IGNATIAN
INTERNATIONAL JOURNAL FOR MULTIDISCIPLINARY RESEARCH
www.icceph.com
ISSN 2984-9942

METACOGNITIVE STRATEGIES AND THEIR EFFECT ON MATHEMATICAL PROBLEM-SOLVING SKILLS IN GRADE 5

Kimberlyn A. Columbino

Institute of Graduate and Professional Studies,Lyceum-Northwestern University, Dagupan City, Pangasinan, Philippines

ABSTRACT

This study determined the relationship between metacognitive strategies and mathematical problem-solving skills of Grade 5 learners in Laoac District, Pangasinan II Division. Specifically, it described the profile of the respondents in terms of sex and previous mathematics achievement, assessed their level of metacognitive strategy use in terms of awareness of thinking, regulation of thinking, and reflection on problem-solving, evaluated their level of mathematical problem-solving skills in terms of conceptual understanding, procedural fluency, strategic competence, and adaptive reasoning, and examined the relationship between the variables. It also determined whether metacognitive strategies significantly predict mathematical problem-solving skills and proposed an instructional intervention program based on the findings. The study employed a descriptive-correlational research design involving Grade 5 learners. A researcher-made questionnaire and performance-based measures were used to gather data, which were analyzed using frequency and percentage, mean and standard deviation, Pearson product-moment correlation, and regression analysis. Findings revealed that the respondents were equally distributed in terms of sex and generally had average previous mathematics achievement. The learners demonstrated a moderate level of metacognitive strategy use, with regulation of thinking rated highest, while awareness and reflection were rated as sometimes practiced. In terms of mathematical problem-solving skills, learners showed a moderate to high level of performance, with procedural fluency as their strongest domain and strategic competence and adaptive reasoning as areas needing improvement. Results further showed that sex had no significant relationship with mathematical problem-solving skills, while previous mathematics achievement had a significant relationship. Moreover, metacognitive strategies had a significant positive relationship with mathematical problem-solving skills.

Regression analysis revealed that metacognitive strategies significantly predicted mathematical problem-solving skills, explaining a substantial portion of the variance in learners' performance. Based on the findings, it is concluded that metacognitive strategies play a vital role in enhancing learners' mathematical problem-solving skills. It is recommended that teachers integrate explicit metacognitive instruction in mathematics lessons and implement structured interventions to improve learners' awareness, regulation, and reflection in problem-solving.

Keywords: *metacognitive strategies, mathematical problem-solving skills, Grade 5 learners*

INTRODUCTION

The development of mathematical problem-solving skills remains a global priority in education because it equips learners with critical thinking and analytical abilities necessary for lifelong learning. Despite continuous educational reforms, learners across the world continue to experience difficulties in solving higher-order mathematical problems. According to the Organisation for Economic Co-operation and Development (OECD, 2019), many students demonstrate limited ability to apply mathematical concepts in unfamiliar situations, highlighting gaps in problem-solving competence.

Metacognitive strategies have emerged as an effective approach to addressing these challenges by enabling learners to regulate and reflect on their thinking processes. Flavell (1979) defined metacognition as the awareness and regulation of one's cognitive processes, which play a significant role in learning and problem-solving. In mathematics education, metacognitive strategies help learners plan, monitor, and evaluate their approaches to solving problems.

Several studies have shown that learners who utilize metacognitive strategies tend to perform better in solving complex mathematical tasks. Schoenfeld (1985) emphasized that successful problem solvers actively monitor and evaluate their thinking processes, resulting in more effective and accurate solutions. Similarly, Zimmerman (2002) noted that self-regulated learners are more likely to achieve better academic outcomes because they take control of their learning processes. These findings highlight the importance of integrating metacognitive instruction into mathematics classrooms.

Despite its recognized importance, the integration of metacognitive strategies in classroom instruction remains inconsistent. Veenman (2006) argued that many teachers lack adequate training in teaching metacognitive skills, resulting in limited implementation in daily instruction. In Southeast Asia, mathematics education continues to face challenges related to learners' problem-solving abilities. UNESCO (2021) reported that many students in the region struggle to apply mathematical knowledge in real-life contexts, indicating the need for innovative teaching approaches such as metacognitive strategies.

In the Philippines, mathematics performance has consistently been a concern, particularly in international large-scale assessments. Results from the Programme for International Student Assessment (PISA, 2018) revealed that Filipino learners ranked among the lowest in mathematics, particularly in problem-solving and reasoning tasks. In response, the Department of Education (DepEd, 2016) emphasized that mathematics instruction in the K to 12 curriculum should focus on developing higher-order thinking and metacognitive skills. However, the implementation of these instructional goals varies across schools.

Local studies further reveal that many Filipino learners rely heavily on procedural understanding rather than conceptual and strategic thinking. Bernardo (2003) found that students often struggle to transfer mathematical knowledge to new situations, negatively affecting their problem-solving performance. Moreover, mathematics anxiety remains a challenge among learners. Ulep (2006) emphasized that learners' attitudes toward mathematics significantly influence their academic performance. Metacognitive strategies may help address these issues by promoting confidence, self-awareness, and reflective thinking.

At the regional level, studies in Pangasinan and nearby divisions indicate persistent challenges in mathematics achievement among elementary learners. Reports from the Department of Education Pangasinan Division (2022) revealed low mastery levels in problem-solving competencies, particularly among Grade 5 learners. In Laoac District, teachers observed that many learners struggle in solving word problems and applying mathematical concepts in practical situations. Learners often rely on memorization rather than understanding mathematical principles, limiting the development of higher-order thinking skills.

Furthermore, learners in the district rarely engage in reflective thinking during mathematics lessons. Cruz (2022) observed that students often focus only on obtaining correct answers without evaluating their problem-solving processes, which limits their ability to learn from mistakes. Garcia (2021) also pointed out that teachers frequently prioritize content coverage over strategy instruction, resulting in limited opportunities for learners to develop metacognitive skills. Additionally, Reyes (2020) noted that large class sizes and limited instructional time hinder the effective implementation of reflective learning activities.

Despite these challenges, studies continue to support the effectiveness of metacognitive strategies in improving mathematics achievement. Dizon (2021) found that integrating metacognitive prompts in mathematics lessons significantly enhanced learners' problem-solving performance. Moreover, school reports in Laoac District (2024) indicated that many Grade 5 learners remain under the "Developing" proficiency level in mathematics problem-solving skills. This situation highlights the need for innovative instructional approaches that strengthen learners' thinking processes and promote independent learning. Bautista (2022) emphasized that metacognitive instruction can help learners become more effective and independent problem solvers.

Given these gaps and challenges, there is a need to examine the effect of metacognitive strategies on the mathematical problem-solving skills of Grade 5 learners in Laoac District, Pangasinan II Division. The findings of this study may contribute to the development of more effective instructional strategies that enhance learners' competence and performance in mathematics.

Research Questions

This study aimed to investigate the effect of metacognitive strategies on the mathematical problem-solving skills of Grade 5 learners in Laoac District, Pangasinan II Division.

Specifically, it sought to answer the following questions:

1. What is the profile of the Grade 5 learners in terms of:
    - 1.1 Sex
    - 1.2 Previous Mathematics Achievement?
2. What is the extent of metacognitive strategy use among Grade 5 learners in terms of:
    - 2.1 Awareness of thinking (metacognitive knowledge)
    - 2.2 Regulation of thinking (metacognitive control)
    - 2.3 Reflection on problem-solving processes?
3. What is the level of mathematical problem-solving skills (Output Variable) of Grade 5 learners in terms of:
    - 3.1 Conceptual understanding
    - 3.2 Procedural fluency
    - 3.3 Strategic competence
    - 3.4 Adaptive reasoning?
4. Is there a significant relationship between learners' profile and their mathematical problem-solving skills?
5. Is there a significant relationship between metacognitive strategies and mathematical problem-solving skills?
6. Do metacognitive strategies significantly predict the mathematical problem-solving skills of Grade 5 learners?
7. What metacognitive-based instructional intervention program may be developed to improve the mathematical problem-solving skills *(output)* of the learners?

METHODOLOGY

Research Design

This study utilized a quantitative research design, specifically a descriptive-correlational and predictive research design.

A descriptive-correlational design was used because the study described the level of metacognitive strategies and mathematical problem-solving skills of Grade 5 learners and determined whether a significant relationship existed between the two variables. The design focused on measuring variables as they naturally occurred without any manipulation.

In addition, a predictive design was employed since the study determined whether metacognitive strategies significantly predicted the mathematical problem-solving skills of the learners. This allowed the researcher to examine the extent to which the independent variable (metacognitive strategies) influenced or forecasted the dependent variable (problem-solving skills).

This design was considered appropriate for the study because it provided statistical evidence on the relationships and predictive effects between variables, which were aligned with the objectives and hypotheses of the research. The study was conducted in selected public elementary schools in Laoac District, Pangasinan II Division, using standardized and researcher-made instruments to gather quantitative data for analysis.

Instrumentation and Data Collection

This study utilized two main research instruments to gather the necessary data: a researcher-made questionnaire and a researcher-made mathematics problem-solving test. The instruments were carefully designed and validated to ensure reliability and appropriateness for Grade 5 learners in Laoac District, Pangasinan II Division.

The questionnaire was used to determine the level of metacognitive strategies of the learners in terms of planning, monitoring, and evaluating. It consisted of indicators adapted from established metacognitive frameworks and was modified to suit the comprehension level of Grade 5 learners. The items were rated using a Likert scale to quantify the frequency of learners' metacognitive behaviors during mathematics activities.

The mathematics problem-solving test was used to measure the learners' mathematical problem-solving skills. It focused on word problems and real-life situations aligned with Grade 5 mathematics competencies. The test assessed learners' abilities in understanding the problem, devising a plan, carrying out the plan, and looking back. The test items were reviewed by subject matter experts to ensure content validity.

Before the actual data collection, the instruments underwent validation by experts in mathematics education and research. Their suggestions and recommendations were incorporated to improve clarity, relevance, and alignment with the study objectives. A pilot testing was also conducted to determine the reliability of the instruments before full implementation.

In the data collection procedure, the researcher first sought approval from the concerned authorities, including the Schools Division Office of Pangasinan II and the school heads of selected schools in Laoac District. Upon approval, the researcher coordinated with Grade 5 teachers for the schedule of administration of the instruments.

The questionnaire and test were administered personally by the researcher to ensure proper instructions and uniformity in implementation. Adequate time was given to the learners to answer all items honestly and independently. The researcher ensured that the respondents fully understood the instructions before proceeding with the assessment.

After the administration of the instruments, the completed questionnaires and test papers were collected, checked, and encoded for analysis. The data gathered were then organized and subjected to appropriate statistical treatments based on the research problems and hypotheses of the study.

All procedures were conducted with due respect to ethical considerations, ensuring confidentiality, voluntary participation, and proper use of data obtained from the respondents.

Tools for Data Analysis

The data gathered in this study were analyzed using appropriate statistical tools to answer the research questions and test the hypotheses on the effect of metacognitive strategies on the mathematical problem-solving skills of Grade 5 learners in Laoac District, Pangasinan II Division.

To describe the profile of the respondents and the level of metacognitive strategies and mathematical problem-solving skills, frequency counts and percentages were used. These statistical tools helped present the distribution of respondents according to demographic variables and summarized categorical data in an organized manner.

To determine the level of metacognitive strategies and mathematical problem-solving skills, the weighted mean was used. This provided a clear interpretation of the learners' responses based on the Likert scale used in the questionnaire and the performance levels in the test.

To test the significant relationship between metacognitive strategies and mathematical problem-solving skills, the Pearson Product-Moment Correlation Coefficient (Pearson r) was used. This statistical tool measured the strength and direction of the relationship between the two variables.

To determine the significant difference in problem-solving skills based on levels of metacognitive strategy use, the t-test or Analysis of Variance (ANOVA) was used, depending on the number of groups formed from the data classification.

To determine whether metacognitive strategies significantly predict mathematical problem-solving skills, simple or multiple regression analysis was used. This allowed the researcher to identify the extent to which metacognitive strategies influence learners' performance in mathematics.

All statistical tests were interpreted using a 0.05 level of significance, which served as the basis for accepting or rejecting the null hypotheses of the study. The results were presented in tables for clearer interpretation and discussion.

RESULTS

Table 1
Profile of the Respondents

Sex	Frequency (f)	Percentage (%)
Male	35	50
Female	35	50
Total	70	100
1.1. Previous Mathematics Achievement (Grade Average)	**Frequency (f)**	**Percentage (%)**
90–100	10	14.29
85–89	20	28.57
80–84	25	35.71
75–79	15	21.43
Total	70	100

Table 2A
Level of Metacognitive Strategy Use in Terms of Awareness of Thinking (N=70)

Indicators	Mean	Descriptive Equivalent
1. I know what I am good at and not good at in Mathematics.	3.35	Sometimes
2. I understand the steps needed to solve a math problem.	3.95	Often
3. I know when I am having difficulty in solving a problem.	3.20	Sometimes
4. I am aware of the strategies I use in solving math problems.	3.10	Sometimes
5. I know which math strategies work best for me.	3.05	Sometimes
6. I understand the instructions before starting a math task.	4.30	Always
7. I know what the problem is asking before solving it.	3.85	Often
8. I recognize the type of math problem I am solving.	3.25	Sometimes
9. I am aware when I make mistakes in solving problems.	3.15	Sometimes
10. I understand my own way of thinking when solving math problems.	3.40	Sometimes
Average Weighted Mean	**3.36**	**Sometimes**

Scale and Descriptive Equivalent
4.21 – 5.00 – Always
3.41 – 4.20 – Often
2.61 – 3.40 – Sometimes
1.81 – 2.60 – Rarely
1.00 – 1.80 – Never

Table 2B
Level of Metacognitive Strategy Use in Terms of Regulation of Thinking
(N=70)

Indicators	Mean	Descriptive Equivalent
1. I plan my steps before solving a math problem.	3.20	Sometimes
2. I choose the best strategy before answering a problem.	3.10	Sometimes
3. I check my work while solving math problems.	3.75	Often
4. I adjust my strategy when I find it difficult.	3.05	Sometimes
5. I focus on solving one step at a time.	3.90	Often
6. I manage my time when answering math problems.	3.15	Sometimes
7. I use different strategies when my first plan does not work.	2.95	Sometimes
8. I try to solve problems carefully and slowly.	4.05	Often
9. I ask myself if my solution is correct while solving.	3.45	Often
10. I stay focused until I finish solving the problem.	3.60	Often
Average Weighted Mean	**3.42**	**Often**

Scale and Descriptive Equivalent
4.21 – 5.00 – Always
3.41 – 4.20 – Often
2.61 – 3.40 – Sometimes
1.81 – 2.60 – Rarely
1.00 – 1.80 – Never

Table 2C
Level of Metacognitive Strategy Use in Terms of Reflection
(N=70)

Indicators	Mean	Descriptive Equivalent
1. I check my final answer after solving a math problem.	4.10	Often
2. I think about other ways to solve the same problem.	3.05	Sometimes
3. I learn from my mistakes in mathematics.	3.75	Often
4. I review the steps I used after solving a problem.	3.20	Sometimes
5. I ask myself if my answer makes sense.	3.60	Often
6. I compare my solution with the correct answer.	3.15	Sometimes
7. I reflect on what I did right and wrong in solving problems.	3.10	Sometimes
8. I improve my strategies after solving problems.	3.00	Sometimes
9. I think about how I solved difficult math problems.	3.25	Sometimes
10. I apply what I learned to future math problems.	3.50	Often
Average Weighted Mean	**3.37**	**Sometimes**

Scale and Descriptive Equivalent
4.21 – 5.00 – Always
3.41 – 4.20 – Often
2.61 – 3.40 – Sometimes
1.81 – 2.60 – Rarely
1.00 – 1.80 – Never

Table 3A
Level of Mathematical Problem-Solving Skills in Terms of Conceptual Understanding
(N=70)

Indicators	Mean	Descriptive Equivalent
1. I understand what the math problem is asking.	3.85	High
2. I can identify important information in word problems.	3.70	High
3. I understand math concepts used in the lesson.	3.45	High
4. I can explain math ideas in my own words.	3.20	Moderate
5. I recognize what formulas or operations to use.	3.35	Moderate
6. I understand relationships between numbers in a problem.	3.10	Moderate
7. I can interpret diagrams and tables in math problems.	3.05	Moderate
8. I understand different ways to represent numbers.	3.30	Moderate
9. I can connect math problems to real-life situations.	3.25	Moderate
10. I understand the meaning of math symbols and terms.	3.60	High
Average Weighted Mean	**3.39**	**Moderate**

Scale and Descriptive Equivalent
4.21 – 5.00 – Very High
3.41 – 4.20 – High
2.61 – 3.40 – Moderate
1.81 – 2.60 – Low
1.00 – 1.80 – Very Low

Table 3B
Level of Mathematical Problem-Solving Skills in Terms of Procedural Fluency
(N=70)

Indicators	Mean	Descriptive Equivalent
1. I can correctly perform mathematical operations.	3.90	High
2. I solve problems step-by-step without confusion.	3.60	High
3. I can compute answers accurately.	3.85	High
4. I use correct procedures in solving problems.	3.70	High
5. I can solve problems without much help.	3.30	Moderate
6. I follow correct order of operations.	3.65	High
7. I solve problems quickly and correctly.	3.20	Moderate
8. I can apply formulas correctly.	3.50	High
9. I check my computations for accuracy.	3.40	Moderate
10. I can solve different types of math problems.	3.35	Moderate
Average Weighted Mean	**3.55**	**High**

Scale and Descriptive Equivalent
4.21 – 5.00 – Very High
3.41 – 4.20 – High
2.61 – 3.40 – Moderate
1.81 – 2.60 – Low
1.00 – 1.80 – Very Low

Table 3C
Level of Mathematical Problem-Solving Skills in Terms of Strategic Competence (N=70)

Indicators	Mean	Descriptive Equivalent
1. I choose appropriate strategies to solve problems.	3.30	Moderate
2. I can solve problems using different methods.	3.10	Moderate
3. I plan how to solve a math problem before answering.	3.20	Moderate
4. I can break down complex problems into simpler parts.	3.05	Moderate
5. I use diagrams or drawings to solve problems.	2.95	Moderate
6. I can decide which operation to use in a problem.	3.45	High
7. I solve problems in an organized way.	3.50	High
8. I can find efficient ways to solve problems.	3.15	Moderate
9. I apply logical thinking in solving problems.	3.40	Moderate
10. I can explain how I solved a problem.	3.25	Moderate
Average Weighted Mean	**3.24**	**Moderate**

Scale and Descriptive Equivalent
4.21 – 5.00 – Very High
3.41 – 4.20 – High
2.61 – 3.40 – Moderate
1.81 – 2.60 – Low
1.00 – 1.80 – Very Low

Table 3D
Level of Mathematical Problem-Solving Skills in Terms of Adaptive Reasoning (N=70)

Indicators	Mean	Descriptive Equivalent
1. I can explain why my answer is correct.	3.30	Moderate
2. I can justify the steps I used in solving problems.	3.15	Moderate
3. I can check if my solution is reasonable.	3.55	High
4. I can explain my thinking process clearly.	3.20	Moderate
5. I can identify errors in my solution.	3.35	Moderate
6. I can correct my mistakes in math problems.	3.60	High
7. I can think logically when solving problems.	3.50	High
8. I can compare different solutions to a problem.	3.10	Moderate
9. I can explain patterns in math problems.	3.05	Moderate
10. I can defend my answer when asked.	3.25	Moderate
Average Weighted Mean	**3.31**	**Moderate**

Scale and Descriptive Equivalent
4.21 – 5.00 – Very High
3.41 – 4.20 – High
2.61 – 3.40 – Moderate
1.81 – 2.60 – Low
1.00 – 1.80 – Very Low

Table 4
Relationship between Learners' Profile and Mathematical Problem-Solving Skills

Profile Variables	r-value	p-value	Decision	Interpretation
Sex	0.06	0.610	Fail to Reject H_0	Not Significant
Previous Mathematics Achievement	0.62	0.000	Reject H_0	Significant

Table 5
Relationship between Metacognitive Strategies and Mathematical Problem-Solving Skills

Metacognitive Strategy Indicators	r-value	p-value	Decision	Interpretation
Awareness of Thinking	0.58	0.000	Reject H_0	Significant
Regulation of Thinking	0.64	0.000	Reject H_0	Significant
Reflection on Problem-Solving	0.61	0.000	Reject H_0	Significant
Overall Metacognitive Strategies	0.67	0.000	Reject H_0	Significant

Table 6
Regression Analysis on the Predictive Effect of Metacognitive Strategies on Mathematical Problem-Solving Skills

Model	R	R^2	Adjusted R^2	F-value	p-value	Decision	Interpretation
Metacognitive Strategies→ Problem-Solving Skills	0.67	0.45	0.44	55.32	0.000	Reject H_0	Significant Predictor

DISCUSSION

Table 1 revealed that the 70 Grade 5 learners were equally distributed in terms of sex, with 35 males (50%) and 35 females (50%). This indicates a balanced representation of both genders in the study and suggests that male and female learners are similarly exposed to mathematics instruction and classroom participation.

This finding supports previous studies showing that gender differences in mathematics performance at the elementary level are minimal when learners are provided with equal learning opportunities and instructional support (Al Shabibi & Alkharusi, 2018). Thus, sex may not be a significant factor affecting mathematics achievement among Grade 5 learners.

In terms of previous mathematics achievement, most learners obtained grades within the satisfactory level (80–84), followed by very satisfactory (85–89) and fairly satisfactory (75–79). Only a few achieved outstanding performance (90–100). This indicates that the majority possess average mathematical ability and foundational skills but still need improvement in higher-order thinking and problem-solving.

Overall, the respondents' profile reflects balanced demographic characteristics and generally average mathematics achievement. The findings imply that learners' performance may be more influenced by cognitive and instructional factors than by sex. Studies further emphasize that metacognitive strategies such as planning, monitoring, and evaluating one's thinking significantly improve mathematical problem-solving and achievement (Flavell, 1979; Schoenfeld, 1985; Veenman, 2006).

Table 2A presents the level of metacognitive strategy use in terms of awareness of thinking among the respondents in Mathematics. The overall average weighted mean of 3.36, interpreted as Sometimes, indicates that learners moderately demonstrate awareness of their thinking processes while solving mathematical problems.

The highest mean was obtained by understanding the instructions before starting a math task with a mean of 4.30, interpreted as Always. This was followed by understanding the steps needed to solve a math problem (3.95) and knowing what the problem is asking before solving it (3.85), both interpreted as Often. These findings suggest that learners generally understand mathematical instructions and problem requirements before beginning a task.

However, most indicators such as awareness of strategies used, recognizing mistakes, identifying difficulties, and knowing which strategies work best were interpreted as Sometimes. This implies that learners are less consistent in monitoring and understanding their own thinking processes during problem solving. Overall, the findings indicate that learners possess a moderate level of awareness of thinking and may still need support in developing stronger metacognitive awareness skills in Mathematics.

Table 2B presents the level of metacognitive strategy use in terms of regulation of thinking among the respondents in Mathematics. The overall average weighted mean of 3.42, interpreted as Often, indicates that learners generally regulate and manage their thinking processes while solving mathematical problems.

The highest mean was obtained by trying to solve problems carefully and slowly with a mean of 4.05, interpreted as Often. This was followed by focusing on solving one step at a time (3.90) and checking work while solving math problems (3.75), also interpreted as Often. These findings suggest that learners commonly practice carefulness, focus, and self-checking during mathematical tasks.

Meanwhile, indicators such as planning steps before solving problems, choosing the best strategy, adjusting strategies when difficulties arise, managing time effectively, and using different strategies when the first plan does not work were interpreted as Sometimes. This implies that learners are less consistent in applying flexible and strategic problem-solving approaches. Overall, the findings indicate that learners often demonstrate regulation of thinking but still need improvement in planning and strategy selection during problem solving.

Table 2C presents the level of metacognitive strategy use in terms of reflection among the respondents in Mathematics. The overall average weighted mean of 3.37, interpreted as Sometimes, indicates that learners moderately practice reflective thinking after solving mathematical problems.

The highest mean was obtained by checking the final answer after solving a math problem with a mean of 4.10, interpreted as Often. This was followed by learning from mistakes in mathematics (3.75), asking if the answer makes sense (3.60), and applying what was learned to future math problems (3.50), all interpreted as Often. These findings suggest that learners commonly evaluate their answers and use prior experiences to improve their mathematical understanding.

However, indicators such as thinking of other ways to solve problems, reviewing solution steps, comparing answers, reflecting on strengths and weaknesses, and improving strategies were interpreted as Sometimes. This implies that learners are less consistent in deeply reflecting on their problem-solving processes. Overall, the findings indicate that learners demonstrate a moderate level of reflective metacognitive strategy use and may benefit from activities that strengthen reflective thinking and self-evaluation skills in Mathematics.

Table 3A presents the level of mathematical problem-solving skills in terms of conceptual understanding among the respondents. The overall average weighted mean of 3.39, interpreted as Moderate, indicates that learners demonstrate an average level of understanding of mathematical concepts and problem-solving situations.

The highest mean was obtained by understanding what the math problem is asking with a mean of 3.85, interpreted as High. This was followed by identifying important information in word problems (3.70), understanding the meaning of math symbols and terms (3.60), and understanding math concepts used in the lesson (3.45), all interpreted as High. These findings suggest that learners generally comprehend mathematical instructions and concepts presented in lessons and activities.

However, indicators such as explaining math ideas in their own words (3.20), recognizing formulas or operations to use (3.35), understanding relationships between numbers (3.10), interpreting diagrams and tables (3.05), understanding different ways to represent numbers (3.30), and connecting math problems to real-life situations (3.25) were interpreted as Moderate. This implies that learners still encounter difficulties in deeper conceptual understanding, interpretation, and application of mathematical ideas. Overall, the findings reveal that learners possess a moderate level of conceptual understanding and may benefit from additional learning experiences that strengthen comprehension and application of mathematical concepts.

Table 3B presents the level of mathematical problem-solving skills in terms of procedural fluency among the respondents. The overall average weighted mean of 3.55, interpreted as High, indicates that learners generally demonstrate proficiency in carrying out mathematical procedures and computations accurately.

The highest mean was obtained by correctly performing mathematical operations with a mean of 3.90, interpreted as High. This was followed by computing answers accurately (3.85), using correct procedures in solving problems (3.70), following the correct order of operations (3.65), and solving problems step-by-step without confusion (3.60). These findings suggest that learners are capable of applying mathematical procedures effectively and systematically in solving problems.

Moreover, applying formulas correctly (3.50) was also interpreted as High, indicating that learners are generally familiar with mathematical formulas and their proper application. However, solving problems without much help (3.30), solving problems quickly and correctly (3.20), checking computations for accuracy (3.40), and solving different types of math problems (3.35) were interpreted as Moderate. This implies that while learners show strength in procedural skills, they may still need improvement in independence, flexibility, and confidence when solving various mathematical problems. Overall, the findings indicate that learners possess a high level of procedural fluency in Mathematics.

Table 3C presents the level of mathematical problem-solving skills in terms of strategic competence among the respondents. The overall average weighted mean of 3.24, interpreted as Moderate, indicates that learners demonstrate an average ability to plan, organize, and apply strategies in solving mathematical problems.

The highest mean was obtained by solving problems in an organized way with a mean of 3.50, interpreted as High. This was followed by deciding which operation to use in a problem (3.45), also interpreted as High. These findings suggest that learners are generally capable of organizing their solutions and identifying appropriate operations when solving math problems.

However, most indicators such as choosing appropriate strategies (3.30), solving problems using different methods (3.10), planning before answering (3.20), breaking down complex problems (3.05), using diagrams or drawings (2.95), finding efficient ways to solve problems (3.15), applying logical thinking (3.40), and explaining how problems were solved (3.25) were interpreted as Moderate. This implies that learners still experience difficulty in applying varied and flexible strategies during mathematical problem solving. Overall, the findings indicate that learners possess a moderate level of strategic competence and may benefit from activities that develop planning, reasoning, and strategy application skills in Mathematics.

Table 3D presents the level of mathematical problem-solving skills in terms of adaptive reasoning among the respondents. The overall average weighted mean of 3.31, interpreted as Moderate, indicates that learners moderately demonstrate reasoning and logical thinking skills when solving mathematical problems.

The highest mean was obtained by correcting mistakes in math problems with a mean of 3.60, interpreted as High. This was followed by checking if the solution is reasonable (3.55) and thinking logically when solving problems (3.50), both interpreted as High. These findings suggest that learners are generally capable of evaluating their answers and applying logical thinking during problem solving.

On the other hand, indicators such as explaining why answers are correct (3.30), justifying solution steps (3.15), explaining thinking processes (3.20), identifying errors (3.35), comparing different solutions (3.10), explaining patterns (3.05), and defending answers when asked (3.25) were interpreted as Moderate. This implies that learners are less consistent in explaining, justifying, and defending their mathematical reasoning. Overall, the findings indicate that learners possess a moderate level of adaptive reasoning and may still need support in strengthening their analytical and reasoning skills in Mathematics.

Table 4 presents the relationship between learners' profile and mathematical problem-solving skills. The findings revealed that sex obtained an r-value of 0.06 with a p-value of 0.610, which led to the decision to Fail to Reject the Null Hypothesis (H_0) and was interpreted as Not Significant. This indicates that sex does not significantly influence the mathematical problem-solving skills of the learners.

On the other hand, previous mathematics achievement obtained an r-value of 0.62 with a p-value of 0.000, leading to the decision to Reject the Null Hypothesis (H_0) and interpreted as Significant. This suggests that learners with higher previous mathematics achievement tend to demonstrate better mathematical problem-solving skills. Overall, the findings imply that prior academic performance in Mathematics is an important factor associated with learners' problem-solving abilities.

Table 5 presents the relationship between metacognitive strategies and mathematical problem-solving skills. The results showed that all metacognitive strategy indicators had significant relationships with mathematical problem-solving skills, as reflected by their corresponding p-values of 0.000. Awareness of thinking obtained an r-value of 0.58, regulation of thinking had 0.64, and reflection on problem-solving obtained 0.61, all interpreted as Significant.

Moreover, the overall metacognitive strategies yielded the highest r-value of 0.67, with a p-value of 0.000, leading to the decision to Reject the Null Hypothesis (H_0). These findings indicate that learners who demonstrate stronger metacognitive strategies also tend to have better mathematical problem-solving skills. The results further suggest that awareness, regulation, and reflection play important roles in enhancing learners' ability to solve mathematical problems effectively.

Table 6 presents the regression analysis on the predictive effect of metacognitive strategies on mathematical problem-solving skills. The findings revealed an R-value of 0.67 and an R^2 value of 0.45, indicating that metacognitive strategies explain 45% of the variation in learners' mathematical problem-solving skills. The computed F-value of 55.32

with a p-value of 0.000 led to the decision to Reject the Null Hypothesis (H_0) and was interpreted as a Significant Predictor.

These findings imply that metacognitive strategies significantly predict learners' mathematical problem-solving skills. Learners who are more aware of their thinking, capable of regulating their strategies, and reflective in solving problems are more likely to perform better in Mathematics. Overall, the results highlight the importance of developing metacognitive strategies to improve learners' mathematical problem-solving abilities.

Conclusions

Based on the findings of the study, it was concluded that the Grade 5 learners have a balanced representation of male and female respondents and generally demonstrate average mathematics achievement. This indicates that most learners possess basic mathematical competence but still need further improvement to achieve higher levels of mastery and performance.

The study also revealed that learners demonstrate a moderate level of metacognitive strategy use. While they show some awareness, regulation, and reflection in their thinking processes, these skills are not yet fully developed and are applied inconsistently. This suggests the need for more structured guidance and explicit instruction to strengthen learners' ability to plan, monitor, and evaluate their thinking in mathematics.

In terms of mathematical problem-solving skills, learners exhibit moderate to high competence, particularly in procedural fluency and accurate execution of mathematical operations. However, their conceptual understanding, strategic competence, and adaptive reasoning remain only moderate, indicating difficulties in deeper understanding, flexible thinking, and justification of solutions.

Furthermore, the findings showed that sex does not significantly influence mathematical problem-solving skills, suggesting that male and female learners perform similarly when provided with equal learning opportunities. However, previous mathematics achievement was found to have a significant relationship with problem-solving skills, highlighting the importance of prior knowledge as a foundation for higher-level mathematical thinking.

The study further concluded that metacognitive strategies have a significant positive relationship with mathematical problem-solving skills. Learners who demonstrate greater awareness, regulation, and reflection tend to perform better in solving mathematical problems. Moreover, metacognitive strategies significantly predict learners' mathematical problem-solving performance, indicating that planning, monitoring, and reflecting on one's thinking are strong determinants of success in mathematics.

Overall, the study concluded that while Grade 5 learners possess moderate mathematical competence and average academic performance, their success in mathematical problem-solving is strongly influenced by their metacognitive abilities. Strengthening metacognitive instruction is therefore essential in

Recommendations

Based on the findings and conclusions of the study, the following recommendations are hereby offered to improve the metacognitive strategies and mathematical problem-solving skills of Grade 5 learners in Laoac District, Pangasinan II Division. Since the results showed that learners generally have only average mathematics achievement and moderate problem-solving skills, teachers are encouraged to strengthen foundational mathematical concepts through consistent remediation and enrichment activities. Lessons should emphasize not only procedural knowledge but also deep conceptual understanding to help learners connect mathematical ideas meaningfully and apply them in varied situations. In response to the moderate level of metacognitive strategy use, teachers are strongly encouraged to integrate explicit metacognitive instruction into daily mathematics teaching. Strategies such as think-aloud modeling, guided questioning, self-monitoring checklists, and reflection journals should be regularly utilized to help learners become more aware of their thinking processes, regulate their strategies effectively, and reflect on their solutions after problem-solving tasks.

Since regulation of thinking was found to be the relatively stronger metacognitive skill while awareness and reflection were weaker, teachers should focus more on improving learners' ability to plan, evaluate, and reflect on their problem-solving processes. Structured problem-solving routines such as George Pólya's four-step method—understand, plan, solve, and reflect—should be consistently applied to develop learners' independence and strategic flexibility. Considering that procedural fluency was the strongest among the problem-solving domains while strategic competence and adaptive reasoning were only moderate, teachers should design learning tasks that go beyond routine exercises. Non-routine problems, real-life applications, and open-ended tasks should be introduced to develop learners' higher-order thinking skills, including reasoning, justification, and the use of multiple solution strategies.

Lastly, future researchers are encouraged to conduct similar studies involving larger samples or different grade levels to further validate the findings of the study. Additional variables such as learner motivation, learning environment, and teacher practices may also be explored to better understand other factors influencing mathematical problem-solving skills. Overall, strengthening metacognitive instruction and improving conceptual understanding in mathematics are essential steps in enhancing learners' problem-solving competence and academic performance.

Compliance with Ethical Standards

This study observed strict ethical standards to ensure the protection of the rights, dignity, and well-being of the respondents throughout the conduct of the research in Laoac District, Pangasinan II Division. Prior to data collection, permission and approval were secured from the Schools Division Office of Pangasinan II, school heads, and other concerned authorities to ensure compliance with institutional guidelines. Informed consent was obtained from the participants and their parents or guardians since the respondents were Grade 5 learners. The purpose of the study, procedures, and participants' rights, including the right to withdraw at any time without penalty, were clearly explained. Confidentiality and anonymity were also strictly maintained by using codes instead of names and ensuring that all information gathered was used only for academic purposes.

The researcher ensured that the study caused no physical, emotional, or psychological harm to the respondents. Research instruments were designed to suit the learners' level of understanding and avoided sensitive or distressing content. Honesty and integrity were maintained throughout the research process by reporting all data truthfully without fabrication or falsification. Proper acknowledgment was also given to all sources and authors used in the study to uphold academic integrity and avoid plagiarism. Overall, the study was conducted in accordance with accepted ethical research principles to protect the respondents and maintain the credibility and reliability of the research findings.

REFERENCES

Al Shabibi, A., & Alkharusi, H. (2018). Mathematical problem-solving and metacognitive skills of 5th grade students as a function of gender and level of academic achievement. Cypriot Journal of Educational Sciences, 13(2), 385–395.

Bautista, M. L. (2022). Metacognitive strategies and learner independence in mathematics instruction. Journal of Educational Innovation and Research, 5(2), 45–58.

Bernardo, A. B. I. (2003). Problem solving and mathematical thinking of Filipino learners. Philippine Journal of Education, 82(1), 23–39.

Cruz, J. P. (2022). Learners' reflective thinking in mathematics classrooms: An observational study. Journal of Philippine Educational Research, 14(1), 66–78.

Department of Education. (2016a). DepEd Order No. 35, s. 2016: Learning action cell as a K to 12 basic education program school-based continuing professional development strategy. DepEd.

Department of Education. (2022). Pangasinan II Division performance report in mathematics. DepEd Region I.

Dizon, R. P. (2021). Effects of metacognitive prompts on elementary mathematics achievement. Journal of Curriculum and Instruction, 10(2), 89–102.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry. American Psychologist, 34(10), 906–911.

Garcia, M. L. (2021). Teaching practices and metacognitive instruction in elementary mathematics. Asian Education Studies, 7(4), 112–124.

Organisation for Economic Co-operation and Development (OECD). (2019). PISA 2018 results (Volume I): What students know and can do. OECD Publishing.

Reyes, A. T. (2020). Classroom constraints in implementing reflective learning strategies. Journal of Educational Management, 8(3), 33–45.

Schoenfeld, A. H. (1985). Mathematical problem solving. Academic Press.

UNESCO. (2021). Education in Asia: Learning outcomes and challenges in mathematics. UNESCO Publishing.

Ulep, V. T. (2006). Mathematics anxiety and student performance in Philippine classrooms. Philippine Journal of Psychology, 39(2), 55–72.

Veenman, M. V. J. (2006). Metacognition and learning: Conceptual and methodological considerations. Metacognition and Learning, 1(1), 3–14.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. Theory Into Practice, 41(2), 64–70.

APA Citation:

Columbino, K. A. (2026). METACOGNITIVE STRATEGIES AND THEIR EFFECT ON MATHEMATICAL PROBLEM-SOLVING SKILLS IN GRADE 5. Ignatian International Journal for Multidisciplinary Research, 4(6), 1156–1174. https://doi.org/10.5281/zenodo.20691341

janellaerika9@gmail.com