# The Relationship of Motivation to the Problem-Solving Skills of Students in Mathematics

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## ABSTRACT

Problem-solving skills are influenced by factors that enhance or hinder their development. This study aimed to assess students' problem-solving skills, evaluate their motivation towards Mathematics, and explore the relationship between motivation and problem-solving skills. Data were collected through survey questionnaires from one hundred fifty (150) Grade 11 students at Lurugan National High School in Valencia City, Bukidnon, during the second semester of the 2024-2025 school year. A descriptive-correlational research design was employed. The findings revealed that: (1) most students exhibited moderate performance; (2) their motivation levels were rated as moderately motivated; and (3) there was a significant relationship between motivation and problem-solving skills. Based on these results, it is recommended that efforts be made to enhance students' motivation, which may help to encourage their interest in problem-solving and strengthen their skills in this area. This research explored the relationship between motivation and mathematics students' problem-solving skills. A sample of students was assessed to determine their motivation and problem-solving abilities. Correlation analysis revealed a strong positive relationship, with a correlation coefficient of 0.718, indicating that higher motivation was associated with improved problem-solving skills. The probability value of 0.000 suggested that this relationship was statistically significant, emphasizing the crucial role of motivation in enhancing students' performance in mathematics. These findings underscore the importance of promoting motivation to improve problem-solving skills, leading to better academic outcomes in mathematics education.

**Keywords**: problem-solving skills, motivation

## INTRODUCTION

The relationship between motivation and problem-solving skills in mathematics has garnered significant attention in recent years in educational research. Previous studies have found that many students exhibit varying problem-solving abilities, often correlating with their motivation to engage with mathematical tasks. For instance, research by [1] found that students with intrinsic motivation were likelier to approach math problems with persistence and creativity. In contrast, a study by [2] indicated that low motivation levels led to a decline in problem-solving skills, resulting in poorer academic performance in mathematics.

Recent data from the National Achievement Test (NAT) results for grade 12 students at Lurugan National High School (LNHS) for the school year 2024 revealed that the mean percentage score (MPS) was 31.2%, which was the lowest among the seven subjects they had taken. The Division Achievement Test (DAT) indicated that junior high school students achieved an MPS of 38.5%, while senior high school students attained an even lower MPS of 31.9%. During the first semester of 2024, the mathematics exams for the first two quarters at Lurugan National High School (LNHS) also showed low performance. Junior high school students had an MPS of 52.75%, and senior high school students achieved 56.44%, significantly below the proficiency benchmark of 75%. These results indicated that most students failed to reach the desired proficiency level in mathematics. The low scores suggested that students struggled with analyzing and evaluating problems and were often unable to begin writing solutions to the given tasks.

Despite these findings, a notable gap persisted in understanding how different types of motivation-intrinsic and extrinsic-impact students' problem-solving strategies. A report by [3] highlighted that many students continued to struggle with mathematical problem-solving, showing a need for further investigation into the motivational factors that influence these skills.

Several studies supported the idea that motivation is essential for improving problem-solving abilities. For instance, a study by [4] showed that students who participated in motivation-boosting interventions significantly improved their problem-solving methods. Similarly, research by [5] indicated that motivated students employed more effective strategies and demonstrated greater engagement in mathematics. Locally, studies by [6] and [7] reinforced that increased motivation directly correlates with enhanced problem-solving skills among students, highlighting the effectiveness of motivational interventions in improving academic performance in mathematics. These findings reveal a positive link between students' motivation and ability to handle complex mathematical problems.

The study's primary aim was to investigate the connection between motivation and problem-solving skills in mathematics among students. By analyzing how different types of motivation, including intrinsic and extrinsic, influenced students' problem-solving abilities, the research sought to identify key factors that impact academic performance. The study aimed to fill the gap in understanding the specific problem-solving strategies used by motivated students compared to those who are less motivated. It provides insights for educators on effective teaching methods that can enhance motivation and, in turn, improve problem-solving skills. Ultimately, the research hoped to contribute to developing strategies that foster a more engaging and effective learning environment in mathematics education.

**Objectives**

This study explored how motivation affects mathematics problem-solving skills among 11th graders at Lurugan National High School during the 2024-2025 school year.

Specifically, it aimed to:

1. Determine the level of students' motivation in mathematics in terms of:

    a. intrinsic motivation;

    b. extrinsic motivation; and

    c. self-efficacy

2. Identify the level of students' problem-solving skills in mathematics in terms of:

    a. Understanding the problem;

    b. planning a solution; and

    c. evaluating the solution.

3. Find the relationship between motivation and students' problem-solving skills in Mathematics 11.

**Theoretical Framework**

**Review of Related Studies**

**Motivation**

Motivation is the internal and external factors that stimulate individuals' desire and energy to remain interested and committed to a task or goal. It was crucial in influencing behavior, performance, and learning outcomes. For example, a study conducted by [8] examined the relationship between self-efficacy and motivation among students from diverse cultural backgrounds, revealing that higher self-efficacy was positively associated with increased motivation in mathematics.

### Problem-Solving Skills

Problem-solving skills involve identifying, analyzing, and effectively resolving issues. They involve various cognitive processes, including critical thinking, creativity and analyitical reasoning. These skills are essential in educational settings, especially in mathematics, as they allow students to systematically approach complex problems and devise solutions grounded in logical reasoning and evidence. One notable study by [9] examined the relationship between students' problem-solving abilities and mathematical understanding.

### Conceptual Framework

The study examining the relationship between motivation and problem-solving skills in mathematics was grounded in Expectancy-Value Theory. This theory proposed that students' his theory proposed that students' motivation to engage in a task depended on their expectations of success and the value they attributed to the task. According to [10] students were more motivated and performed better in mathematics when they believed in their ability to succeed (high self-efficacy) and viewed the subject as valuable for their future goals. This framework indicated that enhancing students' motivation through positive reinforcement and relevant learning experiences could improve problem-solving skills in mathematics.

Various theories have examined the link between motivation and problem-solving skills in mathematics. Self-determination theory (SDT) emphasizes the importance of intrinsic and extrinsic motivation in the learning process. It suggests that when students experience autonomy, competence, and social connection, their intrinsic motivation increases, leading to enhanced engagement and improved problem-solving abilities [11].

## METHODOLOGY

### Research Design

This study used a descriptive-correlational research design to examine the relationship between motivation and problem-solving skills among students in mathematics. The descriptive part provided a detailed account of the levels of motivation and problem-solving abilities of Grade 11 students at Lurugan National High School. Through surveys, data were collected on students' internal and external motivation and their performance in solving math problems.

### Locale of the Study

The pilot test for this study took place at Bangcud National High School, located in the Division of Malaybalay City. Researchers chose this school for its large size and variety of programs, which match the number of students involved in the study. The study was also conducted at Lurugan National High School in Barangay Lurugan, Valencia City, Bukidnon. This institution serves junior high school students in grades 7 to 10 and those in the senior high school curriculum, offering five specialized strands: STEM, ABM, HUMSS, TVL-ICT, and TVL-Agriculture. This setting provided a varied population for exploring the relationship between motivation and problem-solving skills in mathematics.

### Participants of the Study

The research participants in this study were Grade 11 students from Lurugan National High School. Five specialized strands were offered: STEM, ABM, HUMSS, TVL-ICT, and TVL-Agriculture. A total of 150 Grade 11 students were selected for the study. The analysis aimed to determine the strength and direction of the relationship between motivation and problem-solving skills in mathematics. This included examining whether the relationship was positive, negative, or nonexistent and assessing its strength.

### Research Instrument

This study utilized two research instruments. The first instrument measured motivation through a standardized questionnaire, which showed strong reliability with a Cronbach's alpha of 0.961. This motivation instrument included three sub-variables: intrinsic motivation, extrinsic motivation, and self-efficacy. Each sub-variable

comprised ten indicators derived from the work of [12] and utilized a five-point Likert scale to assess student responses.

The scoring procedure was applied to assess students' motivation in mathematics.

| Scale | Range | Descriptive Rating | Qualitative Interpretation |
|---|---|---|---|
| 1 | 1.00-1.50 | Strongly Disagree (SD) | Very low motivated |
| 2 | 1.51-2.50 | Disagree (D) | Low motivated |
| 3 | 2.51-3.50 | Neither (N) | Moderately motivated |
| 4 | 3.51-4.50 | Agree (A) | Highly motivated |
| 5 | 4.51-5.00 | Strongly Agree (SA) | Very highly motivated |

The second instrument evaluated problem-solving skills using a standardized questionnaire, which exhibited strong reliability with a Cronbach's alpha of 0.975. This instrument included three sub-variables: understanding the problems, planning solutions, and evaluating solutions. Each sub-variable contains ten indicators, assessed through a five-point Likert scale to evaluate student responses.

The scoring procedure was applied to determine the level of problem-solving skills of students in mathematics.

| Scale | Range | Descriptive Rating | Qualitative Interpretation |
|---|---|---|---|
| 1 | 1.00-1.50 | Strongly Disagree (SD) | Very poor problem-solving skills |
| 2 | 1.51-2.50 | Disagree (D) | Poor problem-solving skills |
| 3 | 2.51-3.50 | Neither (N) | Fair problem-solving skills |
| 4 | 3.51-4.50 | Agree (A) | Good problem-solving skills |
| 5 | 4.51-5.00 | Strongly Agree | Excellent problem-solving skills |

**Data Gathering Procedure**

A formal letter was addressed to the Principal of Bangcud National High School to seek permission to conduct a pilot test of the survey questionnaires with Grade 11 STEM students. The pilot test involved 30 students. Afterward, a formal letter was sent to the Principal of Lurugan National High School for permission to conduct the main study there. This letter sought authorization and approval to conduct research with Grade 11 students across five strands of the senior high school curriculum (ABM, HUMSS, STEM, TVL-Agri, and TVL-ICT). A total of 150 Grade 11 students received a set of questionnaires; the first set focused on the students' motivation, while the second set concentrated on problem-solving skills. The complete process took approximately an hour.

Along with the surveys, an interview was conducted to gather qualitative data. After completing the surveys, students participated in the interview. The interview aimed to gain deeper insights into their motivational factors and problem-solving experiences. The evaluation sheet included questions that asked students to rate their motivation on a scale of 1 to 5, identify specific factors influencing their motivation, and assess their confidence in problem-solving skills. The feedback form contained open-ended questions, promting students to describe recent math problems they solved, their challenges, and any strategies or resources that helped improve their problem-solving abilities.

**Statistical Techniques**

The researchers utilized several statistical tools to analyze and interpret the data collected from the survey questionnaires effectively. Descriptive statistics assessed motivation and problem-solving skills, including the mean and standard deviation. Pearson's correlation was applied to examine the relationship between students' motivation and their problem-solving skills in mathematics.

# RESULTS AND DISCUSSIONS

**Student's Motivation**

Table 1 summarizes the mean scores for motivation across three sub-variables: intrinsic motivation, extrinsic motivation, and self-efficacy. In total, thirty (30) indicators represent motivation, with ten (10) for each variable. The findings reveal that extrinsic motivation had the highest mean score of 3.43, while intrinsic motivation followed closely with a mean score of 3.35. Conversely, self-efficacy recorded the lowest mean score at 3.32.

Table I. Summary of Mean Scores of Motivation

| Sub-variable | Mean | Descriptive Rating | Qualitative Interpretation |
|---|---|---|---|
| Extrinsic Motivation | 3.43 | Neither | Moderately motivated |
| Intrinsic Motivation | 3.35 | Neither | Moderately motivated |
| Self-efficacy | 3.32 | Neither | Moderately motivated |
| Overall Mean | **3.37** | **Neither** | **Moderately motivated** |

| Legend | |
|---|---|
| **Range of Means** | **Qualitative Interpretation** |
| 1.00 – 1.50 | Very low motivated |
| 1.51 – 2.50 | Low motivated |
| 2.51 – 3.50 | Moderately motivated |
| 3.51 – 4.50 | Highly motivated |
| 4.51 – 5.00 | Very highly motivated |

The results in Table 1 regarding students' motivation showed an overall mean score of 3.37, indicating that Grade 11 students in Lurugan National High School exhibited moderate motivation levels. This finding suggested that although students showed some interest and involvement in math, there was still considerable room for enhancing their motivation levels. Among the sub-variables, extrinsic motivation scored the highest at 3.43, placing it in category of neither level. It showed that external factors such as grades and teachers strongly influence students' praise. In contrast, self-efficacy had the lowest mean score of 3.32, categorized as "Neither agree nor disagree," indicating that students felt only moderately confident in their problem-solving skills. This lower score reflected a lack of confidence in their abilities, which could have hindered their overall performance in math.

The results had important implications. The high external motivation showed that Lurugan National High School students relied heavily on outside approval to engage with math. While this might have been beneficial in the short term, it probably didn't promote a strong, personal interest in the subject. Additionally, the moderate belief in their abilities suggested that students didn't fully trust themselves, which led to anxiety and a tendency to avoid challenging tasks. This finding highlighted the need for teachers to focus on building students' confidence through supportive teaching methods and opportunities for success in problem-solving.

Research showed that both internal and external motivations were key to students' performance in school. For example, one study [13] found that students who believed in their abilities were likelier to take on challenging tasks and persist when faced with difficulties. Another study by [14] highlighted that confidence was a decisive factor in achieving academic success, particularly in math. Local research also supported these ideas; the study of [15] showed that students who received positive feedback from teachers displayed greater motivation in math. Furthermore, another study by [16] demonstrated that improving students' confidence through specific support led to better performance in the subject. Together, these studies underscored the importance of creating a

motivational environment that nurtured both internal and external factors to enhance student motivation and success in math.

Finally, the analysis of students' motivation for problem-solving in mathematics revealed a moderate level, with external factors having a more decisive influence than self-confidence. This finding highlighted the need for teaching strategies that utilized rewards and support to enhance students' confidence in their math skills.

**Problem-Solving Skills**

Table 2 summarizes the mean scores of problem-solving skills across three sub-variables: understanding the problem, planning a solution, and evaluating solutions. Thirty (30) indicators represented problem-solving skills, with ten (10) indicators for each variable. The results indicated that evaluating solutions achieved the highest mean score of 3.39, followed closely by planning a solution with a mean score of 3.32. In contrast, understanding the problem recorded the lowest mean score of 3.26.

Table II. Summary of Mean Scores of Problem-Solving Skills

| Sub-variable | Mean | Descriptive Rating | Qualitative Interpretation |
|---|---|---|---|
| Evaluating Solutions | 3.39 | Neither | Fair problem-solving skills |
| Planning a Solution | 3.32 | Neither | Fair problem-solving skills |
| Understanding the Problem | 3.26 | Neither | Fair problem-solving skills |
| Overall Mean | **3.28** | **Neither** | **Fair problem-solving skills** |

The summary table for problem-solving skills indicated an overall mean score of 3.28, suggesting that Grade 11 students at Lurugan National High School displayed fair problem-solving abilities. This finding implied that students had some understanding and skills in problem-solving, but considerable improvement is needed.

Among the sub-variables, the highest indicator was evaluating solutions, which received a mean score of 3.39. This score indicated that students at Lurugan National High School felt somewhat confident in their ability to assess the effectiveness of their solutions after attempting to solve problems. These findings suggested that students recognized the importance of evaluating their work, a critical step in problem-solving. Conversely, the lowest indicator was understanding the problem, with a mean score of 3.26. This finding indicated that students were less confident in comprehending the issues they encountered, which is a fundamental skill for effective problem-solving. The gap between these two indicators highlighted a potential area for targeted instructional strategies to improve students' comprehension skills.

These results had important implications. The average in problem-solving abilities indicated that educators should have prioritized helping students understand the problems, as this was the foundational step in problem-solving. Enhancing this skill could have improved outcomes in planning and evaluating solutions. The higher scores in evaluating solutions suggested that students would have benefited from additional practice in this area, emphasizing its importance in their learning.

Supporting literature reinforced these findings; for instance, the study in [17] showed that students who engaged in reflective practices, such as evaluating their solutions, tended to excel in math. Similarly, [18] noted that effective problem-solving involves not just understanding concepts but also applying them in various contexts. Additionally, [19] found that students who practiced evaluation in problem-solving and participated in math-related extracurricular activities achieved better results in math. A study in [15] indicated that students involved in math-related extracurricular activities improved their problem-solving skills, highlighting the value of real-world applications. Furthermore, [16] established a connection between students' math enjoyment and academic performance, suggesting that positive attitudes could enhance problem-solving outcomes. Lastly, the study in [20] emphasized the advantages of digital game-based learning in improving students' numeracy skills, potentially boosting their problem-solving abilities.

Finally, although students at Lurugan National High School demonstrated fair problem-solving skills, especially in assessing solutions, there was a clear need to enhance their ability to understand problems. Teachers needed to focus on approaches that helped students grasp concepts better, leading to a deeper understanding of mathematics.

**Correlation of the Variables**

Pearson correlation was used to assess the degree of relationship between the dependent variable, Motivation, and the independent variable, Problem-solving skills.

As shown in Table 3, correlation results provided sufficient evidence at the 0.01 level to conclude that there was a linear relationship between students' motivation and problem-solving skills. The correlation between students' motivation and problem-solving skills (r=0.718) and p-value of 0.000 indicated a statistically significant relationship.

Table III. Correlation Analysis of Motivation to the Problem-Solving Skills of Students in Mathematics

| Indicators | Correlation Coefficient | Probability |
|---|---|---|
| Motivation | 0.718 | 0.000 |

The correlation analysis showed a strong positive link between motivation and problem-solving skills in mathematics, with a correlation coefficient of 0.718. This finding means that as students' motivation increased, their ability to solve math problems also improved. The probability value of 0.000 indicated that this relationship was statistically significant, suggesting that it was unlikely to have occurred by chance. This finding emphasized the importance of motivation in helping students perform better in math.

The results had significant implications. They suggested that when students were motivated, they were more likely to engage with challenging math tasks and persist in finding solutions. This aligns with previous studies. For example, the study of [17] found that motivation positively influenced students' academic performance. Additionally, [21] showed that motivated students tended to approach problems with more enthusiastically and resourcefully. The study of [22] indicated that students with higher motivation generally performed better in math assessments.

The local studies supported these findings. [23] discovered that when Filipino students were motivated, their problem-solving math skills improved. The study by [24] highlighted that using motivational techniques, such as group work and positive feedback, significantly helped students solve math problems. Another study by [25] confirmed that motivated students exhibited more significant improvement in their problem-solving abilities, reinforcing that motivation plays a key role in academic success.

In summary, the strong correlation between motivation and problem-solving skills highlights the importance of educators boosting motivation, which is crucial for improving students' problem-solving abilities and overall academic achievement.

# CONCLUSION

The study found that students had moderate motivation in mathematics, with intrinsic motivation and self-efficacy around 3.3, while extrinsic motivation was higher at 3.43. This finding indicated a significant dependence on external factors, highlighting the need for strategies to boost intrinsic motivation and self-efficacy to enhance student engagement and performance.

The study revealed that students exhibited fair problem-solving skills in mathematics, with understanding the problem scoring the lowest at 3.26. Planning and evaluating solutions scored 3.32 and 3.39, respectively. All scores fell within the "neither agree nor disagree" range, indicating fair overall abilities. This finding suggested the need for targeted interventions to enhance students' skills across all areas.

The study concluded a significant relationship between motivation and problem-solving skills in mathematics, with a Pearson correlation of 0.718. This strong correlation, important at the 0.01 level, indicated that higher motivation was linked to better problem-solving abilities, highlighting motivation's importance in improving student mathematics performance.

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