Current Issues on Elementary Education Journal

Journal homepage: https://ejournal.upi.edu/index.php/CIEE

THE EFFECTIVENESS OF THE "BANGDAT" PBL-BASED LEARNING MATERIALS FOR IMPROVING ELEMENTARY SCHOOL STUDENTS' UNDERSTANDING OF MATHEMATICAL CONCEPTS

Fitra Ramadhan[1], Rosiana Mufliva[2], Silvi Fatimah Azhara Suherman[3] , Diki Riyadi[4], Muhammad Keisar Arrasyid[5]

[12345]Universitas Pendidikan Indonesia, Indonesia

*rosianamufliva@upi.edu

ABSTRACT

study aims to examine the effectiveness of teaching materials 'Misi BangDat' based on Problem-Based Learning (PBL) in improving the understanding of mathematical concepts of elementary school students on the material of flat buildings. The research design used pre-experimental method with one-group pretest-posttest. The research sample consisted of 24 grade II students in one of the elementary schools in West Bandung Regency. The results showed an increase in the average score of students' understanding of mathematical concepts from 57.29 (pretest) to 82.29 (posttest). N-Gain analysis showed a score of 80.87%, which is in the high category, proving that this teaching material is effective. The implementation of PBL-based teaching materials helps students understand concepts interactively and contextually, improve critical thinking skills, and facilitate understanding of abstract mathematics material. This study recommends the use of 'Misi BangDat' teaching materials as an innovative solution to improve mathematics learning at the primary school level.

ARTICLE INFO

Article History:
Submitted/Received 09/04/2025
First Revised 21/04/2025
Accepted 30/05/2025
First Available online 01/06/2025
Publication Date 01/06/2025

Keyword:
Teaching Materials "MISI BANGDAT" based on Problem Based Learning.
Mathematical Concept Understanding.

How to cite: Fitra, R., Mufliva, R., Suherman, S. F. A., Riyadi, D., & Arrasyid, M. K. (2025). The effectiveness of the "Bangdat" PBL-based learning materials for improving elementary school students' understanding of mathematical concepts. ***Current Issues on Elementary Education Journal***, *Vol 4 (1), 49-55*.

1. INTRODUCTION

Mathematics is a subject that must be taught at all levels of education in Indonesia. Education is an effort to help the souls of students, both physically and mentally, from their natural characteristics to better characteristics in the future (Riyadi et al., 2025). This subject is known for its abstract nature, so understanding it requires critical thinking skills and a high level of concentration (Wiryanto, 2020). Because of its abstract and systematic nature, mathematics is often considered a difficult subject to understand, leading many students to lose interest. Students tend to simply follow along without truly understanding the theory being taught by the teacher, resulting in poor conceptual understanding (Farhana et al., 2022). Mathematics is closely related to concepts, so to succeed in this field, it is necessary to master mathematical concepts first. according to Febriyani et al., (2022) states that understanding mathematical concepts is a student's ability to explain the relationship between concepts and apply concepts or algorithms accurately in various problem-solving situations based on an understanding of the mathematical concepts they have mastered. Conceptual understanding can be defined as the ability to define concepts verbally and in writing. In line with Ardiansyah's statement (dalam Friantini et al., 2020) states that conceptual mastery is a child's ability to express their ideas from abstract to concrete forms so that they can be easily understood by others. In the process of learning mathematics, understanding mathematical concepts is a very important part. This is because conceptual understanding is an important foundation for solving mathematical problems and problems in everyday life. It will be difficult for students to learn more advanced material before they understand basic concepts (Istikomah et al., 2022). From these explanations, it can be concluded that conceptual understanding is the competency demonstrated by students in applying concepts according to the correct procedures to solve problems. Therefore, conceptual mastery is crucial for mathematical understanding, especially fundamental concepts. Fundamental concepts in mathematics learning consist of newly introduced material and are embedded, serving as prerequisites for understanding subsequent concepts.

A person who is said to have mastered the ability to understand mathematical concepts will certainly have traits or characteristics that distinguish them from others. The following are indicators for assessing students' ability to understand mathematical concepts: 1) Restate ideas that have been learned in writing. 2) Categorize topics based on whether or not a condition that forms the concept is met. 3) Provide examples and non-examples of a concept that has been learned. 4) Express concepts in various forms of mathematical representation (graphs, tables, pictures, diagrams, mathematical models, sketches, etc.). 5) Apply concepts in solving meaningful problems related to the concepts learned (Depdikbud, dalam Sengkey et al., 2023).

In reality, students' understanding of mathematical concepts is not yet fully achieved. Learning plane geometry in elementary school often presents significant challenges. Many students struggle to understand the properties and calculations associated with plane geometry such as triangles, squares, and circles. Overall, the current state of conceptual understanding of plane geometry in elementary school demonstrates the need for improvements in teaching methods. In line with the statement Darwani (dalam Annisa, 2024) which states that students' low understanding of mathematical concepts is caused by several

things, such as traditional learning methods, students' difficulty in applying concepts when solving math problems, lack of teaching materials that support independent learning, and students' dependence on teacher explanations to understand the material.

e- ISSN 2776-5970

One factor contributing to students' low understanding is a lack of varied teaching methods. Many teachers still rely on lectures and theoretical explanations without providing real context for students. One learning model that can be used by students to support mathematics learning is the Problem-Based Learning model. Problem-based learning (PBL) is a problem-driven learning method that encourages students to learn and work cooperatively in groups to find solutions, think critically and analytically, and be able to determine and use appropriate learning resources (Hotimah, 2020). In line with the statement Suparman (dalam Ariyani dkk, 2021) states that problem-based learning is a learning strategy model in which students collaboratively solve problems and reflect on their experiences. Therefore, the problem-based learning model is designed to help students develop critical thinking and problem-solving skills, as well as foster independence in their learning.

Apart from using a good learning model approach, teaching materials are also a supporting factor in achieving students' understanding of mathematical concepts. According to Panen (dalam Nuryasana, 2020) revealed that teaching materials are materials or subject matter that are systematically arranged, which are used by teachers and students in the learning process. Therefore, to support the problem regarding the lack of understanding of mathematical concepts in the material of plane figures, the Problem Based Learning model can be used with the teaching materials "BangDat" which includes material on the concept of plane figures as well as interesting and non-monotonous visualizations. This teaching material also serves as an alternative learning so that teachers do not have to rely on textbooks.

2. METHODS

The research design that will be used is a pre-experimental one-group pretest-posttest design, which is an experimental research design that provides an initial test (pretest) before the learning treatment is given. After the treatment is given, a final test (posttest) is held to measure the extent to which the results are applied (Ulya etc, 2024). The description of the one-group pre-test post-test design is as follows:

Table 1. Desain *Pre-Experimental*

Group	*Pre-test*	Treatment	*Post-test*
Experiment	O1	X	O2

Information:

O1 = Pre-test value (before being given treatment) of the experimental group.

X = Treatment using the "Misi BangDat" Teaching Material based on Problem Based Learning.

O2 = Post-test value (after being given treatment) of the experimental group.

The population in this study were second-grade elementary school students at a public elementary school in West Bandung Regency, with the sample being drawn using a purposive sampling technique. The research instrument used was a pretest-posttest to assess students' mathematical concept comprehension. The instruments used were pre-test and post-test, consisting of five questions that had undergone validity and reliability testing. Data analysis was conducted using descriptive statistics to describe the sample data, and inferential statistics to draw conclusions from the research results.

3. RESULTS AND DISCUSSION

3.1 Results

This research was conducted in an elementary school involving 24 second-grade students as a sample. The study aimed to measure the effectiveness of Problem-Based Learning (PBL)-based teaching materials in improving students' understanding of mathematical concepts, particularly plane figures. The research process began with a validity and reliability test of the instrument to ensure the measuring tool used could provide valid results. Next, students were given a pre-test to determine their initial level of understanding of the material that was the focus of the study. The pre-test results showed that students' initial understanding of plane figures was still low. After that, the PBL-based teaching materials developed by the researcher and implemented as a treatment, followed by a post-test to evaluate the effectiveness of the learning. Data from the pre-test and post-test were processed using the SPSS Statistics program version 29 to obtain a comprehensive picture of the research results.

Table 2. Student Pre-Test Score Results

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
pretest	24	40	70	57.29	7.220
Valid N (listwise)	24				

Based on Table 2, the sample size for the pre-test was 24 students. The minimum score obtained from the pre-test was 40, and the maximum score was 70. The average score from the pre-test was 57.29. Furthermore, to see the students' scores after the treatment, the descriptive statistics for the post-test results are presented in Table 3.

Table 3. Student Post-Test Score Results

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Postest	24	70	100	82.29	8.073
Valid N (listwise)	24				

Based on Table 3, the number of students who completed the post-test was 24, the same number as the students who completed the pre-test. The minimum score obtained from the post-test was 70, and the maximum score was 100. The average post-test score obtained by the students was 82.29. The improvement in student scores for each indicator can be seen in the diagram below

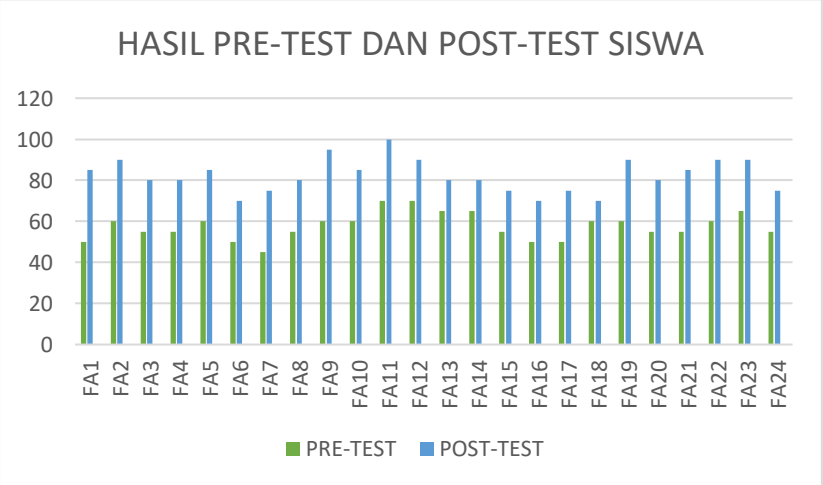

Figure 1. Diagram of Pre-test & Post-test Results

Based on diagram 1, it can be seen in the graph of the pre-test and post-test results of 24 grade II elementary school students above, it can be seen that there has been an increase in students' conceptual understanding of the material on flat shapes.

Next, to assess the effectiveness of the PBL approach on students' mathematical conceptual understanding, a mean difference test was conducted on the pre-test and post-test scores. However, prior to this, normality and homogeneity tests were conducted as prerequisites for conducting the mean difference test. This was to determine whether the pre-test and post-test scores were normally distributed.

Table 4. Normality Test Results

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.163	24	.097	.945	24	.206
Postest	.153	24	.149	.949	24	.260

a. Lilliefors Significance Correction

Table 4 presents the pre-test and post-test significance values of mathematical concept understanding based on the Shapiro-Wilk normality test, which are 0.206 and 0.260, respectively. Seeing the pre-test and post-test significance values are 0.206 > 0.05 and 0.260 > 0.05, it can be concluded that the results of the pre-test and post-test of students' conceptual understanding ability on the material of plane figures are normally distributed. Therefore, a homogeneity test is necessary because the pre-test and post-test data meet the assumption of normal distribution.

Table 5. Results of Homogeneity Test

Tests of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Hasil	Based on Mean	1.558	1	46	.218
	Based on Median	.935	1	46	.339
	Based on Median and with adjusted df	.935	1	40.925	.339
	Based on trimmed mean	1.495	1	46	.228

Table 5 shows that the homogeneity test results for the pre-test and post-test scores for students' mathematical concept understanding were 0.228 > 0.05, indicating that the students' pre-test and post-test scores varied homogeneously.

Next, a gain normality test was conducted to determine the extent of the increase in pre-test scores relative to the post-test scores and the effectiveness of the treatment.

Table 6. Test *N-Gain*

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Ngain_Skor	24	69	98	80.87	7.822
Ngain_Persen	24	6850	9767	8087.03	782.191
Valid N (listwise)	24				

The table above shows that the N-Gain score obtained was 80.87%. Based on the N-Gain criteria, this result is in the range of N-Gain g > 0.7, which can be said to be in the high category. It can be concluded that the "Misi BangDat" teaching material based on Problem Based Learning is effective in improving the ability to understand mathematical concepts of second-grade elementary school students on the material of flat shapes.

3.2 Discussion

Based on the explanation above, it can be seen that the descriptive statistical analysis presented in Table 2 shows the average pre-test score of 57.29. The results indicate that most of the samples have not reached this average score. It can be seen in diagram 1 that the average score of students' mathematical concept understanding ability during the pre-test is

also still low. This is because students have not mastered the indicators of mathematical concept understanding ability. Indicators of mathematical concept understanding according to Bardini (in Nurani et al., 2021) are (1) restating a concept; (2) classifying objects according to certain properties; (3) presenting concepts in various forms of mathematical representation; (4) explaining the relationship between one concept and another and (5) applying concepts in problem solving. Learning mathematics takes into account many factors, including the abilities, readiness of teachers and students or student conditions. In addition to these factors, there is a factor that is no less important and can influence students' conceptual understanding, namely the learning model. In line with Setiawan (in Sitepu et al., 2022), a learning model is a process pattern used as a guideline in planning learning activities. This means that learning models are highly influential as plans that will be implemented in the learning process.

Based on table 3, it can be seen that the results of the post-test scores of students obtained a minimum score of 70 and a maximum score of 100. From this statement, it can be seen that the lowest score in the post-test is much higher than that of the pre-test. Based on descriptive statistics, it can be seen that the average score of students' conceptual understanding ability during the post-test was 82.29, which indicates that there was an increase in the average post-test score compared to the previous average pre-test score. After students received treatment, their mathematical conceptual understanding ability was in the very good category. Then, based on the results of the N-Gain test, a score of 80.87 was obtained which is in the high effectiveness category. Therefore, the "Misi BangDat" teaching material based on Problem Based Learning is very effective in improving students' mathematical conceptual understanding ability in the material of flat shapes.

5. CONCLUSION

This study shows that the "Misi BangDat" teaching material based on Problem-Based Learning (PBL) is effective in improving the understanding of mathematical concepts of second-grade elementary school students on the material of plane figures. This is evidenced by an increase in the average pre-test score of 57.29 to an average post-test score of 82.29, as well as an N-Gain score of 80.87% which is included in the high category. The use of Problem-Based Learning-based teaching materials helps students understand the material of plane figures more interactively and contextually through a problem-based approach. This method also facilitates students to think critically, work together, and apply mathematical concepts independently. Attractive visualizations in the "Misi BangDat" teaching material also support the effectiveness of learning, making abstract concepts easier to understand. The results of this study provide implications that the Problem-Based Learning-based learning approach, supported by systematically designed teaching materials, can be a solution in improving students' understanding of mathematical concepts.

6. REFERENCES

Annisa, C. N., Fitriani, A. D., & Mufliva, R. Bahan Ajar "Misi Pian" Berbasis PMRI sebagai Upaya Meningkatkan Pemahaman Konsep Matematis Siswa. In *Social, Humanities, and Educational Studies (SHES): Conference Series* (Vol. 7, No. 3). https://doi.org/10.20961/shes.v7i3.91597

Ariyani, O. W., & Prasetyo, T. (2021). Efektivitas model pembelajaran problem based learning dan problem solving terhadap kemampuan berpikir kritis siswa sekolah dasar. *Jurnal Basicedu*, *5*(3), 1149-1160. https://doi.org/10.31004/basicedu.v5i3.892

Farhana, S., Amaliyah, A., Safitri, A., & Anggraeni, R. (2022). Analisis persiapan guru dalam pembelajaran media manipulatif matematika di sekolah dasar. *Educenter: Jurnal Ilmiah Pendidikan*, *1*(12), 892-896. https://doi.org/10.55904/educenter.v1i12.171

Febriyani, A., Hakim, A. R., & Hakim, N. (2022). Peran Disposisi Matematis terhadap Kemampuan Pemahaman Konsep Matematika. *Plusminus: Jurnal Pendidikan Matematika*, *2*(1), 87-100. https://doi.org/10.31980/plusminus.v2i1.1087

Friantini, R. N., Winata, R., Annurwanda, P., Suprihatiningsih, S., Annur, M. F., & Ritawati, B. (2020). Penguatan konsep matematika dasar pada anak usia sekolah dasar. *Jurnal Abdimas Bina Bangsa*, *1*(2), 276-285. https://doi.org/10.46306/jabb.v1i2.55

Hotimah, H. (2020). Penerapan metode pembelajaran problem based learning dalam meningkatkan kemampuan bercerita pada siswa sekolah dasar. *Jurnal edukasi*, *7*(2), 5-11. https://doi.org/10.19184/jukasi.v7i3.21599

Nurani, M., Riyadi, R., & Subanti, S. (2021). Profil pemahaman konsep matematika ditinjau dari self efficacy. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *10*(1), 284-292. http://dx.doi.org/10.24127/ajpm.v10i1.3388

Nuryasana, E., & Desiningrum, N. (2020). Pengembangan bahan ajar strategi belajar mengajar untuk meningkatkan motivasi belajar mahasiswa. *Jurnal Inovasi Penelitian*, *1*(5), 967-974. https://dx.doi.org/10.47492/jip.v1i5.177

Riyadi, D., Mufliva, R., Ramadhan, F., & Suherman, S. F. A. (2025). STRATEGI PEMBELAJARAN BERDIFERENSIASI DALAM PENDIDIKAN PANCASILA DI SEKOLAH DASAR: TINJAUAN LITERATURE SISTEMATIS. *Awwaliyah: Jurnal Pendidikan Guru Madrasah Ibtidaiyah*, *8*(2). https://doi.org/10.58518/awwaliyah.v8i2.3433

Sengkey, D. J., Sampoerno, P. D., & Aziz, T. A. (2023). Kemampuan Pemahaman Konsep Matematis: Sebuah Kajian Literatur. *Griya Journal of Mathematics Education and Application*, *3*(1), 67-75. https://doi.org/10.29303/griya.v3i1.265

Sitepu, M., Napitupulu, R. P., & Sidabutar, Y. A. (2022). Pengaruh Model Pembelajaran Kooperatif Tipe Teams Games Tournament (TGT) terhadap Hasil Belajar Siswa pada Subtema 2 Pentingnya Makanan Sehat bagi Tubuh Kelas V SD. *Jurnal Pendidikan dan Konseling (JPDK)*, *4*(5), 6599-6606. https://doi.org/10.31004/jpdk.v4i5.7757

Ulya, H., & Reffiane, F. (2024). Pengaruh Model Pembelajaran Problem Based Learning Terhadap Hasil Belajar Matematika Kelas I SDN Sawah Besar 01. *Innovative: Journal Of Social Science Research*, *4*(2), 595-601. https://doi.org/10.31004/innovative.v4i2.9361

Utaminingsih, S. (2022). The Effectiveness of Guided Inquiry on Understanding Mathematical Concepts. *ANP Journal of Social Science and Humanities*, *3*, 70-76. https://doi.org/10.53797/anp.jssh.v3sp2.9.2022

Wiryanto, W. (2020). Proses pembelajaran matematika di sekolah dasar di tengah pandemi covid-19. *Jurnal Review Pendidikan Dasar: Jurnal Kajian Pendidikan Dan Hasil Penelitian*, *6*(2), 125-132. https://doi.org/10.26740/jrpd.v6n2.p125-132