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EFFECTIVENESS OF PROBLEM BASED LEARNING ASSISTED BY POWERPOINT MEDIA ON STUDENTS' MATHEMATICAL PROBLEM-SOLVING ABILITY IN JUNIOR HIGH SCHOOL

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ABSTRACT

This study aims to examine the effectiveness of the Problem Based Learning (PBL) model assisted by PowerPoint media in mathematics learning for seventh-grade students at SMP Negeri 1 Puding Besar, particularly in improving students' mathematical problem-solving ability. This study employed a pre-experimental research design using a one-group posttest-only approach. The participants consisted of 29 students from class VII.A. Data were collected through observation sheets, questionnaires, and a posttest. Data analysis was conducted using percentage analysis to evaluate student activities, learning outcomes, and learning attitudes. The results showed that the overall effectiveness of the PBL model assisted by PowerPoint media reached 82.7%, which falls into the very effective category. This effectiveness is supported by high levels of student activity, satisfactory learning completeness, and positive student responses. The findings indicate that the integration of PBL with visually supported PowerPoint media encourages active engagement and collaborative problem-solving, which are essential components in developing students' mathematical problem-solving skills.

ABSTRAK

Penelitian ini bertujuan untuk mengetahui efektivitas penerapan model pembelajaran *Problem Based Learning* (PBL) berbantuan media PowerPoint dalam pembelajaran matematika siswa kelas VII SMP Negeri 1 Puding Besar ditinjau dari aktivitas, hasil belajar, serta respons atau sikap siswa dalam pembelajaran. Pengumpulan data diperoleh melalui observasi, kuesioner, dan tes. Data yang terkumpul kemudian dianalisis menggunakan teknik analisis statistik persentase skor dengan tabel efektivitas penerapan model. Berdasarkan hasil penelitian, ditemukan bahwa efektivitas penerapan model *Problem Based Learning* berbantuan media PowerPoint dalam pembelajaran matematika pada siswa kelas VII A SMP Negeri 1 Puding Besar ditinjau dari tiga aspek—yaitu aktivitas, ketuntasan belajar, serta respons atau sikap siswa—

memperoleh nilai efektivitas sebesar 82,7% dengan kategori 'Sangat Efektif'. Secara perinci, aktivitas siswa tergolong aktif, ketuntasan belajar siswa tergolong baik, dan respons atau sikap siswa menunjukkan tanggapan yang positif.

Introduction

Rapid advancements in science and technology significantly impact life, as they require the ability to obtain, manage, and apply knowledge proportionally. This capability demands systematic, logical, and critical thinking, which is developed through mathematics education (Jamil et al., 2024). Mathematics is the foundation of modern technology and plays a vital role in advancing human reasoning and various scientific disciplines (Haratua et al., 2025).

According to the Decree of the Minister of National Education No. 41 of 2007 regarding process standards, the learning process must be flexible, varied, and meet established standards to nurture student potential. Learning at every primary and secondary education unit should be inspiring, enjoyable, and motivating, providing students with opportunities to be active, creative, and independent according to their talents, interests, and physical and psychological development. Iswara (2024) stated that to master core competencies, learning must be student-centered by providing experiences related to real life; thus, teachers must select relevant models to ensure active student involvement. However, (Setiawati et al., 2024) argue that students' problem-solving abilities remain low, suggesting that teachers should provide more varied and innovative lessons.

Low problem-solving ability often stems from students only listening, watching, and taking notes, which results in a lack of interaction during the lesson (Nalurita & Jayanti, 2024). A learning model widely trusted for improving problem-solving is Problem-Based Learning (PBL).

Problem-Based Learning is a model that actively involves students in solving problems using their existing skills based on scientific concepts and disciplines (Darwati & Purana, 2021). Similarly, (Fitriani et al., 2025) state that PBL uses real-world problems as a context for students to think critically, solve issues, and gain knowledge focused on specific subject concepts. In this model, students are active participants in analyzing cases, while the teacher acts only as a facilitator and consultant. To ensure students enjoy the process, teachers must provide services that facilitate learning through engaging activities, such as the use of learning media.

Media is a supporting factor in education that serves as a tool to deliver material, stimulate creativity, increase effectiveness, and achieve learning objectives (Masdar et al., 2024). In terms of cognitive development, junior high

school students (aged 11-12) are in a transition from concrete to formal operational thinking. Since they cannot yet think entirely abstractly, learning media is essential to support their cognitive understanding. Wulandari (2022) notes that learning media, such as Microsoft PowerPoint, can improve student learning outcomes.

PowerPoint is a learning medium capable of enhancing student achievement (Amalida & Halimah, 2023). It is an application that creates interactive slide presentations, allowing material to be displayed more effectively and professionally. Often, teachers rely only on conventional media or textbooks, causing students to become bored and uninterested (Yuniarti et al., 2023). Therefore, PowerPoint can be upgraded into a more interactive medium to increase student interest.

Interactive PowerPoint can feature various menus, such as materials, videos, images, and quizzes, which facilitate two-way interaction between teachers and students (Putri, 2024). This tool makes material delivery easier and encourages student involvement (Rosyada et al., 2025). Research by Sutriyani (2025) on the effectiveness of PBL assisted by animation media found a significant increase in mathematics achievement. Consequently, the objective of this study is to determine the effectiveness of implementing the Problem-Based Learning model assisted by interactive PowerPoint media.

Although several studies have examined the effectiveness of Problem Based Learning and the use of instructional media in mathematics education (Setiawati et al., 2024; Sutriyani, 2025), most previous research focused either on PBL without emphasizing digital presentation media or on PowerPoint usage without integrating problem-based instructional stages. The originality of this study lies in examining the effectiveness of combining PBL with PowerPoint media to specifically support students' mathematical problem-solving ability through visual problem presentation and structured group discussion. This integration is expected to provide a more comprehensive learning experience by addressing both cognitive and motivational aspects of mathematics learning.

Method

This study employed a pre-experimental design, specifically a one-group posttest-only design, as no control group was involved. The type of research used is Pre-Experimental Design. A pre-experimental design is a design where external variables may still influence the dependent variable, meaning the experimental results—expressed as the dependent variable—are not solely influenced by the independent variable (Albina, 2025). The specific experimental design employed is the One-Shot Case Study using a single experimental class.

This research was conducted at SMP Negeri 1 Puding Besar. The population consisted of seventh-grade students in the odd semester of the 2022/2023 academic year. The sample was selected using purposive sampling, which is a technique for determining samples based on specific considerations (Septian & Rahayu, 2021). Consequently, class VIIA, consisting of 29 students, was selected as the sample.

For data collection, the researcher utilized test sheets, questionnaires, and observation sheets. Before administering the tests and questionnaires, a trial run was conducted. The instruments were then analyzed for validity, reliability, discriminating power, and difficulty level. Once tested, these items were used as post-test instruments to measure student learning outcomes. The test was administered after the experimental class received the treatment. There are four data analysis techniques used: analysis of test results, questionnaires, observations, and the effectiveness of the model's application. Data were measured using the following percentage formula:

$$\text{Individual Aspect Percentage } P = (f / N) \times 100\%$$

The results were obtained by calculating the score percentages according to the following criteria intervals (see Table1).

Table 1
Criteria intervals

Percentage	Qualification
< 20%	Ineffective
21% - 40%	Less Effective
41% - 60%	Fairly Effective
61% - 80%	Effective
81% - 100%	Very Effective

To calculate the overall effectiveness, the following formula was used:

$$E = (n / JS) \times 100\%$$

description:
E: Effectiveness percentage
n: Number of students who meet the criteria across three aspects (High Activity, Learning Mastery, and Positive Attitude).
JS: Total number of samples (Total Students).

Results and Discussion

This research was conducted over four meetings: three meetings for the implementation of the PBL model and one meeting for the learning outcomes test and student attitude data collection. The implementation process followed these stages:

1. Planning stage

2. Refinement stage
3. Implementation and evaluation stage

The data obtained during the study were calculated as percentage scores and analyzed. The description of the analysis results for the Problem-Based Learning model assisted by PowerPoint media is presented in Table 2.

Table 2
The results for the Problem-Based Learning

Interval	Criteria	Attitude	Learning Outcomes	Meeting Test		
				1	2	3
0 – 20	Very Poor	0%	0%	0%	0%	0%
21 – 40	Poor	0%	3,4%	3,4%	0%	3,4%
41 – 60	Fair	0%	0%	13,8%	10,3%	10,3%
61 – 80	Good	58,6%	62%	41,4%	48,2%	31%
81 - 100	Very Good	41,3%	34,4%	41,4%	41,4%	55,1%

Based on Table 2, tests were conducted at each meeting to measure students' ability to understand the material during the implementation of the learning model. For the post-test (learning outcomes), data were analyzed by scoring student answer sheets according to the established guidelines. The average percentage of student learning outcomes was 75, placing it in the "Good" category. Student attitudes and responses were collected through a questionnaire consisting of 14 statements.

Student activity data were obtained through observation sheets and analyzed based on the observers' assessments. The average analysis of student activity is shown in Table 3. As shown on Table 3, the average student activity during the learning process was 71.75%, categorized as "High."

Table 3
The average analysis of student activity

Indikator	Meeting			Indicator Average	Total
	1	2	3		
Visual activity	83,6	82,8	85,3	83,9	71,75
Oral activity	60,3	58,6	57,8	58,9	
Writing activity	85,3	89,7	94,0	89,6	
Emotional activity	54,3	56,9	52,6	54,6	
Average Score	70,9	72,0	72,4		71,75
Category					High

The percentages for activity, student response, and learning outcomes are analyzed in the effectiveness Table 4.

Table 4
The percentages for activity, student response, and learning outcomes are analyzed in the effectiveness

Interval	Activity	Learning Outcomes	Attitude
81 – 100	7	10	12
61 – 80	22	3+14	17+5
41 – 60	0	0	0
21 – 40	0	1	0
0 – 20	0	0	0

The effectiveness of mathematics learning using the Problem-Based Learning model assisted by PowerPoint media reached 82.7%. This value falls within the interval of 80% < P < 100, indicating that the application is "Very Effective".

The study measured effectiveness through three aspects: learning outcomes, observations, and questionnaires. The results show that the PBL model assisted by PowerPoint media makes students more interested in mathematics and more attentive to explanations. Students did not feel pressured; instead, they engaged in group activities to find solutions, fostering positive interaction and communication between students and the teacher. This aligns with Marjuki (2020), who defines PBL as a model that involves students actively in solving problems using their abilities based on scientific concepts.

The results indicate that students' learning activities reached a high category, suggesting that the PBL model assisted by PowerPoint media successfully promoted active participation. This finding is consistent with Setiawati et al. (2024), who reported that PBL encourages students to actively engage in problem analysis and discussion. However, this study extends previous findings by showing that the visual elements of PowerPoint, such as videos, images, and structured problem presentations, played a significant role in capturing students' attention and facilitating understanding.

Compared to Sutriyani (2025), who found that PBL assisted by animation media significantly improved learning outcomes, this study demonstrates that PowerPoint media, when designed interactively, can serve a similar function by enhancing visualization and contextualization of mathematical problems. The increased student activity observed in this study is likely influenced by two main factors: (1) the collaborative group discussion inherent in the PBL model, and (2) the visual nature of PowerPoint media that helped students better understand problem situations.

The use of PowerPoint to present problem-based videos successfully attracted student interest. Students were able to connect mathematical problems to everyday life and solve them using their own ideas. During the process, the researcher acted as a facilitator, assisting groups that encountered difficulties. Additionally, three observers helped monitor student activities to ensure a comprehensive assessment.

In conclusion, the implementation of PBL at SMP Negeri 1 Puding Besar is categorized as very effective, evidenced by high student activity, complete learning outcomes, and positive student attitudes. Furthermore, positive student responses indicate that the learning environment was perceived as engaging and less stressful. This supports the argument that PBL shifts the learning focus from teacher-centered instruction to student-centered problem-solving, allowing students to construct knowledge actively.

Conclusion

The results of this study indicate that the PBL model supported by PowerPoint media is highly effective in mathematics learning, as reflected by an effectiveness score of 82.7%. This study makes a meaningful contribution to mathematics education by showing that the integration of problem-based instructional approaches with visual presentation media can enhance students' mathematical problem-solving skills, increase learning engagement, and cultivate positive learning attitudes. Therefore, mathematics teachers are encouraged to integrate PBL with interactive digital media to support students' cognitive development and active participation in the classroom. Despite these findings, this study has several limitations. The research was conducted within a limited sample size and in a specific educational context, which may restrict the generalizability of the results. In addition, the use of PowerPoint as the primary digital medium limits the scope of technological variation examined in this study. Future research is recommended to involve larger and more diverse samples, explore different educational levels, and examine the effectiveness of PBL when integrated with other interactive digital media or emerging technologies. Longitudinal studies may also be conducted to investigate the long-term impact of PBL-assisted digital media on students' mathematical achievement, learning motivation, and higher-order thinking skills.

Declarations

Author contribution. ERR: resources, visualization, writing–original draft, editing, project administration; writing–review & editing; DL: conceptualization, data

curation, methodology, validation; All authors agreed with the results and conclusions The contribution or credit of the author must be stated in this section.

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