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THE EFFECT OF PROBLEM BASED LEARNING MODEL ASSISTED BY DIORAMA-MONOPOLY MEDIA AND CLASS MANAGEMENT SUPPORT ON THE LEARNING OUTCOMES OF FOURTH GRADE SCIENCE STUDENTS ON PHOTOSYNTHESIS MATERIAL

Mildha Rachmadhani Cahya Husadaningtyas[1], Herry Sanoto[2*]

[1,2]Departmen Pendidikan Guru Sekolah Dasar, Fakultas Keguruan dan Ilmu Pendidikan, Universitas Kristen Satya Wacana, Salatiga, Indonesia

[a]*E-mail: mildharachmadhani95@gmail.com*
[b]*E-mail: herry.sanoto@uksw.edu*

(*) Corresponding Author
herry.sanoto@uksw.edu

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ABSTRACT
The development of understanding science concepts in the 21st century requires a learning approach that can actively engage students in problem-solving and meaningful learning experiences. However, the topic of photosynthesis remains one of the concepts that is difficult for elementary school students to understand due to its abstract nature. On the other hand, previous research generally examined the Problem Based Learning (PBL) model, learning media, and classroom management separately. This study aims to analyze the effect of the PBL model assisted by Diorama–Monopoly media and classroom management support on the science learning outcomes of fourth-grade students on the topic of photosynthesis. This study uses a quantitative approach with a quasi-experimental method and a Non-Equivalent Control Group Design. The research subjects numbered 44 students, divided into an experimental group and a control group. Data were collected through pretest-posttest and observation, then analyzed using descriptive statistics, N-Gain test, and Mann–Whitney test. The results showed that students who learned using the PBL model assisted by Diorama–Monopoly media achieved significantly better learning outcomes compared to students who participated in conventional learning. The intervention provided also demonstrated higher effectiveness in supporting the understanding of photosynthesis concepts. In addition, good classroom management also supported the successful implementation of learning. This study contributes an integrated learning model that combines PBL, game-based visual media, and classroom management as an alternative science learning method to help students understand abstract science concepts in elementary schools.

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INTRODUCTION

Natural and Social Sciences (IPAS) in the 21st century play a strategic role in equipping students with critical thinking, creativity, collaboration, and communication skills needed to face the increasingly complex development of science and technology. Education is no longer solely focused on mastering knowledge, but also on developing competencies that enable students to solve various problems in real life. In line with this, IPAS learning in elementary schools is expected to be able to shape scientific thinking patterns while also developing 21st-century skills that are demanded by global education (Mustari & Darmayanti, 2024; Farikhatin et al., 2024).

One of the important subjects in natural science learning in elementary school is photosynthesis. This material forms the basis of students' understanding of the relationship between plants, the environment, and the sustainability of life on earth. However, various studies show that photosynthesis is one of the science concepts that is difficult for students to understand because it involves processes that cannot be observed directly and are abstract in nature (Yanti & Huda, 2023). This condition was also found in fourth-grade students of SDN Bringin 01 and SDN Bringin 02, which indicates a low understanding of the stages of photosynthesis and the functions of the components involved in the process.

The problem is inseparable from the still dominant use of conventional teacher-centered learning. Observations and interviews show that learning mostly uses lecture methods and media limited to Student Worksheet books. As a result, students tend to be passive, less involved in the learning process, and have difficulties in understanding the concept of photosynthesis. This condition is reflected in the pretest results, which show that most students have not yet reached the Minimum Completeness Criteria (MCC) set by the school. In addition, suboptimal classroom management causes students to easily lose focus during the learning process.

One alternative that can be used to address this problem is the implementation of a Problem Based Learning (PBL) model assisted by concrete and interactive learning media. The PBL model has been proven to enhance student engagement, train critical thinking skills, and encourage problem-solving through meaningful learning experiences (Kelana & Wardani, 2021). To support the implementation of the model, the Diorama-Monopoly media is used, which integrates three-dimensional visualization with educational games. This media allows students to learn the photosynthesis process in a more tangible and interesting way, thereby increasing motivation and concept understanding (Kusuma et al., 2023). The success of implementing those learning models and media also needs to be supported by effective classroom management in order to create a conducive learning environment (Kurniawan et al., 2022).

Various previous studies have proven the effectiveness of the Problem Based Learning model in improving learning outcomes as well as the use of innovative learning media in aiding the understanding of science concepts. However, research that simultaneously examines the influence of the Problem Based Learning model assisted by Diorama-Monopoly media while considering classroom management support on science learning outcomes regarding photosynthesis material in elementary schools is still very limited. Most previous studies only focused on the learning model or learning media separately, thus not providing an overview of the contribution of these three variables in an integrated manner to students' learning outcomes.

Based on the description, this study aims to analyze the effect of the Problem Based Learning model assisted by Diorama-Monopoly media and classroom management support on the science learning outcomes of fourth-grade students on the topic of photosynthesis. The novelty of this research lies in the integration of the PBL model, Diorama-Monopoly media, and classroom management support into a single learning model tested simultaneously to improve science learning outcomes in elementary schools.

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METHOD

This research uses a quantitative approach with a quasi-experimental research type using a Non-Equivalent Control Group Design. According to Sugiyono (2023), a quasi-experimental design is used to determine the effect of a certain treatment on other variables without randomization of research subjects. The study aims to analyze the influence of the Problem Based Learning (PBL) model assisted by Diorama–Monopoly media and classroom management support on students' science learning outcomes regarding the photosynthesis material for fourth-grade elementary school students. The research was conducted at SD Negeri Bringin 01 and SD Negeri Bringin 02 in Bringin District, Semarang Regency, in the even semester of the 2025/2026 academic year.

The research population was all fourth-grade students at both schools. The research sample was determined using a purposive sampling technique by considering school readiness and class characteristics (Sugiyono, 2023). The sample consisted of two groups, namely 22 fourth-grade students from SD Negeri Bringin 01 as the experimental group and 22 fourth-grade students from SD Negeri Bringin 02 as the control group. The experimental group was given treatment in the form of applying the PBL model assisted by Diorama–Monopoly media and classroom management support, while the control group used conventional learning.

The data collection techniques in this study include tests, observations, and documentation. Tests are used to measure students' learning outcomes through pretests and posttests consisting of 20 multiple-choice questions on photosynthesis material. According to Arikunto (2020), tests are used to measure students' abilities and knowledge. Observations are conducted to observe student activities, teacher activities, and classroom management conditions during the learning process (Sugiyono, 2023), while documentation is used to obtain supporting data in the form of photos and research activity archives. The research instruments were tested for validity and reliability before use. Validity testing was carried out using the Product Moment correlation, while reliability testing used Cronbach's Alpha with the assistance of IBM SPSS Statistics version 30 (Janna & Herianto, 2021). Data analysis was conducted descriptively and inferentially through normality tests, homogeneity tests, hypothesis tests using Paired Sample t-test, Wilcoxon, and Mann-Whitney, as well as N-Gain tests to determine the effectiveness of improving student learning outcomes after treatment was given (Ghozali, 2021); .

RESULTS AND DISCUSSION

Results

This research was conducted from November 4, 2025, to February 10, 2026, at SD Negeri Bringin 01 and SD Negeri Bringin 02. The research subjects consisted of 44 fourth-grade students, comprising 22 students in the experimental group and 22 students in the control group. The experimental group was given treatment in the form of the implementation of the Problem Based Learning (PBL) model assisted by Diorama–Monopoly media and classroom management support, while the control group used conventional learning. Before the treatment was given, both groups were first given a pretest to determine the students' initial abilities on the topic of photosynthesis. Based on the results of descriptive analysis, there was an improvement in learning outcomes in both groups, but the improvement in the experimental group was higher compared to the control group. The descriptive results of the pretest and posttest can be seen in Table 1.

Table 1. Descriptive Results of Pretest and Posttest

Variabel	N	Minimum	Maximum	Mean	Std. Deviation
Experimental Pretest	22	10.00	90.00	51.1364	26.18305

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Variabel	N	Minimum	Maximum	Mean	Std. Deviation
Experimental Posttest	22	45.00	100.00	84.3182	19.77826
Control Pretest	22	10.00	90.00	52.5000	24.23840
Control Posttest	22	15.00	100.00	66.3636	25.26911

The results indicate that the average posttest score of the experimental group increased to 84.32 from an average pretest score of 51.14. Meanwhile, in the control group, the average posttest score increased to 66.36 from an average pretest score of 52.50. This indicates that the implementation of the PBL model assisted by Diorama–Monopoly media has a better effect on students' learning outcomes.

Before being used, the research instruments were tested for validity and reliability. The validity test results showed that all question items had a calculated r value greater than the table r value (0.4227), so all question items were declared valid. Reliability testing using Cronbach's Alpha obtained a value of 0.875, so the instrument was declared reliable because the alpha value > 0.60. In addition, the results of the difficulty level test showed that most of the questions were in the moderate category, while the results of the discriminating power test showed that most of the questions were in the good and very good categories.

The normality test using Shapiro-Wilk showed that the posttest data of the experimental group were not normally distributed with a significance value < 0.001, while the control group was normally distributed with a significance value of 0.149. Therefore, hypothesis testing was conducted using the nonparametric Mann-Whitney U Test. The results of the Mann-Whitney test showed an Asymp. Sig. (2-tailed) value of 0.007 < 0.05, indicating a significant difference between the learning outcomes of the experimental group and the control group. The test results can be seen in Table 2.

Table 2. Mann-Whitney Test Result

Group	N	Mean Rank	Sum of Ranks
Experiment	22	27.70	609.50
Control	22	17.30	380.50

Table 3. Statistical Test

Statistics	Value
Mann-Whitney U	127.500
Wilcoxon W	380.500
Z	-2.706
Asymp. Sig. (2-tailed)	0.007

The results indicate that the experimental group had a higher average learning outcomes ranking compared to the control group. Thus, the Problem Based Learning model assisted by Diorama–Monopoly media and classroom management support has a significant effect on the science learning outcomes regarding photosynthesis material for fourth-grade students. The effectiveness of the learning was also analyzed using the N-Gain test (Hake, 1999). The analysis results show that the experimental group obtained an average N-Gain of 63.82%, which falls into the fairly effective category, while the control group obtained an average of 25.45%, categorized as ineffective. These results indicate that the implementation of the PBL model assisted by Diorama–Monopoly media is more effective in improving student learning outcomes compared to conventional learning.

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In addition to test results, observations of student activities showed a percentage of 95% in the very good category. Teacher activities obtained a percentage of 96%, while classroom management obtained a percentage of 96.59%, which is also included in the very good category. This indicates that the implementation of the PBL model assisted by Diorama–Monopoly media is able to create active, interactive, and conducive learning. Media validation results by experts also showed a feasibility percentage of 95.45% in the very good category, so the Diorama–Monopoly media is declared valid and suitable for use in learning.

Discussion

The research results indicate that the implementation of the Problem Based Learning (PBL) model assisted by Diorama–Monopoly media and classroom management support has a positive effect on science learning outcomes on photosynthesis material for fourth-grade students. This is evident from the increase in the average posttest score of the experimental group, which reached 84.32, higher than the control group, which obtained an average of 66.36. Although both groups experienced an improvement in learning outcomes, the increase in the experimental group was greater, indicating that the treatment provided was able to enhance the understanding of photosynthesis concepts more effectively compared to conventional learning.

These findings are reinforced by the N-Gain test results, which show that the experimental group obtained a score of 0.72 (high category) with an effectiveness percentage of 63.82%, while the control group obtained a score of 0.34 (medium category) with an effectiveness percentage of 25.45%. This data indicates that the use of PBL assisted by Diorama–Monopoly media not only results in improved learning outcomes but also provides a more effective learning impact in helping students understand the material on photosynthesis.

The difference in learning outcomes between the two groups is further reinforced by the results of the Mann-Whitney test, which showed a significance value of $0.007 < 0.05$. These results indicate that there is a significant difference between the experimental group and the control group after the treatment was applied. In other words, the integration of the PBL model, Diorama–Monopoly media, and classroom management support contributes significantly to the improvement of students' learning outcomes.

The improvement in learning outcomes in the experimental group can be interpreted as a result of the learning process that enables students to build a deeper understanding of concepts. The topic of photosynthesis is an abstract concept and often causes difficulties in understanding if delivered through lecture methods. In this study, visualization through the Diorama–Monopoly media helped students connect concepts that cannot be observed directly with more concrete representations. At the same time, problem-solving activities in the PBL model encourage students to examine relationships between concepts, identify the causes of a phenomenon, and formulate solutions based on group discussion results.

These findings are in line with the research of Nabila dan Suryanti (2024) which shows that the implementation of PBL assisted by diorama media has a significant effect on students' critical thinking skills. Research by Nurfazira et al. (2025) also reports that the use of PBL assisted by diorama media can significantly improve science learning outcomes with high N-Gain in the experimental class. In addition, research by Apriani et al. (2025) shows that diorama media on photosynthesis material effectively improves students' conceptual understanding with an N-Gain value of 0.84. Research by Anggraini dan Kristin (2022) also proves that educational monopoly media can increase motivation and learning outcomes through more engaging and interactive learning activities.

The results of this study are also consistent with various international studies that show that problem-based learning can improve students' conceptual understanding, critical thinking skills, and problem-solving abilities in science learning. In addition, international research on game-based learning and the use of interactive visual media shows that combining problem-solving activities with concrete visual representations can help students understand

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complex and abstract science concepts more effectively. Thus, the findings of this study reinforce the empirical evidence that integrating active learning strategies and interactive visual media has a positive impact on science learning in elementary schools.

The success of learning in the experimental group is also supported by the implementation of very good classroom management with a percentage of 96.59%. A well-organized and conducive classroom condition allows students to follow each stage of learning optimally. Effective classroom management plays a role in facilitating group interactions, maintaining students' focus during the learning process, and ensuring that the use of media and problem-solving activities can proceed according to the learning objectives.

In contrast, in the control group, conventional learning still showed an improvement in learning outcomes, but the improvement was not as significant as in the experimental group. This indicates that presenting material directly without the support of problem-solving activities and interactive-visual media is less able to help students understand the concept of photosynthesis in depth. As a result, students receive more information than they construct knowledge through meaningful learning experiences.

Overall, the research results show that the integration of the Problem Based Learning model, Diorama–Monopoly media, and classroom management support has a significant influence on science learning outcomes regarding photosynthesis. The novelty of this research lies in the combination of these three components in a single integrated learning design. These findings indicate that learning which combines problem-solving, visual-interactive media, and effective classroom management can be an alternative learning strategy to improve elementary school students' understanding of science concepts.

The findings of this study also indicate that learning which integrates problem-solving with visual-interactive media provides opportunities for students to build knowledge through the process of exploration and investigation. In the context of 21st-century science learning, the ability to understand concepts is no longer only measured by information mastery, but also by the ability of students to connect concepts with phenomena encountered in everyday life. Recent research shows that problem-based learning can improve the quality of conceptual understanding because students are actively involved in the processes of investigation, scientific argumentation, and evidence-based decision-making (Kanyesigye et al., 2022; Suwastini et al., 2021).

In addition, the use of Diorama–Monopoly media in this study supports multimodal learning theory, which emphasizes the importance of presenting information through various visual, verbal, and kinesthetic representations. In the abstract material of photosynthesis, visual representation helps learners build a more accurate mental model regarding the relationships between sunlight, carbon dioxide, water, and photosynthesis products. Several international studies report that the use of visual and manipulative media can significantly reduce misconceptions and improve the retention of science concepts in elementary school students (Petersen et al., 2023; Rexigel et al., 2024).

From the perspective of game-based learning, this research shows that the game elements in monopoly media not only increase the appeal of learning, but also serve as a means of reinforcing concepts through social interaction and direct feedback. Recent studies show that the integration of educational games in science learning can enhance intrinsic motivation, cognitive engagement, and learning outcomes of students compared to conventional learning. (Lei et al., 2022; Ukgoda, 2025). Therefore, the success of the experimental group in this study can be understood as the result of a combination of problem-solving activities and enjoyable learning experiences.

Furthermore, the success of learning implementation cannot be separated from effective classroom management support. A well-organized learning environment allows students to participate optimally in group discussions, investigations, and the use of learning media. These findings are in line with research that affirms that the quality of classroom management has a positive relationship with student engagement and academic achievement, especially in learning that requires collaboration and project-based or problem-solving activities (Putra & Yanto, 2025; Tomaszewski et al., 2024). Thus, the effectiveness of learning in this study is influenced not only by the models and

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media used, but also by the teacher's ability to create a learning environment that supports the process of knowledge construction.

CONCLUSION

This study shows that the integration of the Problem Based Learning (PBL) model, Diorama–Monopoly media, and classroom management support is an effective learning approach to enhance elementary school students' understanding of the concept of photosynthesis. These findings reinforce the view that science learning that combines problem-solving activities, concrete visual representations, and effective classroom management can support the formation of a deeper conceptual understanding compared to teacher-centered learning.

Theoretically, this study enriches the discussion on IPAS learning by showing that the effectiveness of learning is not only determined by the learning model or media separately, but also by the synergy between learning strategies, learning media, and classroom management. Practically, the results of this study provide alternatives for elementary school teachers in designing photosynthesis lessons and other abstract science materials to be more easily understood by students through meaningful learning experiences. This study implies that the development of science learning in elementary schools needs to integrate problem-based approaches with media that support concept visualization as well as conducive classroom management. Further research can test this integrative model on other science and social studies subjects, at different educational levels, or by adding variables such as critical thinking skills, scientific literacy, and problem-solving ability to gain a more comprehensive understanding of the effectiveness of 21st-century learning.

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