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Application of matrix teaching materials using a problem based learning approach in increasing students' ability to understand mathematical concepts

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ABSTRACT

Efforts to improve the quality of education continue to be carried out comprehensively, including aspects of knowledge, skills, attitudes, and values. Mathematics learning is understanding mathematical concepts when solving a problem. Therefore, whether or not mathematics learning has been achieved can be demonstrated if students can understand and master a given concept. This research aims to determine the increase in students' ability to understand concepts using teaching materials with a problem-based learning approach. This research used one class with 36 students. Data collection uses observation and tests. The pretest and posttest results show that the posttest results are better, namely having 10.417 points more than the pretest results. The results of the t-test analysis show a significance of 0.000. After being tested, it can be concluded that teaching materials using a problem-based learning approach are effective in improving students' ability to understand mathematical concepts.

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INTRODUCTION

Efforts to improve the quality of education continue to be carried out comprehensively, including aspects of knowledge, skills, attitudes, and values. One effort to improve quality is by changing the curriculum (Juniati & Budayasa, 2017). The curriculum exists so

that students get their rights and obtain knowledge that suits their conditions and desires and can adapt to the surrounding environment using the knowledge gained. Based on Government Regulation Number 19 of 2005, Article 19, Paragraph 1, in Nurhairunnisah & Sujarwo (2018). In learning, it is hoped that educators can use methods and media that are able to

actively involve students and create a fun, interesting, and interactive atmosphere that is adapted to the students' stage of thinking development, characteristics, and learning conditions (Komarudin, Suherman, & Anggraini, 2021; Zuhri et al., 2023). This condition is also very necessary for mathematics learning in vocational schools. Mathematics is one of the subjects studied from elementary school to university level. This subject aims to enable students to understand mathematical concepts, explain the relationships between concepts, and apply these concepts accurately and efficiently in solving problems (Aliah, Sukmawati, Hidayat, & Rohaeti, 2020). Based on this opinion, one of the abilities that students must master in learning mathematics is understanding mathematical concepts when solving a problem. Therefore, whether or not mathematics learning has been achieved can be demonstrated if students are able to understand and master a given concept (Que, Kusnadi, Silalahi, Rahman, & Kurniawan, 2022).

Understanding mathematical concepts is one of the important aspects that a mathematics teacher must have. To improve this ability, it is necessary to continue to train. Understanding mathematical concepts is a mathematical skill or proficiency that is expected to be achieved in learning mathematics, namely by showing the relationship between concepts and applying concepts or algorithms in a flexible, accurate, efficient, and precise manner in solving problems (Kurniawati & Nita, 2018). Wiharno (as cited in Retnowati, Fathoni, & Chen (2018)) stated that the ability to understand mathematical concepts is a strength that must be considered during the mathematics learning process, especially to gain broader and more meaningful knowledge. Concept

understanding has several indicators that must be mastered by students, namely: (1) restating each concept; (2) classifying objects according to certain properties (according to the concept); (3) providing examples and non-examples of the concept; (4) presenting concepts in various forms of mathematical representation; (5) developing necessary or sufficient conditions for a concept; (6) using, utilizing, and selecting certain procedures or operations; and (7) applying concepts or problem-solving algorithms (Nupin, 2021). To improve understanding of mathematical concepts, effective and practical teaching materials and strategies are needed for students to use.

This goal can be achieved if a teacher has the skills to choose and use good learning methods and the type of media used to support students' understanding of the concepts presented (Huda et al., 2019). According to Umam & Azhar (2021), the use of good teaching materials can help students' ability to analyze a problem and understand mathematical problems. Therefore, teaching materials and learning strategies are needed that can provide direct experience to students by introducing, familiarizing, and training them to apply the mathematical theories obtained in solving problems. One effort that can be used in learning to solve this is learning with problem-based learning materials. Based on observations made, students' ability to understand concepts tends to be less than satisfactory due to the transition to online learning and the learning process, which still uses continuous lectures, so that students' ability to understand mathematical concepts does not experience a significant increase. To overcome this problem, researchers chose to use teaching materials with a problem-based learning

approach, which they hope will help improve students' understanding of mathematical concepts.

Several previous researchers argued that teaching materials have a significant influence on children's cognitive load abilities and students' problem-solving (Nurhairunnisah & Sujarwo, 2018; K. Umam & Azhar, 2021). It is also very likely that students' ability to understand concepts is influenced by several things. Therefore, researchers pay more attention to students and carry out assessments very strictly to get maximum results.

METHOD

This is quantitative research with a pretest and posttest design. This research uses only one class, namely the experimental class, by applying teaching materials with a problem-based learning (PBL) approach. However, before implementing the teaching materials, students will be given an initial test first to determine the magnitude of the influence of teaching materials using a problem-based learning approach on students' ability to understand mathematical concepts. The research was conducted at SMK N 5, Serang City, Banten Province.

The population of this study was class XI majoring in MPLB and AKL, which consisted of four MPLB classes and four AKL classes, for a total of 288 students. The sample was taken using random sampling, and class XI MPLB 3, with a total of 36 students—seven male students and 29 female students—was chosen as the experimental class. The material used is the matrix chapter. The teaching materials used have been reviewed by the lecturers and also by the MGMP Mathematics Vocational School teachers.

Data collection uses observation and written tests, which are used to measure students' ability to understand

mathematical concepts. The test uses questions containing seven indicators and consists of seven questions. The question instrument was adapted from questions recommended by MGMP mathematics teachers.

The data that has been collected will be analyzed using descriptive analysis and inferential analysis. Inferential analysis consists of a normality test, a homogeneity test, a t-test, and an N-gain. N-gain was carried out to determine the increase in students' ability to understand mathematical concepts before and after the application of teaching materials. According to (Novita, Sukmanasa, & Pratama, 2019), the N-gain criteria can be seen in Table 1.

Table 1. N-Gain Criteria

N-Gain	Criteria
$n\text{-gain} > 0.7$	High
$0.3 \leq n\text{-gain} \leq 0.7$	Middle
$n\text{-gain} < 0.3$	Low

RESULTS AND DISCUSSION

After the research has been carried out and the required data has been collected, carry out descriptive analysis and inferential analysis. In learning mathematics, using teaching materials with a problem-based learning approach turns out to make students more enthusiastic about asking questions because the material provided always relates to problems that exist in everyday life (Xin et al., 2020). Before entering the learning process, a pretest is carried out first to measure the initial ability of students to understand concepts. After the pretest, there will be three meetings to apply teaching materials using a problem-based learning approach, and then a posttest will be carried out to measure the ability to understand mathematical concepts, which has the 7 indicators

mentioned. Table 2 shows the results of the descriptive statistical analysis.

Table 2. Descriptive Statistics

	N	Range	Min	Max	Mean	Std. Deviation	Variance
Posttest	36	13	14	27	20.28	3.352	11.235
Pretest	36	10	5	15	9.86	2.320	5.380

The lowest scores obtained from the pretest and posttest were 5 and 14 out of a total score of 28. The highest scores from the posttest and pretest carried out were 27 and 15. The average for each group was 20.28, the average for the posttest, and 9.86 is the average pretest score. The N-Gain test is carried out before the normality and homogeneity tests.

Table 3. N-gain Test of Understanding Mathematical Concepts

Class	N	N-Gain Average	Ext
Eks	36	0.578	Normal

It can be concluded that the average N-gain value of all experimental class students is in the medium category. However, this is a good thing because, if you look at it as a whole, the students' scores have improved in their abilities, especially their understanding of mathematical concepts.

Table 4. N-gain Normality Test

Class	N	L_{cal}	L_{table}	Ext.
Eks	36	0.119	0.148	Normal

It is explained that the data obtained in the research was normally distributed.

Table 5. N-gain Homogeneity Test

Class	N	χ^2_{hit}	χ^2_{table}	Ext
Eks	36	2.064	4.121	Homogeneous

It can be concluded that the research data obtained is homogeneous or has the same variance. After the data is declared normal and homogeneous, the next test is the t-test (paired sample t test). Look at Table 6.

Table 6. Sample Paired t-Test

	Mean	Std. Deviation	t	Df	Sig.
Pretest - Posttest	-10.417	3.549	-17.612	35	.000

The information above shows the difference in the average score obtained from the pretest and posttest is -10.417, meaning the posttest score is 10 points higher than the pretest. If we look at the significance obtained, it can be concluded that the application of teaching materials using a problem-based learning approach is effective in increasing the ability to understand mathematical concepts.

Based on these results, it can be concluded that teaching materials using a problem-based learning approach have an effect on increasing students' ability to understand mathematical concepts. This is in line with research conducted by Haswati & Dian Nopitasari (2019), which concludes that teaching materials with discovery learning assisted by mathematical software can improve students' ability to understand mathematical concepts. Research conducted by Suparni (2017) and Torro, Kasim, & Awaru (2021) has shown that the application of the problem-based learning model can improve student learning outcomes, and problem-based learning based on local wisdom also influences students' learning motivation to be more supportive in learning mathematics.

This is also supported by research conducted by Nurhairunnisah & Sujarwo (2018), which concludes that interactive teaching materials can help improve students' ability to understand mathematical concepts. Also strengthened by research conducted by Ediansyah, Kurniawan, Perdana, & Salamah (2019), which concludes that problem-based learning influences the ability to understand concepts and motivation. From the conclusions obtained and the literature read, the researcher believes that teaching materials that are easy to

understand and have problems related to daily life have a great influence on student growth and development. However, the use of teaching materials must also be adjusted to the students' initial conditions and abilities so that the material provided is maximally absorbed by the students (Fouryza, Amin, & Ekawati, 2019; Purnomo, 2015).

In this research, there were also several things that were factors for one of the students, namely economic factors and a broken home. The researcher hopes that future researchers will consider various existing factors so that students' abilities can become more developed. Apart from that, good teaching materials and appropriate methods or approaches must also be carefully considered by future researchers.

CONCLUSIONS AND SUGGESTIONS

From the data analysis and discussion that have been presented, the researcher concludes that teaching materials with a problem-based learning approach are effective in improving students' ability to understand mathematical concepts. Teaching materials that are appropriate to the curriculum and students' abilities have a significant influence on the development of children's abilities. Therefore, educators must be more careful in choosing the teaching materials, methods, delivery, and models that will be used in learning. The condition of students must also be considered so that our goal of making the nation's life intelligent can run as it should.

The researcher hopes that future researchers will consider various existing factors so that students' abilities can become more developed. One of the

factors that researchers found was students' lack of interest in learning mathematics and students' lack of concentration in learning (Suendarti & Liberna, 2021; M. A. Umam & Zulkarnaen, 2022). Apart from that, good teaching materials and appropriate methods or approaches must also be carefully considered by future researchers.

REFERENCES

- Aliah, S. N., Sukmawati, S., Hidayat, W., & Rohaeti, E. E. (2020). Analisis kemampuan pemecahan masalah matematika dan disposisi matematika siswa pada materi spldv. *Jurnal Pembelajaran Matematika Inovatif*, 3(2).
- Ediansyah, E., Kurniawan, D. A., Perdana, R., & Salamah, S. (2019). Using problem-based learning in college: Mastery concepts subject statistical researh and motivation. *International Journal of Evaluation and Research in Education (IJERE)*, 8(3), 446. <https://doi.org/10.11591/ijere.v8i3.20243>
- Fouryza, D., Amin, S. M., & Ekawati, R. (2019). Designing lesson plan of integer number operation based on fun and easy math (fem) approach. *International Journal of Evaluation and Research in Education (IJERE)*, 8(1), 103. <https://doi.org/10.11591/ijere.v8i1.15514>
- Haswati, D., & Dian Nopitasari. (2019). Implementasi bahan ajar persamaan diferensial dengan metode guided discovery berbantuan software mathematica untuk meningkatkan pemahaman konsep. *Jurnal Gantang*, 4(2), 97-102. <https://doi.org/10.31629/jg.v4i2.1358>
- Huda, S., Firmansyah, M., Rinaldi, A., Suherman, S., Sugiharta, I., Astuti, D. W., ... Prasetyo, A. E. (2019). Understanding of mathematical concepts in the linear equation with two variables: Impact of e-learning and blended learning using google classroom. *Al-Jabar : Jurnal Pendidikan Matematika*, 10(2), 261-270. <https://doi.org/10.24042/ajpm.v10i2.5303>
- Juniati, D., & Budayasa, I. K. (2017). Pengembangan bahan ajar geometri fraktal berbasis eksperimen untuk meningkatkan kompetensi mahasiswa. *Jurnal Cakrawala Pendidikan*, 36(1). <https://doi.org/10.21831/cp.v36i1.11660>
- Komarudin, K., Suherman, S., & Anggraini, A. (2021). Analysis of mathematical concept understanding capabilities : The impact of makerspae stem learning approach models and student learning activities. *Journal of Innovation in Educational and Cultural Research*, 2(1), 35-43. <https://doi.org/10.46843/jiecr.v2i1.21>
- Kurniawati, I. D., & Nita, S.-. (2018). Media pembelajaran berbasis multimedia interaktif untuk meningkatkan pemahaman konsep mahasiswa. *DoubleClick: Journal of Computer and Information Technology*, 1(2). <https://doi.org/10.25273/doubleclick.v1i2.1540>
- Novita, L., Sukmanasa, E., & Pratama, M. Y. (2019). Penggunaan media pembelajaran video terhadap hasil belajar siswa sd. *Indonesian Journal of Primary Education*, 3(2), 64-72. <https://doi.org/10.17509/ijpe.v3i2.22103>
- Nupin, I. S. (2021). *Pola pengembangan karier pustakawan melalui motivasi kerja dan pemahaman teknis jabatan fungsional*. CV. Adanu.
- Nurhairunnisah, N., & Sujarwo, S. (2018). Bahan ajar interaktif untuk meningkatkan pemahaman konsep

- matematika pada siswa sma kelas x. *Jurnal Inovasi Teknologi Pendidikan*, 5(2).
<https://doi.org/10.21831/jitp.v5i2.15320>
- Purnomo, Y. W. (2015). Pengembangan desain pembelajaran berbasis penilaian dalam pembelajaran matematika. *Jurnal Cakrawala Pendidikan*, 2(2).
<https://doi.org/10.21831/cp.v2i2.4823>
- Que, B. J., Kusnadi, I. H., Silalahi, R. M. P., Rahman, A. A., & Kurniawan, A. (2022). The effect of deep dialogue / critical thinking model on students' conceptual understanding ability. *Journal of Innovation in Educational and Cultural Research*, 3(3), 422–431.
<https://doi.org/10.46843/jiecr.v3i3.130>
- Retnowati, E., Fathoni, Y., & Chen, O. (2018). Mathematics problem solving skill acquisition: Learning by problem posing or by problem solving. *Cakrawala Pendidikan*, 37(1).
- Suendarti, M., & Liberna, H. (2021). Analisis pemahaman konsep perbandingan trigonometri pada siswa sma. *JNPM (Jurnal Nasional Pendidikan Matematika)*, 5(2), 326.
<https://doi.org/10.33603/jnpm.v5i2.4917>
- Suparni, S. (2017). Meningkatkan hasil belajar siswa dengan pembelajaran berbasis masalah. *JPPI (Jurnal Penelitian Pendidikan Indonesia)*, 3(1), 36–41.
<https://doi.org/10.29210/02017107>
- Torro, S., Kasim, N., & Awaru, A. O. T. (2021). Implementasi model problem based learning berbasis kearifan lokal dalam meningkatkan motivasi belajar siswa sekolah menengah atas. *JPPI (Jurnal Penelitian Pendidikan Indonesia)*, 7(2), 197–202.
<https://doi.org/10.29210/020211137>
- Umam, K., & Azhar, E. (2021). Bagaimana bahan ajar berbasis website membantu meningkatkan kemampuan berpikir kritis matematis siswa? *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 10(3), 1493.
<https://doi.org/10.24127/ajpm.v10i3.3702>
- Umam, M. A., & Zulkarnaen, R. (2022). Analisis kemampuan pemahaman konsep matematis siswa dalam materi sistem persamaan linear dua variabel. *Jurnal Educatio FKIP UNMA*, 8(1), 303–312.
<https://doi.org/10.31949/educatio.v8i1.1993>
- Xin, Y. P., Kim, S. J., Lei, Q., Wei, S., Liu, B., Wang, W., ... Richardson, S. E. (2020). The effect of computer-assisted conceptual model-based intervention program on mathematics problem-solving performance of at-risk english learners. *Reading & Writing Quarterly*, 36(2), 104–123.
<https://doi.org/10.1080/10573569.2019.1702909>
- Zuhri, Z., Dewi, S. V., Kusuma, J. W., Rafiqoh, S., Mahuda, I., & Hamidah, H. (2023). Implementation of ethnomathematics strategy in indonesian traditional games as mathematics learning media. *Journal of Innovation in Educational and Cultural Research*, 4(2), 294–302.
<https://doi.org/10.46843/jiecr.v4i2.613>

