*, 88(5), 707–727.
- Delisle, R. (1997). *Use problem-based learning in the classroom*. ASCD (Association for Supervision and Curriculum Development).
- Fathurrahman, F., & Dewi, R. O. P. (2019). Manajemen Sarana Dan Prasarana Pendidikan Dalam Mendukung Proses Belajar Siswa Di Sdn Puter 1 Kembangbahu Lamongan. *Reforma: Jurnal Pendidikan Dan Pembelajaran*, 8(1), 178–187.
- Kurniawan, C. A. (2023). Meningkatkan Motivasi Belajar Siswa pada Materi Pribadi yang Unik sebagai Laki-Laki dan Perempuan yang Sederajat dengan Model Problem Based Learning di Kelas X SMK Negeri 3

- Kasihani. *Prosiding Seminar Nasional Pendidikan Dan Agama*, 4(1), 1–19.
- Lismaya, L. (2019). *Berpikir Kritis & PBL:(Problem Based Learning)*. Media Sahbat Cendekia.
- Merritt, J., Lee, M. Y., Rillero, P., & Kinach, B. M. (2017). Problem-Based Learning in K–8 Mathematics and Science Education: A Literature Review. *Interdisciplinary Journal of Problem-Based Learning*, 11(2).
- Nuraini, F., & Kristin, F. (2017). Penggunaan Model Problem Based Learning (Pbl) Untuk Meningkatkan Hasil Belajar Ipa Siswa Kelas 5 Sd. *E-Jurnalmitrapendidikan*, 1(4), 369–379.
- Nurkhin, A., & Pramusinto, H. (2020). Problem-Based Learning Strategy: Its Impact on Students' Critical and Creative Thinking Skills. *European Journal of Educational Research*, 9(3), 1141–1150.
- Pangesti, J. A. (2019). *Analisis Kualitas Butir Soal Penilaian Akhir Semester 1 Mata Pelajaran Pendidikan Agama Islam Kelas XII di SMA Negeri 2 Kroya Kabupaten Cilacap*. IAIN.
- Pantiwati, Y. (2016). Hakekat asesmen autentik dan penerapannya dalam pembelajaran biologi. *JEMS: Jurnal Edukasi Matematika Dan Sains*, 1(1), 18–27.
- Patton, A. (2012). *Work that matters: The teacher's guide to project-based learning*. The Paul Hamlyn Foundation.
- Pujiasih, E. (2020). Membangun generasi emas dengan variasi pembelajaran online di masa pandemi covid-19. *Ideguru: Jurnal Karya Ilmiah Guru*, 5(1), 42–48.
- Rahmadani, R. (2019). Metode Penerapan Model Pembelajaran Problem Based Learning (Pbl). *Lantanida Journal*, 7(1), 75–86.
- Rahman, S. (2022). Pentingnya motivasi belajar dalam meningkatkan hasil belajar. *Prosiding Seminar Nasional Pendidikan Dasar*.
- Saenab, S., & Muslimin, A. A. (2019). Pengaruh Problem Based Learning Terhadap Motivasi Belajar Pendidikan Agama Islam Peserta Didik Kelas Vii Di Smp Negeri 1 Duampanua Kabupaten Pinrang. *Jurnal Pilar: Jurnal Kajian Islam Kontemporer*, 10(2), 12–23.
- Septian, A., & Komala, E. (2019). Kemampuan koneksi matematik dan motivasi belajar siswa dengan menggunakan model Problem-Based Learning (PBL) berbantuan geogebra di SMP. *Prisma*, 8(1), 1–13.
- Sinurat, S. Y., & Bangun, S. Y. (2019). Peningkatan Hasil Belajar Passing Atas Bola Voli, Siswa SMK Melalui Variasi Pembelajaran. *Jurnal Publikasi Pendidikan*, 9(2), 125–133.
- Sujatmika, S. (2016). Pengaruh metode pembelajaran problem based learning terhadap prestasi belajar ditinjau dari gaya belajar dan kemandirian. *Sosiohumaniora: Jurnal Ilmiah Ilmu Sosial Dan Humaniora*, 2(1).
- Sukmadinata, N. S. (2007). *Metodologi penelitian pendidikan*. Remaja Rosda Karya.
- Susanti, A., & Janattaka, N. (2020). Analisis Keterampilan Guru dalam Mengadakan Variasi Pembelajaran Tematik Kelas 1 SDN 1 Gondang Kabupaten Tulungagung. *Jurnal DIDIKA: Wahana Ilmiah Pendidikan Dasar*, VI (1). <https://doi.org/10.29408/Didika.V6i1.1516>.
- Sutama, S., Hartini, S., & Novitasari, M. (2019). Kemandirian dalam Pembelajaran Matematika di Madrasah Tsanawiyah. *Jurnal VARIDIKA*, 30(2), 7–14.
- Tatar, E., & Oktay, M. (2011). The effectiveness of problem-based learning on teaching the first law of thermodynamics. *Research in Science & Technological Education*, 29(3), 315–332.
- Thorndahl, K. L., & Stentoft, D. (2020). Thinking critically about critical thinking and problem-based learning in higher education: A scoping review. *Interdisciplinary Journal of Problem-Based Learning*, 14(1).
- Yulianingsih, D., Gaol, L., & Marbun, S. (2019). Keterampilan Guru PAK Untuk Meningkatkan Minat Belajar Murid Dalam Proses Pembelajaran Di Kelas. *FIDEI: Jurnal Teologi Sistematika Dan Praktika*, 2(1), 100–119.
- Yusuf, A. (2002). Inter-relationship among academic performance, academic achievement and learning outcomes. *Journal of Curriculum and Instruction*, 1(2), 87–96.
- Zolfaghari, M., Mehrdad, N., Z, P., Salmani, N., & Bahrani, N. (2007). The Effect of Lecture and E-learning Methods on Learning Mother and Child Health Course in Nursing Students. *Iranian Journal of Medical Education*, 7, 31–38.