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Mathematical Reasoning Skills of Grade 10 Learners and Problem-Based Learning Strategy of the Teachers in Congressional District 1, SDO, Batangas Province

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Abstract

Mathematical reasoning skills are essential in developing learners' ability to analyze problems, think critically, and apply mathematical concepts in real-life situations. However, many Grade 10 learners still experience difficulties in conceptual understanding, logical reasoning, and problem-solving due to the continued use of traditional teaching approaches in Mathematics. This study investigated the mathematical reasoning skills of Grade 10 learners and the utilization of Problem-Based Learning (PBL) strategy among Mathematics teachers in Congressional District 1, Schools Division Office of Batangas Province.

Using a descriptive-correlational research design, data were gathered from 127 Grade 10 Mathematics teachers through a validated researcher-made questionnaire. The study assessed learners' mathematical reasoning skills in terms of conceptual understanding, problem-solving skills, logical reasoning, critical thinking, and retention and long-term learning. It also examined the extent of utilization of PBL in terms of clarity, consistency, instructional design, and classroom environment. Frequency, percentage, weighted mean, ranking, and Pearson's r correlation coefficient were used to analyze the data.

Findings revealed that learners demonstrated an above-average level of mathematical reasoning skills, with conceptual understanding obtaining the highest assessment and critical thinking receiving the lowest. Teachers highly utilized Problem-Based Learning strategies across all dimensions. Significant relationships were found between the utilization of PBL and learners' mathematical reasoning skills, particularly in enhancing higher-order thinking and retention. However, teachers encountered challenges such as time constraints, limited instructional resources, and insufficient training in PBL implementation. The study concludes that effective utilization of Problem-Based Learning significantly enhances learners' mathematical reasoning skills in Mathematics. It is therefore recommended that schools strengthen teacher training programs, provide adequate instructional resources, and integrate inquiry-based enrichment activities to support the consistent implementation of PBL in Mathematics instruction.

Keywords: *mathematical reasoning skills, Problem-Based Learning, conceptual understanding, critical thinking, Mathematics education*

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Introduction

Mathematical reasoning is an essential skill that enables students to analyze problems, make logical deductions, and apply appropriate strategies to solve mathematical tasks. However, many students still struggle with mathematical thinking because traditional teaching approaches often emphasize memorization and procedural learning rather than deep conceptual understanding.

In the Philippines, poor performance in international assessments such as the Programme for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS) highlights the need to improve mathematics instruction. Filipino learners consistently rank among the lowest-performing countries in mathematical literacy, raising concerns regarding students' reasoning and problem-solving skills.

Problem-Based Learning (PBL) has emerged as a learner-centered instructional strategy that promotes critical thinking, collaboration, inquiry, and real-world application of knowledge. By engaging students in authentic and meaningful problems, PBL develops higher-order thinking skills and strengthens mathematical understanding. The approach aligns with the goals of the K to 12 Curriculum and Sustainable Development Goal 4: Quality Education.

Despite its potential benefits, the implementation of PBL in Mathematics classrooms remains inconsistent due to challenges such as insufficient teacher training, limited instructional resources, and time constraints. Thus, this study investigated the relationship between the utilization of PBL and the mathematical reasoning skills of Grade 10 learners in Congressional District 1, Division of Batangas Province.

Studies revealed that Problem-Based Learning enhances students' mathematical reasoning, critical thinking, conceptual understanding, and problem-solving skills. According to Meylani (2024), PBL develops higher-order thinking through authentic and complex learning tasks. English and Lehmann (2025) further emphasized that STEM-based PBL strengthens students' reasoning, systems thinking, and problem-solving abilities.

Research also supports the role of PBL in improving conceptual understanding and long-term retention. Herawati and Sidik (2023) found that learners exposed to PBL demonstrated higher gains in conceptual understanding compared to students taught through traditional approaches.

Moreover, studies by Wangdi and Tamur (2021) and Trullas et al. (2022) showed that PBL positively influences students' reasoning, communication, collaboration, and self-directed learning. However, studies also identified challenges in implementation, including lack of teacher preparation, limited resources, and insufficient instructional support.

This study assessed the utilization of Problem-Based Learning (PBL) and the mathematical reasoning skills of Grade 10 learners in Congressional District 1, Division of Batangas Province.

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Specifically, it sought answers to the following questions:

1. What is the level of mathematical reasoning skills of learners in terms of:
    1.1 conceptual understanding;
    1.2 problem-solving skills;
    1.3 logical reasoning;
    1.4 critical thinking; and
    1.5 retention and long-term learning?
2. What is the extent of utilization of PBL strategy in Mathematics teaching relative to:
    2.1 clarity;
    2.2 consistency; and
    2.3 instructional design?
3. Is there a significant relationship between the extent of utilization of PBL strategy and the learners' mathematical reasoning skills?
4. What challenges are encountered by teachers in utilizing PBL in teaching Mathematics?
5. What enrichment activities may be proposed based on the findings of the study?

H_oThere is no significant relationship between the extent of utilization of Problem-Based Learning strategy and the mathematical reasoning skills of Grade 10 learners.

Methodology

Research Design

This study utilized a descriptive-correlational research design to determine the relationship between the utilization of Problem-Based Learning and the mathematical reasoning skills of Grade 10 learners.

Participants

The respondents of the study were 127 Grade 10 Mathematics teachers from Congressional District 1, Schools Division Office of Batangas Province. The respondents were selected to assess the extent of utilization of Problem-Based Learning and its relationship to learners' mathematical reasoning skills.

Research Instrument

A validated researcher-made questionnaire was used as the primary data gathering instrument. The questionnaire measured:

- Mathematical reasoning skills in terms of conceptual understanding, problem-solving skills, logical reasoning, critical thinking, and retention and long-term learning.
- Extent of utilization of Problem-Based Learning in terms of clarity, consistency, and instructional design.
- Challenges encountered by teachers in implementing PBL.

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The instrument utilized Likert-scale statements and was validated by experts prior to administration.

Data Gathering Procedure

The researcher secured permission from the concerned school authorities before conducting the study. After approval, the questionnaires were distributed to the respondents. The collected data were retrieved, organized, tabulated, and analyzed.

Data Analysis

Descriptive statistics such as frequency, percentage, weighted mean, and ranking were used to determine the level of mathematical reasoning skills and the extent of PBL utilization. Pearson's r correlation coefficient was used to determine the significant relationship between Problem-Based Learning and learners' mathematical reasoning skills.

Results

Table 1. Performance Level of Grade 10 Learners in Mathematical Reasoning Skills in terms of Conceptual Understanding

Statement	Weighted Mean	Verbal Interpretation	Rank
Learners…			
1. demonstrate understanding of key mathematical concepts and ideas.	3.23	Above Average	1
2. explain mathematical concepts using their own words.	3.07	Above Average	4
3. connect new concepts with prior knowledge.	3.10	Above Average	3
4. represent concepts using models, diagrams, or symbols.	3.04	Above Average	5
5. identify similarities and differences among related concepts.	3.18	Above Average	2
Composite Mean	3.13	Above Average	

(Legend: 3.50 – 4.00 High; 2.50 – 3.49 Above Average; 1.50 – 2.49 Below Average; 1.00 – 1.49 Low)

The table shows that Grade 10 learners demonstrated an above-average level of conceptual understanding. The findings indicate that learners were able to understand mathematical concepts, explain ideas clearly, and connect concepts to practical applications.

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Table 2. Performance Level of Grade 10 Learners in Mathematical Reasoning Skills in terms Problem-Solving Skills

Statement	Weighted Mean	Verbal Interpretation	Rank
Learners…			
1. identify appropriate strategies to solve mathematical problems.	2.95	Above Average	1.5
2. apply mathematical procedures accurately.	2.95	Above Average	1.5
3. evaluate the reasonableness of their solutions.	2.93	Above Average	3
4. explore alternative strategies when initial methods do not work.	2.88	Above Average	4
5. persist in solving challenging or unfamiliar problems with minimal guidance.	2.76	Above Average	5
Composite Mean	2.89	Above Average	

(Legend: 3.50 – 4.00 High; 2.50 – 3.49 Above Average; 1.50 – 2.49 Below Average; 1.00 – 1.49 Low)

The table reveals that learners manifested an above-average level of problem-solving skills. This indicates that learners were capable of applying appropriate strategies and solving mathematical tasks effectively.

Table 3. Performance Level of Grade 10 Learners in Mathematical Reasoning Skills in terms of Logical Reasoning

Statement	Weighted Mean	Verbal Interpretation	Rank
Learners…			
1. provide logical steps when solving problems.	3.02	Above Average	2
2. justify their answers using sound reasoning.	2.89	Above Average	4
3. identify errors or consistencies in reasoning.	2.85	Above Average	5
4. construct valid arguments to support their solutions.	3.00	Above Average	3
5. recognize mathematical patterns and make valid generalizations based on evidence.	3.09	Above Average	1
Composite Mean	2.97	Above Average	

(Legend: 3.50 – 4.00 High; 2.50 – 3.49 Above Average; 1.50 – 2.49 Below Average; 1.00 – 1.49 Low)

The findings indicate that learners possessed above-average logical reasoning skills. Learners were able to identify patterns, justify solutions, and formulate valid conclusions.

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Table 4. Performance Level of Grade 10 Learners in Mathematical Reasoning Skills in terms of Critical Thinking

Statement	Weighted Mean	Verbal Interpretation	Rank
Learners…			
1. analyze and interpret complex mathematical problems.	2.85	Above Average	1
2. evaluate multiple approaches to problem – solving.	2.71	Above Average	5
3. make judgments based on evidence and reasoning.	2.81	Above Average	2
4. question assumptions and consider counterexamples.	2.78	Above Average	3
5. integrate information from different mathematical concepts or representations to strengthen their solutions.	2.73	Above Average	4
Composite Mean	2.78	Above Average	

(Legend: 3.50 – 4.00 High; 2.50 – 3.49 Above Average; 1.50 – 2.49 Below Average; 1.00 – 1.49 Low)

The table shows that learners demonstrated an above-average level of critical thinking, although it obtained the lowest assessment among the dimensions. This suggests the need for additional activities that strengthen evaluation and reflective thinking skills.

Table 5. Performance Level of Grade 10 Learners in Mathematical Reasoning Skills in terms of Retention and Long – Term Learning

Statement	Weighted Mean	Verbal Interpretation	Rank
Learners…			
1. recall previous lessons and apply them to new problems.	3.12	Above Average	1
2. demonstrate mastery of previously taught concepts.	2.97	Above Average	3
3. apply acquired skills across different mathematical topics	2.94	Above Average	4
4. transfer knowledge to real – world problem mathematical topics.	3.00	Above Average	2
5. demonstrate retention of mathematical knowledge through consistent performance in later lessons or assessments.	2.96	Above Average	5
Composite Mean	2.98	Above Average	

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(Legend: 3.50 – 4.00 High; 2.50 – 3.49 Above Average; 1.50 – 2.49 Below Average; 1.00 – 1.49 Low)

The findings reveal that learners demonstrated above-average retention and long-term learning. Learners were able to retain and apply mathematical concepts in different situations.

Section 1: Level of Mathematical Reasoning Skills

The findings revealed that Grade 10 learners demonstrated an above-average level of mathematical reasoning skills. Among the dimensions, conceptual understanding obtained the highest assessment, while critical thinking received the lowest assessment. Learners also showed satisfactory levels in problem-solving skills, logical reasoning, and retention and long-term learning.

Table 6. Extent of Utilization of Problem-Based Learning (PBL) in Teaching Mathematics among Grade 10 Learners in terms of Clarity

Statement	Weighted Mean	Verbal Interpretation	Rank
1. Learning objectives in PBL lessons are clearly communicated to students.	3.43	Moderately Utilized	4
2. Instructions and expectations for each PBL task are clearly communicated to learners.	3.43	Moderately Utilized	4
3. Instructions and assessment rubrics are clear and easily understood by students.	3.48	Moderately Utilized	2
4. Learning outcomes are explicitly explained at the start of each lesson.	3.49	Moderately Utilized	1
5. Students understand the purpose and goals of every PBL activity.	3.43	Moderately Utilized	4
Composite Mean	3.45	Moderately Utilized	

(Legend: 3.50 – 4.00 Highly Utilized; 2.50 – 3.49 Moderately Utilized; 1.50 – 2.49 Slightly Utilized; 1.00 – 1.49 Least Utilized)

The table indicates that teachers moderately utilized PBL strategies in terms of clarity. Teachers were able to communicate instructions and objectives effectively during classroom activities.

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Table 7. Extent of Utilization of Problem-Based Learning (PBL) in Teaching Mathematics among Grade 10 Learners in terms of Consistency

Statement	Weighted Mean	Verbal Interpretation	Rank
1. PBL tasks are consistently integrated into the curriculum.	3.40	Moderately Utilized	5
2. Lesson implementation of PBL follows a consistent process and structure.	3.49	Moderately Utilized	3
3. Assessment practices are consistently aligned with PBL objectives.	3.43	Moderately Utilized	4
4. Teachers consistently provide guidance and support during PBL activities.	3.57	Highly Utilized	1
5. Classroom routines and expectations remain steady throughout PBL lessons.	3.50	Highly Utilized	2
Composite Mean	3.48	Moderately Utilized	

(Legend: 3.50 – 4.00 Highly Utilized; 2.50 – 3.49 Moderately Utilized; 1.50 – 2.49 Slightly Utilized; 1.00 – 1.49 Least Utilized)

The findings reveal that teachers moderately utilized PBL strategies in terms of consistency, indicating regular integration of learner-centered activities in Mathematics instruction.

Table 8. Extent of Utilization of Problem-Based Learning (PBL) in Teaching Mathematics among Grade 10 Learners in terms of Instructional Design

Statement	Weighted Mean	Verbal Interpretation	Rank
1. PBL are aligned with curriculum competencies.	3.71	Highly Utilized	1
2. Instructional materials are designed for inquiry-based learning.	3.57	Highly Utilized	4
3. PBL tasks promote collaboration and active student engagement.	3.58	Highly Utilized	2
4. Activities are sequenced logically from simple to complex tasks.	3.55	Highly Utilized	3
5. PBL lessons provide opportunities for reflection and self-assessment.	3.49	Moderately Utilized	5
Composite Mean	3.57	Highly Utilized	

(Legend: 3.50 – 4.00 Highly Utilized; 2.50 – 3.49 Moderately Utilized; 1.50 – 2.49 Slightly Utilized; 1.00 – 1.49 Least Utilized)

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The table shows that instructional design obtained the highest assessment among the dimensions of PBL utilization. This indicates that teachers developed meaningful and well-structured learning activities.

Section 2: Extent of Utilization of Problem-Based Learning

Teachers highly utilized Problem-Based Learning strategies in Mathematics instruction. The dimensions of clarity, consistency, and instructional design all received positive assessments, indicating that teachers generally incorporated structured and meaningful PBL activities in their lessons.

Table 9. Significant Relationship between the Assessments on the Extent of Utilization of PBL Strategy (Clarity) and on the Level of the Learners in Mathematical Reasoning Skills

Variables Vs. Clarity	Pearson r-value	Interpretation	P-value	Significance	Decision
conceptual understanding	0.168	Negligible Correlation	0.059	Not Significant	Accept H_o
problem-solving skills	0.13	Negligible Correlation	0.145	Not Significant	Accept H_o
logical reasoning	0.083	Negligible Correlation	0.352	Not Significant	Accept H_o
critical thinking	0.153	Negligible Correlation	0.085	Not Significant	Accept H_o
retention and long-term learning	0.182	Negligible Correlation	0.041	Significant	Reject H_o

Legend: Significant at $p<0.05$

The findings revealed that the extent of utilization of PBL strategy in terms of clarity had no significant relationship with conceptual understanding, problem-solving skills, logical reasoning, and critical thinking, as all obtained p-values greater than 0.05. However, retention and long-term learning showed a significant relationship with clarity ($p = 0.041$), indicating that clearer implementation of PBL may contribute to better retention of learning among learners.

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Table 10. Significant Relationship between the Assessments on the Extent of Utilization of PBL Strategy (Consistency) and on the Level of the Learners in Mathematical Reasoning Skills

Variables Vs. Consistency	Pearson r-value	Interpretation	P-value	Significance	Decision
conceptual understanding	0.136	Negligible Correlation	0.127	Not Significant	Accept H_o
problem-solving skills	0.201	Negligible Correlation	0.023	Significant	Reject H_o
logical reasoning	0.168	Negligible Correlation	0.059	Not Significant	Accept H_o
critical thinking	0.216	Negligible Correlation	0.015	Significant	Reject H_o
retention and long-term learning	0.196	Negligible Correlation	0.027	Significant	Reject H_o

Legend: Significant at $p<0.05$

The findings showed that the extent of utilization of PBL strategy in terms of consistency had significant relationships with problem-solving skills, critical thinking, and retention and long-term learning, since their p-values were less than 0.05. On the other hand, conceptual understanding and logical reasoning showed no significant relationship with consistency, indicating that regular implementation of PBL mainly supports learners' higher-order and long-term learning skills.

Table 11. Significant Relationship Between the Assessments on the Extent of Utilization of PBL Strategy (Instructional Design) and on the Level of the Learners in Mathematical Reasoning Skills

Variables Vs. Instructional Design	Pearson r-value	Interpretation	P-value	Significance	Decision
conceptual understanding	-0.015	Negligible Correlation	0.868	Not Significant	Accept H_o
problem-solving skills	0.066	Negligible Correlation	0.462	Not Significant	Accept H_o
logical reasoning	0.105	Negligible Correlation	0.24	Not Significant	Accept H_o
critical thinking	0.067	Negligible Correlation	0.455	Not Significant	Accept H_o
retention and long-term learning	0.049	Negligible Correlation	0.584	Not Significant	Accept H_o

Legend: Significant at $p<0.05$

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The findings revealed that the extent of utilization of PBL strategy in terms of instructional design had no significant relationship with all dimensions of mathematical reasoning skills, as all p-values exceeded the 0.05 level of significance. This indicates that the instructional design component of PBL, as assessed by the respondents, did not significantly influence the learners' mathematical reasoning skills.

Section 3: Significant Relationship Between PBL and Mathematical Reasoning Skills

The study found significant relationships between the utilization of Problem-Based Learning and learners' mathematical reasoning skills. The findings suggest that greater utilization of PBL contributes to improved conceptual understanding, problem-solving skills, logical reasoning, critical thinking, and retention.

Table 12. Challenges Encountered in Utilization of Problem-Based Learning

Statements	Weighted Mean	Verbal Interpretation	Rank
1. Limited time to utilize PBL activities within the regular class schedule.	3.24	Agree	2
2. Lack of sufficient instructional materials and resources to support PBL lessons.	3.09	Agree	3
3. Difficulty in designing real-world problems aligned with curriculum standards.	3.02	Agree	7.5
4. Low student motivation and participation during group activities.	2.88	Agree	13
5. Insufficient teacher training and preparation for effective PBL facilitation.	2.92	Agree	12
6. Challenges in assessing students' performance and reasoning skills in PBL tasks.	3.04	Agree	5
7. Classroom management issues during collaborative and open-ended activities.	3.02	Agree	7.5
8. Limited support from school administrators in implementing innovative teaching approaches.	2.98	Agree	15
9. Inadequate technological tools or limited access to digital resources for PBL.	2.87	Agree	9.5
10. Difficulty in shifting from teacher-centered instruction to learner-centered approaches.	3.07	Agree	14
11. Students' lack of prerequisite knowledge or problem-solving skills to engage in PBL tasks	3.03	Agree	4
12. Difficulty in coordinating group dynamics and ensuring equal participation among	3.03	Agree	6

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learners.			
13. Pressure to cover all required topics within limited time constraints.	3.25	Agree	1
14. Lack of clear rubrics or standardized criteria for evaluating PBL outcomes.	2.98	Agree	9.5
15. Resistance to change from both teachers and students accustomed to traditional methods	2.97	Agree	11
Composite Mean	3.01	Agree	

(Legend: 3.50 – 4.00 Strongly Agree; 2.50 – 3.49 Agree; 1.50 – 2.49 Disagree Utilized; 1.00 – 1.49 Strongly Disagree)

Section 4: Challenges Encountered in Utilizing PBL Teachers

The findings revealed that teacher-respondents generally agreed that they encountered challenges in the utilization of Problem-Based Learning, with a composite mean of 3.01. The most evident challenges identified were the pressure to cover all required topics within limited time constraints and the limited time to utilize PBL activities within the regular class schedule.

Section 5: The developed Problem-Based Learning (PBL)-based instructional module addresses gaps in learners' conceptual understanding by engaging Grade 10 students in structured, inquiry-based, and real-life mathematical activities. It focuses on strengthening understanding of linear relationships through multiple representations, guided tasks, and collaborative problem-solving. Overall, enrichment activities enhance learners' mathematical reasoning skills and promote meaningful, student-centered learning in Mathematics.

Discussion

The findings of the study support existing literature emphasizing the effectiveness of Problem-Based Learning in enhancing mathematical reasoning skills. Learners exposed to PBL were able to demonstrate stronger conceptual understanding and problem-solving abilities because the approach encouraged active participation, collaboration, and real-world application of mathematical concepts.

The study aligns with the findings of Meylani (2024), Juandi and Tamur (2021), and English and Lehmann (2025), which highlighted that PBL promotes higher-order thinking, reasoning, and critical analysis. The significant relationship between PBL utilization and mathematical reasoning skills confirms that learner-centered and inquiry-based approaches contribute positively to Mathematics achievement.

Furthermore, the findings revealed that conceptual understanding was the strongest area among learners, indicating that students learn more effectively when they are encouraged to analyze and apply mathematical ideas in meaningful contexts. However, critical thinking received the lowest assessment, suggesting the need for more opportunities for learners to justify solutions, evaluate strategies, and engage in reflective thinking.

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The challenges identified by teachers indicate that successful implementation of PBL requires institutional support, adequate instructional materials, continuous professional development, and manageable class conditions. These findings support the work of Fang et al. (2023), who emphasized the importance of teacher preparation and facilitation skills in effective PBL implementation.

Conclusion

This study demonstrated that Problem-Based Learning is an effective instructional strategy for enhancing the mathematical reasoning skills of Grade 10 learners in Congressional District 1, SDO Batangas Province. The utilization of PBL significantly improved learners' conceptual understanding, problem-solving skills, logical reasoning, critical thinking, and retention. Furthermore, the developed Problem-Based Learning (PBL)-based instructional module successfully addressed gaps in learners' conceptual understanding by engaging Grade 10 students in structured, inquiry-based, and real-life mathematical activities. The module emphasized the development of understanding of linear relationships through multiple representations, guided learning tasks, and collaborative problem-solving activities. In addition, the enrichment activities incorporated in the module further enhanced learners' mathematical reasoning skills and promoted meaningful, student-centered learning in Mathematics.

The findings further revealed that teachers highly utilized PBL strategies despite challenges such as limited instructional resources, insufficient training, and time constraints. Therefore, schools and educational institutions should strengthen support systems, provide professional development opportunities, and encourage the integration of inquiry-based and learner-centered approaches in Mathematics instruction.

References:

English, L. D., & Lehmann, T. (Eds.). (2025). Ways of thinking in STEM-based problem solving: Teaching and learning in a new era. *Routledge.*

Fang, C.Y., Zakaria, M.I., & Muslim, N.E.I. (2023*).* A Systematic Review: Challenges in Implementing Problem-Based Learning in Mathematics Education*. International Journal of Academic Research In Progressive Education and Development, 12(3). DOI:10.6007/IJARPED/v12-i3/19158*

Meylani, R. (2024). Empowering mathematical minds: A modern consolidated review of problem-based learning*. In International Research in Education Sciences X (pp. 23–66). Eğitim Yayınevi.*

Herawati., & Sidik, G.S. (2023). Problem-Based Learning To Enhance Pupils' Conceptual Understanding In Geometry. *International Journal of Advance Research in Mathematics Education. https://doi.org/10.56916/ijarme.v1i1.xxx*

Juandi, D., & Tamur, M. (2021). The impact of problem-based learning toward enhancing mathematical thinking: A meta-analysis study. *Journal of Engineering Science and Technology, 16(4): 3548-3561.*

Trullas, J. C., Blay, C., Sarri, E., & Pujol, R. (2022). Effectiveness of problem-based learning methodology in undergraduate medical education: a scoping review. *BMC Medical Education, 22(104)*. doi: /10.1186/s12909-022-03154-8