Sosioedukasi
JURNAL ILMIAH ILMU PENDIDIKAN DAN SOSIAL
ISSN: 2086-6135 E-ISSN: 2541-612x
Volume 15 No. 2. June 2026 https://ejournal.unibabwi.ac.id/index.php/sosioedukasi/index

THE IMPLEMENTATION OF THE PROJECT-BASED LEARNING MODEL TO IMPROVE LEARNING OUTCOMES ON PLANE FIGURE CONCEPTS AMONG THIRD-GRADE STUDENTS AT SD GMIM PELELOAN

Marshanda Tumarar[1a*], Roeth A.O. Najoan[2b], Deysti Trifena Tarusu[3c]

[1,2,3] Pendidikan Guru Sekolah Dasar, Fakultas Ilmu Pendidikan Dan Psikologi, Universitas Negeri Manado, Indonesia

E-mail: marshandatumarar17@gmail.com[1]
roethnajoan@unima.ac.id[2]
deystitarusu@unima.ac.id[3]

Corresponding Author
marshandatumarar17@gmail.com

ARTICLE HISTORY
Received : 31-05-2026
Revised : 07-06-2026
Accepted : 30-06-2026

KEYWORDS
Project-Based Learning (PjBL); Plane Figures; Learning Outcomes;

ABSTRACT
This study aims to improve Grade III students' mathematics learning outcomes on plane figure material through the implementation of the Project-Based Learning (PjBL) model at SD GMIM Peleloan. The novelty of this study lies in the application of PjBL to help elementary students recognize, compare, classify plane figures, and calculate the number of sides and angles through project-based activities that connect mathematical concepts with concrete learning experiences. This study employed Classroom Action Research (CAR) using the Kemmis and McTaggart model, which consisted of two cycles. Each cycle included planning, action, observation, and reflection stages. The subjects were 8 Grade III students, consisting of 3 female and 5 male students. Data were collected through observation, tests, and documentation. The findings showed an improvement in teacher activity, student activity, and students' learning mastery. Students' learning outcomes increased from 60.62% in Cycle I to 92% in Cycle II. Teacher activity improved from 83.51% to 96.25%, while student activity increased from 63.81% to 95.29%. Classical learning mastery also increased from 50% in Cycle I to 87.5% in Cycle II. Therefore, the implementation of the PjBL model can improve students' learning outcomes and promote more active, meaningful, and student-centered mathematics learning.

This is an open access article under the CC–BY-SA license .

INTRODUCTION

Mathematics learning in elementary school plays an important role in developing students' logical thinking, problem-solving skills, and conceptual understanding. One of the basic mathematical topics that must be mastered by elementary students is plane geometry. Plane geometry introduces students to various two-dimensional shapes, such as squares, rectangles, triangles, and circles, including their properties, sides, angles, and vertices. Mastery of this material is important because it becomes the foundation for understanding more complex geometry concepts at the next level of education.

However, learning plane geometry is often challenging for elementary students. Plane figure concepts are not only related to recognizing shapes but also require students to compare, classify, and identify the characteristics of each shape. In Grade III, students are expected to understand the number of sides, angles, and vertices of plane figures. These concepts may be difficult to understand when learning is delivered only through verbal explanation or conventional lecture

Sosioedukasi
JURNAL ILMIAH ILMU PENDIDIKAN DAN SOSIAL
ISSN: 2086-6135 E-ISSN: 2541-612x
Volume 15 No. 2. June 2026 https://ejournal.unibabwi.ac.id/index.php/sosioedukasi/index

methods. Therefore, mathematics learning at the elementary level should be presented through concrete, contextual, and interactive activities that allow students to observe, manipulate, and construct mathematical ideas directly.

Based on the initial observation conducted in Grade III at SD GMIM Peleloan, students' learning outcomes in mathematics, particularly in plane figure material, were still relatively low. The observation showed that of the 10 students who participated in the learning process, only 4 students, or 40%, achieved the minimum mastery criterion (KKTP) of 75, while 6 students, or 60%, had not yet achieved mastery. Students experienced difficulties in recognizing types of plane figures and identifying the number of sides, angles, and vertices. This condition was influenced by the learning process, which was still dominated by teacher-centered instruction. The teacher mainly explained the material verbally, while students had limited opportunities to practice, explore objects, work collaboratively, or create learning products related to plane figures. As a result, students tended to be passive, less confident in asking or answering questions, and less able to visualize mathematical concepts concretely.

Several previous studies have shown that the use of appropriate learning models can improve students' mathematics learning outcomes and support conceptual understanding. Najoan et al. (2023) state that an appropriate learning model in mathematics learning can facilitate students' understanding of mathematical concepts at the elementary school level. Tarusu et al. (2020) also emphasize that learning should not only focus on cognitive achievement but also support character development, independence, and active participation. In addition, Project-Based Learning (PjBL) has been widely recognized as a learning model that encourages students to learn actively through projects, collaboration, problem solving, creativity, and meaningful learning experiences.

Although previous studies have discussed the effectiveness of learning models in improving mathematics learning outcomes, there is still a gap in studies that specifically examine the implementation of the Project-Based Learning model in plane figure material among lower-grade elementary students, especially in the context of Grade III students at SD GMIM Peleloan. Most learning practices in the observed classroom had not provided sufficient project-based activities that allowed students to directly identify, classify, and arrange plane figures into concrete products. Therefore, it is necessary to conduct classroom action research that applies PjBL as an effort to improve students' learning outcomes, activeness, collaboration, and conceptual understanding in plane geometry learning.

Project-Based Learning is considered relevant to overcome these problems because it places students as active learners. Through PjBL, students are not only asked to listen to explanations but are also involved in planning, creating, discussing, and presenting project results. In the context of plane figure material, students can learn by observing real objects, identifying plane figures, cutting and arranging shapes, and explaining the number of sides and angles. These activities are expected to help students understand mathematical concepts more concretely and meaningfully.

Based on the problems and literature gap described above, this study was conducted to implement the Project-Based Learning model in mathematics learning on plane figure material. Therefore, this classroom action research is entitled "The Implementation of the Project-Based Learning Model to Improve Learning Outcomes on Plane Figure Concepts among Grade III Students at SD GMIM Peleloan." This study aims to improve students' learning outcomes through project-based activities that are concrete, collaborative, and student-centered.

METHOD

The research method was implemented in the form of Classroom Action Research (CAR), referring to the research design proposed by Kemmis and McTaggart in Aqib Zainal (2013: 31). CAR consisted of two cycles, and each cycle applied four action components, namely: 1) planning stage, 2) action stage, 3) observation, and 4) reflection, within an interconnected spiral. The research subjects were Grade III students at SD GMIM Peleloan, totaling 8 students, consisting of 3 female students and 5 male students. The data collection techniques in this study included observation and learning outcome tests. Data analysis was conducted at the end of each cycle to evaluate the development of the learning process. In addition, observation data were also analyzed to examine students' skills and attitudes during the learning process. Data analysis techniques could be conducted after reviewing the data collected through tests, observation, and documentation. Sanjaya (2011: 106) states that data analysis is directed toward identifying and discovering the efforts made by teachers or researchers to improve the quality of students' learning processes and outcomes. Observation was used to obtain data on teacher and student activities during the learning process, while tests were used to measure students' learning outcomes in the cognitive aspect after the implementation of actions in each cycle.

The data obtained from observations and tests were analyzed using the formula for individual student learning mastery as follows:

Sosioedukasi
JURNAL ILMIAH ILMU PENDIDIKAN DAN SOSIAL
ISSN: 2086-6135 E-ISSN: 2541-612x
Volume 15 No. 2. June 2026 https://ejournal.unibabwi.ac.id/index.php/sosioedukasi/index

$$\text{Classical Mastery (\%)} = \frac{\text{Number of Students Achieving Mastery}}{\text{Total Number of Students}} \times 100\%$$

Learning is considered classically complete when the percentage of students' learning mastery reaches ≥ 75%.

Meanwhile, the calculation of observation data, including teacher activity in managing learning and student activity during learning activities, used the following formula:

$$\text{Mastery Percentage} = \frac{\text{Score Obtained}}{\text{Maximum Score}} \times 100\%$$

RESULT

Classroom Action Research (CAR) was conducted at SD GMIM Pieleloan with 8 students, consisting of 3 female students and 5 male students. This study applied the Project-Based Learning model. The time allocation for one meeting was 2 × 35 minutes. The discussion of the results in this study was carried out in collaboration with the classroom teacher, two observing teachers, and the principal, so that the research could be implemented properly.

Cycle I

At the planning stage, the researcher first conducted an initial observation and coordinated with the principal and the Grade III teacher to obtain permission and discuss the problems found in the classroom. Based on the results of the identification, the researcher then prepared a PjBL-based teaching module adapted to the characteristics of the students. In addition, the researcher also prepared learning tools in the form of teaching materials, learning media such as plane figure cutouts, tools and materials including scissors, glue, and drawing paper, student worksheets, as well as evaluation instruments complete with grids and answer keys. To support observation during the learning process, the researcher also prepared observation sheets for teacher and student activities.

Table 1. Results of Cycle I

Stage	Implementation	Findings/Notes
Planning	The researcher conducted initial observation, coordinated with the principal and Grade III teacher, and identified classroom problems. The researcher prepared a PjBL-based teaching module, teaching materials, plane figure cutouts, scissors, glue, drawing paper, student worksheets, evaluation instruments, answer keys, and observation sheets.	The planning stage was prepared based on students' needs and classroom conditions.
Action	The action was conducted on September 25, 2025, involving 8 Grade III students. The teacher opened the lesson by greeting students, leading a prayer, checking attendance, and conducting apperception using real objects around the classroom.	Students began to show interest in identifying plane figures, although some students were still less focused and needed guidance.
Essential Question	The teacher asked guiding questions about how plane figures could be recognized and arranged into new forms.	Some students were able to respond and give reasons, but several students still needed teacher guidance.
Project Planning	Students were divided into small groups and asked to arrange various plane figures into a picture.	Students showed enthusiasm, but some still competed over tools and did not fully understand the project objectives.
Schedule Preparation	The teacher and students determined the project completion time and work steps together.	Some groups were able to divide tasks, while others were still unorganized and needed further guidance.
Project Implementation and Monitoring	Students worked on the project while the teacher monitored and guided each group, especially in identifying the number of sides and angles.	Some students collaborated well, but others were less focused and tended to joke around.

Sosioedukasi
JURNAL ILMIAH ILMU PENDIDIKAN DAN SOSIAL
ISSN: 2086-6135 E-ISSN: 2541-612x
Volume 15 No. 2. June 2026 https://ejournal.unibabwi.ac.id/index.php/sosioedukasi/index

Project Presentation	Each group presented its project results in front of the class.	Several students were confident, but others were still shy and unable to explain their work clearly.
Evaluation and Reflection	The teacher guided students to reflect on the lesson and administered an individual evaluation.	Some students were still not orderly during the evaluation, so the process did not run optimally.
Closing	The teacher and students concluded the lesson and reinforced that plane figures can be found in daily life and used to create various forms.	Students received appreciation, and the lesson was closed with a prayer.

Table 2. Observation and Learning Outcomes in Cycle I

Aspect	Result	Category/Description
Teacher Activity	83.51%	Good. The teacher had implemented the PjBL stages systematically, but classroom management and equal guidance still needed improvement.
Student Activity	63.80%	Fair/Not optimal. Some students were less active, lacked confidence, and had not collaborated well in groups.
Learning Mastery	4 of 8 students, or 50%	Not yet achieved classically.
Class Average Score	60.62%	Below the expected mastery criterion.
Main Difficulties	Students had difficulty identifying plane figures, determining the number of sides and angles, and solving analytical questions.	Improvement was needed in material explanation, project guidance, classroom management, and student confidence.

Table 3. Reflection of Cycle I

Reflection Aspect	Description
Successes	The PjBL model encouraged some students to be more active and interested in learning plane figures.
Obstacles	Student participation was uneven, group cooperation was not optimal, and some students still lacked conceptual understanding.
Improvement Plan for Cycle II	The teacher needed to clarify material explanations, provide more concrete examples, strengthen guidance during project work, improve classroom management, and encourage students to be more active, confident, and responsible.

Based on these results, it can be concluded that the implementation of learning in Cycle I was not yet fully successful. Although the Project-Based Learning model had been implemented well and was able to increase the activeness of some students, overall involvement and learning outcomes had not yet reached the expected mastery level. Therefore, improvements were needed in Cycle II by increasing the clarity of material explanation, strengthening guidance during project activities, improving classroom management, and encouraging students to be more active, confident, and responsible in each stage of learning. Through these improvements, it is expected that students' learning outcomes and activeness will increase in the next cycle.

Table 4. Results of Cycle II

Stage	Implementation	Findings/Notes
Planning	Cycle II was planned based on the reflection results of Cycle I. The researcher revised the teaching module, improved the student worksheets, prepared more contextual learning media,	The planning focused on strengthening students' understanding, activeness, and collaboration.

Sosioedukasi
JURNAL ILMIAH ILMU PENDIDIKAN DAN SOSIAL
ISSN: 2086-6135 E-ISSN: 2541-612x
Volume 15 No. 2. June 2026 https://ejournal.unibabwi.ac.id/index.php/sosioedukasi/index

	and designed strategies to improve student participation and group cooperation.	
Action	The action was conducted on November 28, 2025, involving 8 students consisting of 5 male and 3 female students. The teacher opened the lesson by greeting students, praying together, checking attendance, arranging seats, and reviewing Cycle I material.	Students appeared more prepared and active in answering questions.
Essential Question	The teacher provided a contextual guiding question: "How can we find and classify objects around us that have the shapes of plane figures and arrange them into a new form?"	Almost all students were able to mention examples of plane figures and identify them more accurately.
Project Planning	Students were divided into heterogeneous groups. They were asked to identify plane figures, cut patterns, arrange pictures, and write the names of shapes, the number of sides, and angles.	Students were more prepared, more independent, and no longer competed over tools.
Schedule Preparation	The teacher and students agreed on a project completion time of 30–40 minutes and divided the work steps.	Students began to divide tasks evenly and showed better cooperation.
Project Implementation and Monitoring	The teacher monitored each group, provided guidance, and encouraged all students to participate actively.	Students were more focused, active in discussions, and helped one another in completing the project.
Project Presentation	Each group presented its work in front of the class and explained the plane figures used, including the number of sides and angles.	Students became more confident and showed better appreciation for other groups' work.
Evaluation and Reflection	The teacher asked reflection questions and administered an individual evaluation.	Students were able to express their learning experiences more clearly, and the evaluation process ran in an orderly manner.
Closing	The teacher and students concluded the lesson. The teacher reinforced that plane figures can be used to form various pictures in daily life and motivated students to continue learning.	The learning process ended more effectively and meaningfully.

Table 5. Observation and Learning Outcomes in Cycle II

Aspect	Result	Category/Description
Teacher Activity	96.25%	Excellent. The teacher implemented all PjBL stages systematically, managed the classroom well, and provided equal guidance to students.
Student Activity	95.29%	Excellent. Students were more active, confident, and able to cooperate optimally in groups.
Learning Mastery	7 of 8 students, or 87.5%	Classical learning mastery was achieved.
Class Average Score	92%	Excellent.
Total Score	736 out of 800	Students' understanding of plane figures improved significantly.
Main Improvement	Students were able to identify plane figures, determine the number of	The improvements from Cycle I were effective.

Sosioedukasi
JURNAL ILMIAH ILMU PENDIDIKAN DAN SOSIAL
ISSN: 2086-6135 E-ISSN: 2541-612x
Volume 15 No. 2. June 2026 https://ejournal.unibabwi.ac.id/index.php/sosioedukasi/index

	sides and angles, and solve analytical questions more accurately.

Table 6. Reflection of Cycle II

Reflection Aspect	Description
Successes	The implementation of PjBL in Cycle II improved student activity, cooperation, confidence, and conceptual understanding.
Learning Atmosphere	The classroom became more interactive, enjoyable, and conducive. Students learned through direct experience and connected the material with daily life.
Conclusion of Cycle II	All success indicators were achieved. Therefore, the classroom action research was declared successful and did not need to be continued to the next cycle.

At the final stage, the teacher invited students to reflect on the learning that had been conducted by asking several questions, such as: What did you learn today about plane figures? What difficulties did you encounter while working on the project? Most students were able to express their learning experiences more clearly than in Cycle I. Many students stated that they understood the concept of plane figures better after being directly involved in project activities. Furthermore, the teacher administered an individual evaluation to measure students' level of understanding. The evaluation process ran more orderly because the teacher provided clear instructions from the beginning.

Table 7. Comparison of Cycle I and Cycle II

Aspect	Cycle I	Cycle II	Improvement
Teacher Activity	83.51%	96.25%	Increased by 12.74%
Student Activity	63.80%	95.29%	Increased by 31.49%
Class Average Score	60.62%	92%	Increased by 31.38%
Students Achieving Mastery	4 students	7 students	Increased by 3 students
Classical Mastery	50%	87.5%	Increased by 37.5%
Research Status	Not yet successful	Successful	Action stopped in Cycle II

DISCUSSION

The implementation of the Project-Based Learning (PjBL) model in mathematics learning on plane figure material contributed positively to the improvement of students' learning process and learning outcomes. The improvement did not occur merely because students completed projects, but because the learning activities provided opportunities for students to construct mathematical concepts through direct experience, collaboration, discussion, and reflection. In this study, students were not only asked to memorize the names of plane figures, but were also involved in identifying, comparing, classifying, and arranging plane figures into meaningful products. This learning process made abstract mathematical concepts easier for Grade III students to understand.

PjBL was effective because it encouraged students to learn actively through concrete activities. Plane figure material, such as identifying sides, angles, and shapes, can be difficult for elementary students when it is only explained verbally. Through project activities, students were able to observe real objects, manipulate plane figure cutouts, arrange shapes, and explain their findings. These activities helped students connect mathematical concepts with objects in their daily environment. This finding is in line with Piaget's theory, which emphasizes that children at the elementary school level learn more effectively through concrete experiences. It is also supported by Soedjadi's view that mathematics learning in elementary schools should be presented concretely so that students can understand concepts more easily.

Another reason PjBL improved students' learning outcomes is that it created a student-centered learning environment. In the first cycle, some students were still passive and lacked confidence in expressing opinions. However, after improvements were made in the second cycle, students became more involved in group discussions, task division, project completion, and presentation. This shows that PjBL can shift the learning process from teacher-centered instruction to active student participation. Bell states that Project-Based Learning supports the development of critical thinking, communication, collaboration, and creativity through meaningful learning experiences. Therefore, the effectiveness of PjBL in this study was closely related to the active role of students in every stage of learning.

Sosioedukasi
JURNAL ILMIAH ILMU PENDIDIKAN DAN SOSIAL
ISSN: 2086-6135 E-ISSN: 2541-612x
Volume 15 No. 2. June 2026 https://ejournal.unibabwi.ac.id/index.php/sosioedukasi/index

The project activities also supported the development of students' collaboration and communication skills. Through group work, students learned to share tasks, help one another, discuss ideas, and present their project results. These activities provided opportunities for students to interact socially while building their understanding of plane figure concepts. This finding is consistent with Vygotsky's theory, which states that learning occurs through social interaction. In this context, students' understanding developed not only through teacher explanation, but also through discussion and cooperation with peers.

In addition, PjBL helped improve students' confidence and creativity. During the project, students were encouraged to express ideas, determine the form of the product, and explain the results of their work in front of the class. This process gave students space to be creative and responsible for their learning. In the second cycle, students showed greater confidence in presenting their work and explaining the characteristics of plane figures. This indicates that PjBL does not only affect cognitive learning outcomes, but also supports affective and psychomotor aspects, as explained by Gagné and Dimyati and Mudjiono, who state that learning outcomes include knowledge, attitudes, skills, and self-confidence.

The improvement in students' learning outcomes was also influenced by the reflection and improvement process carried out between cycles. The obstacles found in the first cycle, such as uneven student participation, limited conceptual understanding, weak group cooperation, and lack of classroom order, became the basis for improving the learning process in the second cycle. The teacher provided clearer instructions, used more concrete learning media, arranged groups more effectively, gave more intensive guidance, and emphasized group work rules. These improvements made the learning process more organized, interactive, and meaningful. Therefore, the success of PjBL in this study was not only determined by the model itself, but also by the teacher's ability to manage learning and conduct reflection.

Although the PjBL model showed positive results, its implementation also faced several challenges. First, the teacher needed more time to prepare learning tools, project materials, student worksheets, and assessment instruments. Second, classroom management became an important challenge because young learners still needed guidance in using tools, dividing tasks, and staying focused during group activities. Third, not all students had the same level of confidence and participation at the beginning of the learning process. Therefore, the teacher had to provide continuous motivation and equal guidance so that all students could participate actively.

Another challenge was related to students' conceptual understanding. Some students initially focused more on completing the project product than understanding the mathematical concepts behind it. This shows that in PjBL, the teacher must ensure that project activities are not only creative but also conceptually meaningful. The teacher needs to guide students to connect every project activity with the learning objectives, such as identifying plane figures, counting sides, recognizing angles, and explaining the characteristics of each shape.

This study also has several limitations. First, the research subjects were limited to 8 Grade III students at SD GMIM Peleloan, so the findings cannot be generalized broadly to all elementary schools. Second, the study was conducted only in two cycles and focused on one mathematics topic, namely plane figures. Therefore, the effectiveness of PjBL in other mathematical topics still needs further investigation. Third, the assessment mainly focused on teacher activity, student activity, and learning outcomes, while other aspects such as long-term retention, students' creativity levels, and individual learning styles were not examined in depth.

Despite these limitations, the findings of this study indicate that PjBL can be an effective alternative learning model for mathematics at the elementary school level, especially for materials that require concrete understanding. PjBL allows students to learn through experience, collaboration, creativity, and reflection. When supported by careful planning, appropriate media, clear instructions, and effective classroom management, PjBL can improve students' understanding, participation, confidence, and learning outcomes. Therefore, the implementation of PjBL is recommended as a learning strategy to create more active, meaningful, and student-centered mathematics learning.

CONCLUSION

Based on the findings of the study, it can be concluded that the implementation of the Project-Based Learning (PjBL) model can improve students' learning outcomes in learning plane figure concepts, particularly in the material "recognizing, comparing, and classifying plane figure shapes and calculating the number of their sides and angles" among Grade III students at SD GMIM Peleloan. This can be seen from the improvement in students' learning outcomes in each learning cycle that was implemented. The findings of this study show that the average observation score of teacher activity in Cycle I reached 83.51%, which was categorized as good, and then increased significantly in Cycle II to 93, which was

categorized as very good. In line with this, the observation results of students' learning activities also showed a significant increase, from 63.80% in Cycle I, which was categorized as good, to 86.53 in Cycle II, which was categorized as very good. Meanwhile, in terms of students' learning achievement, there was a highly satisfactory increase in the percentage of mastery, from 60.62% in Cycle I to an average score of 92% in Cycle II. Therefore, this model is considered highly effective for use in learning in the classroom.

The implication of this study is that the Project-Based Learning model can be used as an alternative learning strategy to create more active, meaningful, and student-centered mathematics learning. Through project-based activities, students are encouraged to observe, discuss, collaborate, and solve problems directly related to the learning material. For teachers, the results of this study provide an overview that the selection of an appropriate learning model can improve the quality of teaching and students' participation in the learning process. In addition, this study can serve as a reference for schools in developing innovative learning practices, especially in mathematics learning at the elementary school level.

ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to the principal, teachers, and third-grade students of SD GMIM Peleloan for their support and participation during the research process. Appreciation is also extended to all parties who contributed to the successful completion of this study.

REFERENCES

Afandi, M., Chamalah, E., Wardani, O. P., & Chasanah, U. (2013). *Model dan metode pembelajaran di sekolah*. Semarang: Unissula Press.

Ahmad, S. (2016). *Faktor-faktor yang mempengaruhi hasil belajar siswa*. Jakarta: Pustaka Belajar.

Aqib, Z. (2013). *Model-model, media, dan strategi pembelajaran kontekstual (inovatif)*. Bandung: Yrama Widya.

Arikunto, S., Suhardjono, & Supardi. (2019). *Penelitian tindakan kelas* (Edisi revisi). Jakarta: Bumi Aksara.

Bell, S. (2010). Project-Based Learning for the 21st Century: Skills for the Future. The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 83(2), 39–43. https://doi.org/10.1080/00098650903505415

Blumenfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., & Palincsar, A. (1991). Motivating project-based learning: Sustaining the doing, supporting the learning. *Educational Psychologist, 26*(3–4), 369–398.

Christian, Y. A. (2021). Meta analisis model pembelajaran *Project Based Learning* terhadap kreativitas dan hasil belajar siswa di sekolah dasar. *Edukatif: Jurnal Ilmu Pendidikan, 3*(4), 2271–2278.

Depdiknas. (2003). *Undang-undang nomor 20 tahun 2003 tentang sistem pendidikan nasional*. Jakarta: Depdiknas.

Dewey, J. (1938). *Experience and education*. New York: Macmillan.

Dewi, M. R. (2022). Kelebihan dan kekurangan *Project-Based Learning* untuk penguatan profil pelajar Pancasila kurikulum merdeka. *Inovasi Kurikulum, 19*(2), 213–226.

Dimyati, & Mudjiono. (2006). *Belajar dan pembelajaran*. Jakarta: Rineka Cipta.

Ekayani, P. (2017). Pentingnya penggunaan media pembelajaran untuk meningkatkan prestasi belajar siswa. *Jurnal Fakultas Ilmu Pendidikan Universitas Pendidikan Ganesha Singaraja*, *2*(1), 1-11.

Gagné, R. M. (1985). *The conditions of learning and theory of instruction* (4th ed.). New York: Holt, Rinehart and Winston.

Hakim, T. (2020). *Belajar secara efektif*. Jakarta: Puspa Swara.

Hamalik, O. (2017). *Kurikulum dan pembelajaran* (Cet. 16). Jakarta: Bumi Aksara.

Hidayatullah, A. (2022). Pengaruh model *Project Based Learning* terhadap hasil belajar siswa sekolah dasar. *Jurnal Ilmu Pendidikan, 14*(2), 98–110.

Khoerunnisa, P., & Aqwal, S. M. (2020). Analisis model-model pembelajaran. *Fondatia, 4*(1), 1–27.

Kokotsaki, D., Menzies, V., & Wiggins, A. (2016). Project-based learning: A review of the literature. Improving Schools, 19(3), 267–277. https://doi.org/10.1177/1365480216659733

Komara, E., & Mauludin, A. (2016). *Pengembangan keprofesian berkelanjutan (PKB) dan penelitian tindakan kelas (PTK) bagi guru*. Bandung: PT Refika Aditama.

Krajcik, J. S., & Blumenfeld, P. C. (2006). Project-based learning. Dalam R. K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (hlm. 317–334). New York: Cambridge University Press.

Limbong, I. N., & Rahmawati, D. (2024). Pembelajaran berbasis neurosains dalam pendidikan sekolah dasar. *Jurnal Pendidikan Tambusai, 8*, 9190–9194.

Maurin, H., & Muhamadi, S. I. (2018). Metode ceramah plus diskusi dan tugas untuk meningkatkan aktivitas belajar siswa. *Al-Aulad: Journal of Islamic Primary Education*, *1*(2), 65-76.

Nabila, D. S., & Syutaridho. (2024). Analisis kemampuan problem solving ditinjau dari representasi matematis pada materi SPLDV. *Jurnal Penelitian Pendidikan Matematika, 8*(1), 23–36.

Sosioedukasi
JURNAL ILMIAH ILMU PENDIDIKAN DAN SOSIAL
ISSN: 2086-6135 E-ISSN: 2541-612x
Volume 15 No. 2. June 2026 https://ejournal.unibabwi.ac.id/index.php/sosioedukasi/index

Najoan, R. A. O. (2011). Performance assessment based learning problem on models *Team Assisted Individualization* (TAI). *Jurnal Evaluasi Pendidikan, 2*(2), 193–205.

Najoan, R. A. O., Tahiru, Y. S., Kumolontang, D. F., & Tuerah, R. M. (2023). Penerapan model *Problem Based Learning* untuk meningkatkan hasil belajar matematika siswa sekolah dasar. *Edukatif: Jurnal Ilmu Pendidikan, 5*(2), 1268–1278.

Najoan, R. A. O., Buniahe, R. S., Robot, G., Lahiang, E., Mongkol, S. H., Sulangi, G., Korua, A. A. N., Lowai, F., & Sili, I. (2025). Efektivitas pendekatan *realistic mathematics education* terhadap hasil belajar matematika siswa kelas IV sekolah dasar. *Jurnal Ilmiah Pendidikan Dasar (JIPDAS), 5*(4). 35-45

Rahmawati, D. (2023). Peran guru dalam keberhasilan model *Project Based Learning*. *Jurnal Pendidikan Dasar, 12*(1), 55–65.

Sanjaya, W. (2011). *Kurikulum dan pembelajaran: Teori dan praktik pengembangan kurikulum tingkat satuan pendidikan*. Jakarta: Kencana.

Soedjadi, R. (2000). *Kiat pendidikan matematika di Indonesia*. Jakarta: Dirjen Dikti.

Syamsidah, S., & Hamidah, H. (2018). *Model problem based learning (PBL)*. Yogyakarta: Deepublish.

Tarusu, D. T., Zulela, Z., & Adiansha, A. A. (2020). Integrasi pembentukan nilai karakter kemandirian siswa sekolah dasar dalam pembelajaran matematika di era industri 4.0. *Jurnal Ilmiah Mandala Education, 6*(2). 40-49.

Tholib, A. U. (2022). Penerapan model pembelajaran *Project Based Learning* terhadap *problem solving skills* peserta didik. *Jurnal Ilmiah Wahana Pendidikan, 8*(23), 702–711.

Trianto. (2010). *Model pembelajaran terpadu: Konsep, strategi, dan implementasinya dalam KTSP*. Jakarta: Bumi Aksara.