

# Problem-Based Learning Strategy, Critical Thinking Skills and Mathematics Achievement of Students

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## ABSTRACT

This study examined the relationship among Problem-Based Learning (PBL) strategy, critical thinking skills, and mathematics achievement of Grade 7 students under the Revised K–10 Curriculum during the school year 2025–2026. Using a descriptive-correlational research design, the study involved 173 Grade 7 students selected through stratified random sampling from a population of 304 learners. Data were gathered using a researcher-made questionnaire that assessed the extent of Problem-Based Learning strategy as well as students' critical thinking skills. Mathematics achievement was measured using the students' final grades in Mathematics. The findings revealed that the extent of Problem-Based Learning strategy was high, while the respondents also demonstrated a high level of critical thinking skills. Mathematics achievement was found to be satisfactory. Further analysis revealed a significant relationship between Problem-Based Learning and critical thinking skills. However, no significant relationship was found between Problem-Based Learning and mathematics achievement, as well as between critical thinking skills and mathematics achievement. The findings suggest that Problem-Based Learning serves as an effective approach for developing students' critical thinking skills but does not necessarily translate into higher mathematics achievement. Overall, the study underscores the value of learner-centered and inquiry-based instructional practices in fostering higher-order thinking skills while highlighting the influence of other factors on students' academic performance in Mathematics.

**Keywords:** Problem-Based Learning, Critical Thinking, Mathematics Achievement, Grade 7, Revised K–10 Curriculum.

## INTRODUCTION

Mathematics is a cornerstone for developing 21st-century competencies, yet Filipino students face persistent challenges, as evidenced by the 2022 PISA results ranking the Philippines 76th out of 81 countries. In response, the Department of Education implemented the Revised K–10 Curriculum, emphasizing inquiry-based approaches like Problem-Based Learning (PBL). Grounded in Vygotsky's Social Constructivism and Piaget's Cognitive Development Theory, this study explores how PBL influences the critical thinking and academic performance of learners during their transition to secondary mathematics.

## METHODOLOGY

This study utilized a descriptive correlational research design to examine the extent of Problem-Based Learning (PBL) strategy and its relationship with the critical thinking and mathematics achievement of Grade 7 students.

**Participants and Sampling.** The study population consisted of 304 Grade 7 students from a public secondary school during school year 2025–2026. A sample size of 173 was determined using Yamane's formula with a 0.05 margin of error. Respondents were selected via stratified random sampling with proportionate allocation across seven sections, followed by a lottery method for individual identification.

**Instrumentation.** A 30-item researcher-made questionnaire served as the primary instrument, featuring two 15-item scales for PBL and Critical Thinking scored on a five-point Likert scale. Mathematics Achievement was obtained through secondary data using students' final grades from official School Form 9 (SF9) records.

Validity and Reliability. The instrument underwent rigorous psychometric testing:

- Content Validity: Five experts (PhD holders) evaluated the tool, yielding a Content Validity Ratio (CVR) of 1.00, indicating unanimous agreement on item essentiality.
- Reliability: Pilot testing with 30 non-respondents yielded Cronbach's alpha coefficients of 0.775 (PBL) and 0.791 (Critical Thinking), confirming acceptable internal consistency.

Data Analysis Quantitative data were processed using the following statistical treatments:

1. Weighted Mean and Standard Deviation: To determine the extent of PBL implementation, the level of critical thinking, and mathematics achievement.
2. Spearman Rank-Order Correlation Coefficient ( $r_s$ ): To analyze the significance of the relationships between the variables at a 0.05 level of significance.

## RESULTS

Extent of PBL Strategy: The PBL strategy is at a high extent with an overall mean of 3.98 (SD = 0.54). The highest-rated indicator is receiving teacher guidance rather than direct answers (Mean = 4.40), while the lowest is presenting findings and explaining reasoning (Mean = 3.73).

Level of Critical Thinking Skills: Students exhibit a high level of critical thinking (Mean = 3.66, SD = 0.61). They excel at checking their answers (Mean = 3.99) but show relative weakness in predicting results using patterns (Mean = 3.42).

Mathematics Achievement: Academic performance is at a satisfactory level (Mean = 84.35, SD = 5.38). The majority of the 173 respondents fall within the Satisfactory to Very Satisfactory range.

### Correlational Analysis:

- PBL and Critical Thinking: There is a statistically significant relationship ( $r_s=0.535, p<.001$ ).
- PBL and Mathematics Achievement: There is no significant relationship ( $r_s=0.043, p=0.576$ ).
- Critical Thinking and Mathematics Achievement: There is no significant relationship ( $r_s=0.044, p=0.566$ ).

## DISCUSSION

The very high rating for teacher guidance reflects the successful application of Vygotsky's Social Constructivism. It demonstrates that teachers are effectively providing scaffolding within the students' Zone of Proximal Development (ZPD), allowing for gradual independence rather than direct knowledge transmission.

While overall critical thinking is high, the gap between "checking answers" and "pattern recognition" suggests that students have developed strong metacognitive self-regulation but still struggle with predictive analytical thinking. This aligns with Piaget's theory that students must discover "new truths" through exploration to move beyond procedural understanding.

The significant relationship validates PBL as a cognitive catalyst. Exposure to authentic problems forces students to move beyond memorization and toward deeper cognitive engagement, justifying its use in the Revised K–10 Curriculum to develop 21st-century competencies.

The lack of significant relationships between PBL/Critical Thinking and academic grades implies that mathematics achievement is a multifaceted outcome influenced by external variables. These may include prior knowledge, study habits, socioeconomics, and math anxiety.

Furthermore, it suggests that traditional grading (procedural fluency) may not yet fully capture or reward the higher-order reasoning skills (critical thinking) nurtured by inquiry-based strategies like PBL. For PBL to affect grades, it may require sustained, long-term exposure rather than short-term implementation.

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## CONCLUSION

The study concludes that PBL is effectively practiced and directly fosters higher-order thinking. However, the disconnect with academic grades implies that formal assessments may not yet fully capture the 21st-century skills nurtured by PBL.

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