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# TECHNOLOGY INTEGRATION AND PROBLEM-SOLVING SKILLS OF GRADE 10 STUDENTS IN NEW CORELLA DISTRICT AS MEDIATED BY MATHEMATICAL REASONING ABILITY

**Cherry Mae V. Suarez. LPT, Paulino P. Tado. Ph.D**
[1]*St. Mary's College of Tagum, Inc., Tagum City, Davao del Norte, 8100,, Philippines*
[2] *Graduate Education Faculty, St. Mary's College of Tagum, Inc., National Highway, Tagum City, 8100, Philippines*

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## ABSTRACT
*The purpose of this study was to determine whether mathematical reasoning ability significantly mediates the relationship between technology integration and problem-solving skills among Grade 10 students in New Corella District, Division of Davao del Norte for the School Year 2024-2025. A total of 275 students were included in this study. These participants were chosen by way of stratified sampling and approved criteria. The respondents answered two survey questionnaires and one researcher-made test during the data gathering procedure. The data was analyzed using the Mean, standard deviation, Pearson r, and regression analysis. Moreover, there is a significant relationship between technology integration and mathematical reasoning ability. Mathematical reasoning ability does not significantly mediate the relationship between the technology integration and problem-solving skills of students in Mathematics. These findings suggest that while technology integration positively influences mathematical reasoning ability, it does not directly translate to improved problem-solving skills, indicating that other factors may play a more crucial role in developing students' problem-solving competencies. The absence of significant relationships between problem-solving skills and both technology integration and mathematical reasoning ability highlights the need for further exploration of instructional strategies and cognitive processes that contribute to effective problem-solving in mathematics education.*

**KEYWORDS:** *Mathematics, Grade 10 Students, Mathematical Reasoning Skills, Technology Integration, Problem-Solving Skills, Davao Del Norte, Quantitative Research, Descriptive and Correlational Approach, Philippines*

## INTRODUCTION
Problem-solving skills, which foster critical thinking alongside creativity and resilience, have become increasingly crucial for both academic and career success - yet students worldwide continue struggling with these fundamental abilities (Davis & Wang, 2021). Nearly 35% of students demonstrate inadequate problem-solving capabilities, as whom Rani et al. (2024) had discovered through extensive research. The difficulties in problem-solving skills, being widespread across educational institutions, have led towards increased disengagement and dropout risks, whereby 40% of students report challenges with complex problem-solving tasks that are essential for their success (Singh et al., 2025).

Within American education systems, Johnson et al. (2018) have identified that upwards from 60% of high school students struggle in problem-solving tasks, which results to 15% lower STEM performance and decreased college readiness by 20%. Japanese education, despite its reputation, only sees 35% of its students' demonstrating proficiency in creative problem-solving - a consequence that Tanaka and Yamamoto (2019) attribute to their rote memorization-focused system, wherefrom innovation scores dropped 12% over the previous decade. Silva and Costa (2020) have demonstrated through their Brazilian research how approximately 40% of students attending underfunded public schools exhibit inadequate problem-solving abilities, of which correlates strongly with elevated dropout rates.

The Philippines' educational landscape presents particularly concerning data points regarding problem-solving competencies. Only 25% of Filipino high school students demonstrate proficiency in mathematical problem-solving applications, as what Reyes et al. (2018) had documented, contributing to the nation's position at 78th among 79 countries in the 2018 PISA assessment. According to Del Rosario and Tan (2019), 60% of students find it difficult to solve complicated everyday life problems, while the Department of Education (2020) noted that only 18% of high school graduates have been ready for college or the workforce due to a lack of materials and educator preparation. Also, a study by Ragudo (2024) at the University of Northern Philippines in Vigan City revealed that Grade 12 STEM students exhibited a struggling level of performance in problem-solving skills This finding underscores the need for targeted interventions to enhance students' problem-solving abilities.

Locally speaking, one investigation that is especially concerning is the Division of Davao del Norte, where shortcomings in problem-solving are evident. 55% of students in this division struggle with problems that require solving, especially in science and math classes, according to research,

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which results in indicators of performance that are 20% below national averages and 25% lower possibilities for postsecondary studies and job opportunities (Gonzales & Martinez, 2021).

Several studies have explored the problem-solving abilities of junior high school students in mathematics. For instance, Syaiful et al. (2020) examined students' problem-solving skills, emphasizing the importance of these abilities in mathematics education. Similarly, Hanifah et al. (2024) conducted a systematic review on the effectiveness of problem-based learning models in enhancing mathematical problem-solving skills among junior high school students. Additionally, research by Syaiful et al. (2019) investigated the impact of problem-based learning on students' communication skills and mathematical problem-solving abilities.

While these studies provide valuable insights into problem-solving skills and instructional methods, there is a noticeable gap concerning the role of mathematical reasoning abilities in mediating the relationship between technology integration and problem-solving skills among Grade 10 students. Existing research has not sufficiently addressed how enhancing mathematical reasoning can bridge disparities in students' proficiency with technology-enhanced problem-solving tasks. This study aims to fill this gap by focusing on the interplay between technology integration, mathematical reasoning, and problem-solving skills, providing a more comprehensive understanding of the factors that contribute to effective mathematics education. The urgency of this research is underscored by the increasing integration of technology in educational settings and the necessity for students to develop robust problem-solving skills to navigate complex, real-world challenges. Understanding how mathematical reasoning mediates the effectiveness of technology-enhanced learning can inform educators and policymakers in designing interventions that are both timely and relevant, ensuring that students are adequately prepared for future academic and professional endeavors.

Socially, this study holds significant relevance as it not only sheds light on effective educational practices but also offers direct benefits to the educational community. By identifying strategies that enhance problem-solving skills through technology and reasoning, the research can guide curriculum developers in creating more engaging and effective learning materials. Teachers can apply these insights to improve instructional methods, while policymakers can develop informed policies that support equitable and effective education. Ultimately, this contributes to a more informed and capable society, equipped to tackle complex problems through improved educational practices. To ensure that these findings reach key stakeholders, the results of the study will be disseminated through presentations at educational conferences and workshops, as well as through the publication of research articles in peer-reviewed journals. Additionally, summary reports will be shared with local schools and education offices to support immediate application of the findings in classroom and policy settings.

## OBJECTIVES

This study sought answers to the following questions:

1. What is the level of technology integration among Grade 10 students in terms of awareness, learning the process, understanding and application of the process, familiarity and confidence, adaptation to other contexts and creative application to new contexts?
2. What is the level of problem-solving skills among Grade 10 students in terms of test score?
3. What is the level of mathematical reasoning ability among Grade 10 students in terms of conjecturing, justifying, and mathematizing?
4. Is there a significant relationship between technology integration and problem-solving skills among Grade 10 students, mathematical reasoning ability and problem-solving skills among Grade 10 students, technology integration and mathematical reasoning ability among Grade 10 students?
5. Does mathematical reasoning ability significantly mediate the relationship between technology integration and problem-solving skills among Grade 10 students?

## METHODOLOGY

This study employed quantitative research design using descriptive and correlational approach. Quantitative research is characterized by the collection and interpretation of numerical data to examine relationships between variables, make predictions and evaluate theories (Cresswell & Creswell, 2020).

Descriptive research frequently utilizes data that can be systematically organized; this includes results derived from surveys or scores acquired from examinations. Researchers can methodically collect (and) tabulate data employing this methodology, which not only aids in uncovering new trends and patterns (Cresswell and Creswell, 2020) but also enhances the overall analysis. The correlational method, however, offers insight into the strength and direction of relationships by investigating how variations in one variable influence other factors. Although this method differs from the simplistic approach's limited focus on a single variable (McMillan & Schumacher, 2020), it is essential because it allows for a more comprehensive understanding of the interconnections involved. In the domain of intricate social research interrelationships, Bryman (2021) asserts that correlational analysis (1) is essential for understanding the patterns of variable connections that can shift over time. Creswell and Creswell (2020) highlight the significance of correlation; this is because it aids in hypothesis testing and the formulation of predictive models.

In the context of this study, the primary objective of this research was to examine the interrelationships among problem-solving abilities, mathematical cognition and the integration of technology. This investigation was carried out through the gathering and analysis of numerical data, utilizing a quantitative approach. By using this methodology, the researcher could not only test hypotheses but also identify patterns of correlation while assessing the mediating effect of mathematical reasoning. Moreover, the descriptive section of the study identified and elaborated on the variables involved,

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which in this case pertain to the levels of technology integration, problem-solving proficiency and mathematical reasoning exhibited by tenth graders. These variables were effectively measured and characterized through means and other pertinent metrics, in addition to statistical evaluations. However, it was essential to recognize the potential limitations inherent in this approach.

Furthermore, the researcher employed a correlational strategy to determine whether the technological integration, problem-solving skills and mathematical reasoning are interconnected. Then, the mathematical reasoning abilities of tenth graders in the New Corella District of the Davao del Norte Division were assessed, because they may mediate the correlations between students' problem-solving skills and their use of technology. This approach not only determined the direct but also the indirect effects of technological integration on problem-solving skills through mathematical reasoning ability. This research offered valuable insights into the linkages between variables that influence learning outcomes, however, it explored the ways in which technological integration affects students' problem-solving abilities.

## RESULTS

1. The technology integration among Grade 10 students in terms of awareness got a mean of 3.69 described as high, learning the process got a mean of3.41 described as high, understanding and application of the process got a mean of 3.44 described as high, familiarity and confidence got a mean of 3.28 described as moderate, adaptation to other contexts got a mean of 3.35 described as moderate, and creative application to new contexts got a mean of 3.29 described as moderate. It has an overall mean of 3.41 which is described as high.
2. The problem-solving skills among Grade 10 students in terms of test score has a mean of 51.64 which is described as moderate.
3. The mathematical reasoning ability among Grade 10 in terms of conjecturing got a mean of 3.27 described as moderate, justifying got a mean of 3.36 described as moderate, and mathematizing got a mean of 3.28 described as moderate. It has an overall mean of 3.30 which is described as moderate.
4. There is no significant relationship between technology integration and problem-solving skills among Grade 10 students since data revealed that the p-value is 0.917 which is greater than the 0.05 level of significance which means that the null hypothesis is not rejected. Moreover, there is no significant relationship between mathematical reasoning ability and problem-solving skills among Grade 10 students since data revealed that the p-value is 0.516 which is greater than the 0.05 level of significance which means that the null hypothesis is not rejected. Then, there is a significant relationship between technology integration and mathematical reasoning ability among Grade 10 students since data revealed that the p-value is 0.000 which is lesser than the 0.05 level of significance which means to reject the null hypothesis.
5. The decision not to proceed with mediation analysis in this study stems from the failure to meet its fundamental assumptions, particularly the lack of significant relationships between technology integration, mathematical reasoning ability, and problem-solving skills.

## SUGGESTIONS

Based on the findings, analysis, and conclusions drawn in this study, the following recommendations are summarized:

1. Since the level of technology integration among Grade 10 students is high, educators should focus on optimizing how technology is used to improve mathematical reasoning and problem-solving skills. This can be achieved by integrating interactive problem-solving applications, gamified learning experiences, and real-world mathematical modeling activities. Schools should also provide training for teachers to ensure that technology is used not just for engagement but as a tool for deepening students' critical thinking and reasoning abilities in mathematics.
2. Given that students' problem-solving skills are at a moderate level, instructional strategies should emphasize activities that promote analytical thinking, logical reasoning, and structured problem-solving approaches. Teachers may implement inquiry-based learning, open-ended problem-solving tasks, and collaborative problem-solving sessions where students can engage in discussions and share multiple solution strategies. Moreover, embedding real-life problem-solving scenarios in math lessons can help students apply their skills in practical situations.
3. Since the level of mathematical reasoning ability among Grade 10 students is moderate, targeted interventions should be introduced to help students develop stronger reasoning skills. Educators can incorporate activities such as conjecturing exercises, proof-writing tasks, and argumentation-based learning to encourage students to justify their solutions and explore different mathematical approaches. Additionally, providing scaffolding techniques, such as guided questioning and step-by-step problem deconstruction, can help students improve their logical reasoning and ability to construct mathematical arguments effectively.

## CONCLUSIONS

Based on the findings of the study, the following conclusions are drawn:

1. The technology integration among Grade 10 students in terms of awareness, learning the process, understanding and application of the process, familiarity and confidence, adaptation to other contexts, and creative application to new contexts is evident.
2. The problem-solving skills among Grade 10 students is average.
3. The mathematical reasoning ability among Grade 10 students 10 in terms of conjecturing, justifying, and mathematizing is fairly manifested.
4. While technology integration and mathematical reasoning ability are significantly related, neither technology integration nor mathematical reasoning ability alone shows a significant relationship with the

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problem-solving skills of Grade 10 students, suggesting that other factors may play a more substantial role in influencing their problem-solving abilities.

5. The decision not to proceed with mediation analysis in this study stems from the failure to meet its fundamental assumptions, particularly the lack of significant relationships between technology integration, mathematical reasoning ability, and problem-solving skills.

## TABLES AND REFERENCES

**Table 1. Summary on the Level of Technology Integration**

| Indicator | Mean | SD | Descriptive Equivalent |
|---|---|---|---|
| Awareness | 3.69 | 0.78 | High |
| Learning the Process | 3.41 | 0.72 | High |
| Understanding and Application of the Process | 3.44 | 0.78 | High |
| Familiarity and Confidence | 3.28 | 0.79 | Moderate |
| Adaptation to other Contexts | 3.35 | 0.78 | Moderate |
| Creative Application of New Context | 3.29 | 0.76 | Moderate |
| **Overall** | **3.41** | **0.63** | **High** |

**Table 2. Summary on the Level of Problem – Solving Skills**

| Variable | Mean Percentage | SD | Descriptive Equivalent |
|---|---|---|---|
| Problem – solving skills | 51.64 | 25.37 | Moderate |

**Table 3. Summary on the Level of Mathematical Reasoning Ability**

| Indicators | Mean | SD | Descriptive Equivalent |
|---|---|---|---|
| Conjecturing | 3.27 | 0.75 | Moderate |
| Justifying | 3.36 | 0.74 | Moderate |
| Mathematizing | 3.28 | 0.74 | Moderate |
| **Overall** | **3.30** | **0.66** | **Moderate** |

**Table 4. Significance of the Relationship between Technology Integration, Problem Solving Skills and Mathematical Reasoning Test**

| Variables Correlated | r-value | p-value | Decision on $H_o$ | Decision on Relationship |
|---|---|---|---|---|
| Technology Integration and Problem-Solving Skills | 0.078 | 0.197 | Not Rejected | Not Significant |
| Mathematical Reasoning Test and Problem-Solving Skills | 0.039 | 0.516 | Not Rejected | Not Significant |
| Technology Integration and Mathematical Reasoning Test | 0.677 | 0.000 | Rejected | Significant |

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**Table 5. Regression Weights, Total Effect, Direct Effect and Indirect Effect**

| Variables | Label | Estimate | S.E. | p-value | 95% Confidence Interval | | z | p-value |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lowe | Upper | | |
| Technology Integration → Mathematical Reasoning Ability | a | 0.708 | 0.051 | 0.001 | 0.611 | 0.811 | 13.802 | 0.001 |
| Mathematical Reasoning Test → Problem-Solving Skills | b | -0.953 | 3.114 | 0.760 | -7.236 | 4.828 | -0.306 | 0.760 |
| Technology Integration → Problem-Solving Skills | c | 3.796 | 3.344 | 0.256 | -2.430 | 10.338 | 1.135 | 0.256 |
| Total Effect | 3.121 | | Direct Effect | | 3.796 | Indirect Effect | | -0.675 |
| p-value | 0.248 | | p-value | | 0.24 | p-value | | 0.762 |

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