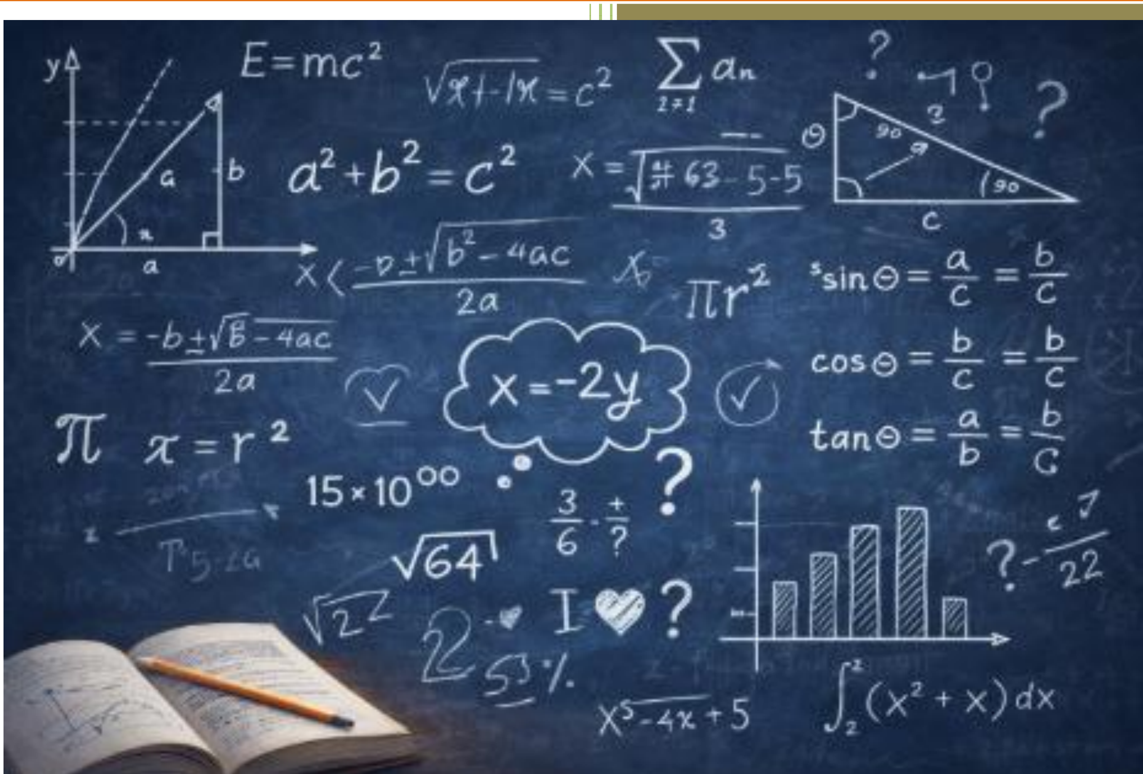
# Mathematics Proficiency & Teaching Effectiveness of Non-Mathematics Major Teachers Teaching Mathematics

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# Mathematics Proficiency & Teaching Effectiveness of Non-Mathematics Major Teachers Teaching Mathematics

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# Preface

Mathematics is a fundamental discipline that cultivates logical reasoning, critical thinking, and problem-solving skills among learners. Its mastery is essential not only for academic success but also for navigating real-world challenges. Despite its importance, many schools in the Philippines and other parts of the world face the challenge of assigning teachers to mathematics classes who do not have formal training in the subject. This reality raises questions about instructional quality and the effectiveness of teaching practices.

This monograph was developed to examine the mathematics proficiency of non-mathematics major teachers and its relationship to teaching effectiveness. It seeks to provide empirical evidence on how content knowledge in mathematics influences the quality of classroom instruction, especially for teachers assigned to teach outside their field of specialization. By focusing on mathematics proficiency as a central factor, this work highlights the practical and pedagogical challenges these teachers encounter and explores strategies to enhance their effectiveness.

The findings of this monograph have important implications for teacher development, professional learning, and institutional support. They underscore the need for targeted interventions, such as professional development programs, mentoring, and extension activities, to strengthen teachers' mathematical understanding and instructional skills. Furthermore, the study emphasizes the role of higher education institutions in supporting non-mathematics major teachers, particularly in contexts where access to mathematics-specific trainings is limited.

It is my hope that this monograph will serve as a valuable resource for teacher educators, school administrators, policymakers, and researchers dedicated to improving mathematics education. By bridging the gap between content knowledge and teaching effectiveness, it aims to contribute to the broader goal of providing quality mathematics instruction for all learners.

Best Regards,

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# Author

**Dr. Roderick R. Montañez** is a dedicated mathematics educator and educational leader with a strong commitment to teacher development and learner success. He graduated Magna Cum Laude with a Bachelor of Secondary Education (BSEd) major in Mathematics from Samar Colleges, Inc. After passing the Licensure Examination for Teachers (LET) in September 2010, he pursued a Master in Education (MEd) major in Mathematics at Leyte Normal University (LNU) as a CHED Faculty Development Scholar, graduating in March 2013.

He also passed the Civil Service Professional Level Examination, further demonstrating his commitment to public service and professional excellence.

He served the Department of Education (DepEd) as a Mathematics Teacher for Grades 8, 9, and 10 and held the role of Teacher In-Charge (TIC), where he was recognized as an Outstanding School Head based on OPCRF ratings in 2020 and 2021. In 2022, he joined Samar State University (SSU), building on his experience as a school head, and continued and pursued a Doctor of Philosophy (PhD) in Educational Management, graduating in June 2025.

He was conferred the Best New Faculty Award in 2025 during the SULO Awards of SSU. At present, he serves as a Mathematics Faculty at the College of Education, Samar State University, and holds the designation as Student Teaching Coordinator. His professional and academic journey reflects his deep commitment to improving mathematics education and supporting the growth of both pre-service and in-service teachers.

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## 1. INTRODUCTION

Mathematics occupies a central place in education as it develops learners' logical reasoning, analytical thinking, and problem-solving abilities. These are the skills that are essential for academic success and everyday decision-making. In basic and secondary education, mathematics is not only a core subject but also a gateway discipline that supports learning in science, technology, engineering, and other related fields. As such, the quality of mathematics instruction plays a critical role in shaping learners' academic trajectories and long-term competencies.

Despite the recognized importance of mathematics, many education systems, including the Philippines, continue to grapple with persistent challenges related to teacher deployment and subject specialization. A growing concern is the increasing number of non-mathematics major teachers who are assigned to teach mathematics classes. This practice is often driven by shortages of qualified mathematics teachers, administrative constraints, and unequal distribution of teaching personnel across schools. Media reports have noted that a significant proportion of teachers are handling subjects outside their field of specialization, with some estimates indicating that more than half of secondary school teachers are assigned outside their area of training (Philstar, 2024). Teacher groups and education advocates have raised concerns that such subject mismatches may compromise instructional quality, particularly in technically demanding subjects like mathematics (ABS-CBN News, 2024).

These concerns are further amplified by international assessments of student achievement. Results from the Programme for International Student Assessment (PISA) 2022 revealed that Filipino learners continue to lag behind their global counterparts in mathematics, as well as in reading and science (Philstar, 2023). While multiple factors contribute to low student performance, teacher-related variables uch as content mastery, instructional competence, and confidence in teaching the subject remain among the most influential. The assignment of non-mathematics major teachers to mathematics classes therefore warrants closer examination, particularly in relation to their mathematics proficiency and teaching effectiveness.

Scholarly literature recognizes that effective mathematics teaching is closely linked to teachers' mathematical proficiency. Schoenfeld and Kilpatrick (2008) emphasized that proficiency in teaching mathematics extends beyond procedural knowledge and includes conceptual understanding, strategic competence, adaptive reasoning, and productive disposition. Their work laid a strong theoretical foundation by arguing that teachers' mathematical proficiency directly influences the quality of instruction and learners' opportunities to develop deep mathematical understanding. Similarly, Altarawneh and Marei (2021) provided empirical evidence showing a significant relationship between mathematical proficiency and instructional performance among preservice classroom teachers, highlighting that higher levels of proficiency are associated with more effective teaching practices.

While these studies establish a clear link between mathematics proficiency and teaching effectiveness, much of the existing literature focuses on preservice teachers or mathematics specialists, with limited attention given to in-service non-mathematics major teachers who are currently teaching mathematics in real classroom contexts. There remains a scarcity of studies that examine how non-mathematics major teachers' level of mathematics proficiency relates to their teaching effectiveness, particularly in developing education systems where out-of-field teaching is common. This gap is especially evident in the Philippine context, where subject mismatch persists despite ongoing reforms in teacher education and professional development.

In response to these gaps, this monograph was undertaken to provide a focused and comprehensive examination of the mathematics proficiency and teaching effectiveness of non-mathematics major teachers teaching mathematics. Drawing from a university-funded research study, this work aims to contribute empirical evidence that can inform teacher education programs, in-service training initiatives, and school-level decision-making. By presenting a detailed analysis of mathematics proficiency and its implications to teaching, this monograph seeks to support more informed policies and practices that address the realities of out-of-field teaching and ultimately strengthen the quality of mathematics education.

In light of the persistent issue of out-of-field teaching in mathematics and the limited empirical studies focusing on non-mathematics major teachers, this monograph aims to examine mathematics proficiency and teaching effectiveness among non-mathematics major teachers teaching mathematics. Specifically, this monograph seeks to: (1) assess the level of mathematics proficiency of non-mathematics major teachers using a 50-item multiple-choice mathematics test; (2) evaluate their teaching effectiveness through structured classroom observation tools; (3) determine whether a significant relationship exists between mathematics proficiency and teaching effectiveness; and (4) draw implications to teaching based on the results of the study. Through these objectives, the monograph intends to provide evidence-based insights that may inform teacher preparation, professional development, and instructional support for teachers handling mathematics outside their field of specialization.

## 2. REVIEW OF LITERATURE

Mathematics proficiency has long been recognized as a critical component of effective mathematics teaching. At the global level, Schoenfeld and Kilpatrick (2008) provided a foundational theoretical framework that conceptualizes proficiency in teaching mathematics as a multidimensional construct. According to their work, effective mathematics teaching requires more than procedural fluency; it involves conceptual understanding, strategic competence, adaptive reasoning, and a productive disposition toward mathematics. Their theory underscores that teachers' depth of mathematical understanding shapes instructional decisions, representations, and the quality of learning opportunities provided to students. This framework has become a cornerstone in understanding why teacher proficiency matters in mathematics classrooms.

Empirical studies further support the relationship between teacher proficiency and teaching effectiveness. Sadeghi, Richards, and Ghaderi (2020) examined the relationship between perceived and measured teaching effectiveness and found that teacher proficiency plays a significant role in actual instructional performance. Their findings suggest that while teachers may perceive themselves as effective, measured indicators of effectiveness such as instructional clarity, classroom management, and engagement strategies are strongly associated with demonstrated subject-matter proficiency. This highlights the importance of objectively assessing both proficiency and teaching effectiveness rather than relying solely on self-reported measures.

Similarly, Kinnari (2010) emphasized the importance of mathematical proficiency in understanding, modeling, and problem-solving, particularly in applied and technical contexts. Although the study focused on engineering-related applications, its findings reinforce the idea that mathematical proficiency is not limited to knowledge of formulas but includes the ability to reason mathematically, interpret results, and apply concepts meaningfully. These competencies are equally relevant to teachers, especially those tasked with teaching mathematics outside their primary field of specialization.

Collectively, these global studies establish a strong theoretical and empirical basis for examining the link between mathematics proficiency and teaching effectiveness. However, much of the international literature focuses on mathematics specialists, preservice teachers, or contexts where teachers are formally trained in mathematics, leaving limited attention to out-of-field or non-mathematics major teachers.

In the Philippine context, research on mathematics teaching proficiency has primarily focused on preservice teachers. Roble and Bacabac (2016) investigated the teaching proficiency and preparedness of preservice secondary mathematics teachers and examined its implications for actual classroom practice. Their findings revealed that teaching proficiency is closely tied to preparedness in both content knowledge and pedagogical skills. The study emphasized that adequate preparation during teacher education programs is essential for effective classroom implementation. While this study provides valuable insights, it centers on mathematics majors and preservice teachers, offering limited evidence on the realities faced by in-service teachers who did not specialize in mathematics.

More recent national research has begun to shed light on the experiences of non-mathematics major teachers teaching mathematics. Moral and Timosa (2024) conducted a phenomenological study exploring the lived experiences of non-mathematics major teachers handling mathematics subjects in public schools in Davao del Norte. Their findings revealed that these teachers face significant challenges related to curriculum content, instructional resources, and confidence in teaching mathematics. Despite these difficulties, participants demonstrated resilience, adaptability, and a commitment to continuous learning. While this study offers rich qualitative insights into teachers' experiences and coping strategies, it does not quantitatively assess teachers' mathematics proficiency nor examine its relationship with teaching effectiveness.

Local and related studies further highlight the instructional implications of assigning non-mathematics major teachers to mathematics classes. A study examining the effects of non-mathematics major professors on the academic performance of Bachelor of Secondary Education (BSED) students majoring in mathematics reported that teacher specialization plays a role in shaping learners' academic outcomes. The findings suggest that subject-matter alignment between teachers and the subjects they teach contributes to better instructional delivery and student performance. However, similar to many related studies, the focus remains largely on student outcomes, with limited emphasis on directly measuring teachers' mathematics proficiency and teaching effectiveness.

The reviewed literature clearly establishes that mathematics proficiency is a vital component of effective mathematics teaching and that teacher proficiency is linked to instructional quality and learner outcomes. Global and national studies provide strong theoretical and empirical support for this relationship. However, a critical gap remains in the literature concerning in-service non-mathematics major teachers who are actively teaching mathematics, particularly in contexts where out-of-field teaching is prevalent. Existing studies either focus on preservice teachers, mathematics specialists, or rely on qualitative accounts of teacher experiences without systematically examining proficiency levels and teaching effectiveness.

This gap underscores the need for a focused investigation that quantitatively assesses the mathematics proficiency of non-mathematics major teachers, evaluates their teaching effectiveness through classroom observation, and examines the relationship between these two variables. Addressing this gap is essential for informing teacher education, professional development, and school-level interventions aimed at improving the quality of mathematics instruction.

## 3. METHODOLOGY

### A. Research Design

This study employed a descriptive-correlational research design. This design was deemed appropriate as it allowed the researcher to describe the levels of mathematics proficiency and teaching effectiveness of non-mathematics major teachers while simultaneously examining the relationship between these two variables. By using this design, the study provides both quantitative descriptions of teacher performance and correlational insights into how mathematics proficiency relates to teaching effectiveness.

### B. Research Locale

The study was conducted in selected public secondary schools within the Division of Samar and the Division of Catbalogan City, Province of Samar, Eastern Visayas, Philippines. These divisions were chosen to represent both urban and rural contexts, providing a more comprehensive understanding of teaching practices and mathematics proficiency among non-mathematics major teachers in the region.

## C. Respondents

The respondents of the study were teachers from public secondary schools within the selected divisions who were assigned to teach mathematics despite having completed a baccalaureate degree in a field other than mathematics. Purposive sampling was employed to ensure that participants met these inclusion criteria.

## D. Instrumentation

Data collection involved two primary instruments. First, a Mathematics Proficiency Test comprising 50 multiple-choice items, adapted and modified from the MTH 110 Proficiency Test Practice Exam (June 2009) of Grand Valley State University – Public Domain, was administered to measure respondents' mastery of mathematical concepts relevant to secondary education. Second, teaching effectiveness was assessed through a document analysis of the Classroom Observation Tool (COT) utilized by the Department of Education (DepEd), which focused on lesson clarity, instructional delivery, learner engagement, and content accuracy.

## E. Data Gathering Procedure

Prior to data collection, the researcher secured **approval letters** from the Schools Division Superintendents of Samar and Catbalogan City. These approvals, along with endorsements, were submitted to the **Public Schools District Supervisors** and subsequently to the **School Heads/Principals** of the participating schools. Data gathering was conducted primarily **face-to-face**, with the Mathematics Proficiency Test administered in-person and facilitated through **Google Forms** where appropriate to ensure convenience and proper documentation. Teaching effectiveness data were obtained through careful review of COT records and classroom observation reports.

## F. Statistical Treatment of Data

Collected data were analyzed using both descriptive and inferential statistics. Means and standard deviations were computed to determine the average levels of mathematics proficiency and teaching effectiveness as well as the variability among respondents. Frequency counts and percentages were used to describe respondents' demographic characteristics. To examine the relationship between mathematics proficiency and teaching effectiveness, Spearman's Rho ($\rho$) was employed, with significance evaluated at $\alpha = 0.01$. This approach allowed the researchers to determine whether higher levels of mathematics proficiency were associated with greater teaching effectiveness among non-mathematics major teachers.

## 4. RESULTS AND DISCUSSION

### A. Mathematics Proficiency of the Teacher-Respondents

Table 1 shows that the overall mean score of the teacher-respondents in the Mathematics Proficiency Test is 27.6, which corresponds to a rating of 82.08 on the transmuted scale. This suggests that, on average, the respondents fall under the Approaching Proficiency level based on the interpretation aligned with DepEd Order No. 31, s. 2012.

The teacher-respondents demonstrated strong proficiency in several advanced mathematical competencies, as evidenced by their high scores in tasks such as multiplying numbers, computing remainders, performing subtraction, solving simple algebraic equations, and applying various mathematical formulas and principles.

For example, Item 1 (To multiply numbers) received a perfect score of 50, translating to a rating of 100 (Advanced). Similarly, Item 21 (To solve the area of a triangle) also earned a perfect score of 50, with a corresponding rating of 100 (Advanced). Other items, such as Item 2 (To compute the remainder), received a score of 48, translating to a rating of 98.4 (Advanced), and Item 41 (To extract the cube root of a given algebraic expression) scored 50, with a rating of 100 (Advanced).

The teacher-respondents demonstrated an "Approaching Proficiency" level in various mathematical tasks, indicating they have developed fundamental knowledge and skills in these areas but may still require some guidance or peer assistance to achieve complete independence. For instance, tasks such as performing multiplication (Item 9) and applying MDAS/PEMDAS rules (Item 13) highlight basic arithmetic and operational skills. While they showed competency, the scores suggest room for refinement in fluency and accuracy.

In algebra, teacher-respondents performed similarly when solving simple algebraic equations (Item 12) and quadratic equations (Items 20 and 29), as well as when working with linear equations (Item 33) and systems of equations (Item 40). These scores reflect foundational understanding but also reveal opportunities for improvement in complex problem-solving and conceptual applications. Similarly, tasks involving the laws of exponents (Items 18 and 32), adding trinomials (Item 19), and dividing algebraic expressions (Item 38) underscore their grasp of key algebraic operations, albeit with some gaps in higher-order application and consistency.

Additionally, teacher-respondents exhibited a moderate ability to apply mathematical concepts like ratio and proportion (Item 39) and solve inequalities using number lines (Item 49). These tasks require analytical reasoning and visualization, areas where respondents appear to be developing proficiency. Overall, the "Approaching Proficiency" designation indicates that while the respondents can effectively perform fundamental tasks, targeted interventions and practice could help elevate their mathematical proficiency to higher levels.

The teacher-respondents' proficiency ratings under the "Developing" level reflect moderate competence in specific mathematical tasks. The ratings range from 72.8 to 79.2, with tasks such as adding mixed numbers, multiplying numbers, and solving linear equations demonstrating foundational understanding. For example, Item 4 (To add mixed numbers) received a rating of 72.8, indicating that respondents are still refining their skills in performing operations with fractions. Similarly, tasks like solving algebraic equations involving fractions (Item 16, Rating: 79.2) and sketching the graph of a linear inequality (Item 36, Rating: 79.2) suggest a growing grasp of intermediate concepts but with room for improvement.

Other tasks, such as applying the concept of average (Item 25, Rating: 76) and performing operations on radical expressions (Item 45, Rating: 76), indicate developing competence in applying mathematical principles in varied contexts. The ratings also highlight areas like solving quadratic equations that involve MDAS/PEMDAS and the distributive property (Item 35, Rating: 76), where respondents are beginning to integrate procedural fluency with conceptual understanding. Overall, these results suggest that while teacher-respondents are building their mathematical proficiency, further practice and targeted support are necessary to achieve higher levels of competency, particularly in tasks that involve more complex operations and abstract reasoning.

The teacher-respondents' proficiency ratings under the "Beginning" level reflect early stages of understanding and limited competence in various mathematical tasks. The ratings, which range from 68 to 74.4, indicate that respondents are still acquiring foundational skills and require further development to improve their proficiency in certain areas.

For instance, tasks like Item 6 (To divide simple fractions, Rating: 68) and Item 26 (To solve algebraic expressions containing fractions, Rating: 68) reveal that teacher-respondents face challenges in handling fractional operations, which are fundamental to algebra and arithmetic. Similarly, tasks such as Item 7 (To perform on ratio, Rating: 74.4) and Item 8 (To compute percentage, Rating: 74.4) demonstrate developing but insufficient proficiency in essential concepts that are frequently applied in mathematics teaching.

The researcher applied DepEd Order No. 31, s. 2012 to interpret the level of proficiency based on the equivalent numerical value.

Other tasks like Item 14 (To perform laws of exponents, Rating: 72.8) and Item 17 (To compute simple interest, Rating: 72.8) reflect an emerging understanding of more complex topics but indicate that respondents are not yet consistently applying these concepts with confidence. Additionally, tasks involving polynomials, such as Item 46 (To factor polynomial expressions, Rating: 68) and Item 47 (To solve equations containing fractions, Rating: 74.4), further demonstrate the need for more practice in both operations and abstract reasoning.

Overall, the "Beginning" level results suggest that teacher-respondents need further guidance and instructional support to build a stronger mathematical foundation, especially in more complex areas like algebraic manipulation, exponents, and functions. With additional practice and targeted interventions, they are likely to advance in their proficiency, ultimately improving their ability to teach mathematics effectively.

The standard deviation for the scores is 12.1, indicating a moderate level of variability in the teacher-respondents' performance on the test. Similarly, the standard deviation for the ratings is 9.69, reflecting some differences in how respondents scored relative to the mean. These values suggest that while most teacher-respondents performed near the average level, there are variations, with some showing stronger proficiency and others requiring more support in mathematics.

**Table 1. Level of Mathematics Proficiency of the Fifty (50) Non-Mathematics Major Teachers Teaching Mathematics**

| Items | Total Score | Rating (Transmuted) Rating = (Score/50)*40 +60 | Interpretation |
|---|---|---|---|
| 1. 2,500,000 x 400,000 = ________<br>a) 100,000,000,000<br>b) 1,000,000,000<br>c) 10,000,000<br>d) 1,000,000,000,000<br>e) none of these | 50 | 100 | Advanced |
| 2. The remainder when 894 is divided by 16 is ___________<br>a) 8 b) 14 c) 12 d) .875 e) 55 | 48 | 98.4 | Advanced |
| 3. If 2.85 is subtracted from 30.6, then the result is________<br>a) 0.21<br>b) 33.45<br>c) 27.75<br>d) 5.91<br>e) -27.75 | 42 | 93.6 | Advanced |
| 4. $3\frac{1}{7}+4\frac{7}{9}$<br>a) $7\frac{8}{16}$ b) $7\frac{8}{63}$ c) $7\frac{58}{63}$<br>d) $\frac{67}{16}$ e) $7\frac{16}{63}$ | 16 | 72.8 | Developing |

| | | | |
|---|---|---|---|
| 5. How many dozens of eggs are there in 6 boxes, each containing 30 eggs?<br>a) 15 b) 12 c) 180 d) 5 e) 72 | 20 | 76 | Developing |
| 6. $\frac{3}{11} \div \frac{5}{6} =$<br>a) $\frac{18}{55}$ b) $\frac{55}{18}$ c) $\frac{15}{66}$ d) $\frac{5}{22}$<br>e) none of these | 10 | 68 | Beginning |
| 7. Jose can assemble 12 car parts in 40 minutes. How many minutes would be needed to assemble 9 parts?<br>a) 2.7 b) 27 c) $53\frac{1}{3}$ d) 60 e) 30 | 18 | 74.4 | Beginning |
| 8. What percent of 48 is 60?<br>a) 125% b) 25% c) 1.25% d) 80% e) 0.8% | 18 | 74.4 | Beginning |
| 9. Which of the following best approximates $5.3 \times 40.2$?<br>a) 22.26 b) 231.006 c) 2130.6 d) 213.05<br>e) 200.6 | 26 | 80.8 | Approaching Proficiency |
| 10. If $7 + 3x = -2(x+4)$, then $x =$<br>a) $-5$ b) $-1$ c) $-15$ d) $\frac{-13}{5}$ e) $-3$ | 44 | 95.2 | Advanced |
| 11. The base of a rectangular box measures 3 ft by 6 ft. What is the height (in feet) of the box if the volume is 72 cubic feet?<br>a) 90 b) 1296 c) 4 d) 12 e) 24 | 38 | 90.4 | Advanced |
| 12. If $0.02x = 40$, then $x =$<br>a) 0.8 b) 39.98 c) 2000 d) 80 e) 200 | 26 | 80.8 | Approaching Proficiency |
| 13. $3[13 - 7(5-2)] =$ _______<br>a) -60 b) 18 c) -72 d) -24 e) 54 | 30 | 84 | Approaching Proficiency |
| 14. $x^5 y^2 \cdot x^5 y =$ _______<br>a) $2x^5y^2$ b) $x^{10}y^2$ c) $x^5y^3$ d) $2x^{10}y^3$<br>e) $x^{10}y^3$ | 16 | 72.8 | Beginning |
| 15. The graph of the equation $3x - 2y + 24 = 0$ crosses the x-axis at x=<br>a) 12 b) 0 c) 8 d) $-12$ e) $-8$ | 20 | 76 | Developing |

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|---|---|---|---|
| 16. If $2x-\frac{3}{2}=4x-\frac{11}{2}$, then $x=$ __ <br> a) 2 b) $\frac{1}{2}$ c) $\frac{7}{2}$ d) $-2$ <br> e) no solution | 24 | 79.2 | Developing |
| 17. Money in a bank triples every 10 years. If ₱ 100 is deposited today, what will its value be after 40 years? <br> a) ₱ 400 b) ₱ 1200 c) ₱ 6400 d) ₱ 8100 e) ₱ 24,300 | 16 | 72.8 | Beginning |
| 18. $(3x^3)^2=$ _____ <br> a) $6x^6$ b) $9x^5$ c) $6x^5$ d) $3x^6$ e) $9x^6$ | 26 | 80.8 | Approaching Proficiency |
| 19. $(5y^2-2+3y)+(y^2-4y+7)=$ ___ <br> a) $6y^2-6y+10$ <br> b) $6y^4-y^2+5$ <br> c) $6y^2-y+5$ <br> d) $6y^2-7y+9$ <br> e) none of these | 26 | 80.8 | Approaching Proficiency |
| 20. If $y=3x^2-3x+5$ and $x=-2$, then y = _____ <br> a) 11 b) 47 c) 23 d) -1 e) 35 | 30 | 84 | Approaching Proficiency |
| 21. The height of a triangle is 3 more than its base. If $x$ is the base, then its area is _______ <br> a) $\frac{1}{2}x^2+3x$ b) $\frac{1}{2}x^2+\frac{3}{2}$ c) $\frac{1}{2}x^2+\frac{3}{2}x$ <br> d) $x^2+3x$ e) $x^2-3x$ | 50 | 100 | Advanced |
| 22. One factor of $x^2+2x-8$ is <br> a) $x+2$ b) $x-8$ c) $x-2$ d) $x-4$ <br> e) $x+6$ | 48 | 98.4 | Advanced |

| | | | |
|---|---|---|---|
| 23. In a standard coordinate system, the graph of the equation $y = 2x - 5$ is<br>a) A line falling to the right.<br>b) A line rising to the right.<br>c) A vertical line.<br>d) A horizontal line.<br>e) Not a line. | 42 | 93.6 | Advanced |
| 24. If $x \geq 0$, then $\sqrt{25x^3} - \sqrt{9x^3} =$ __<br>a) $4x\sqrt{x}$ b) $4$ c) $2x^2\sqrt{x}$ d) $2x\sqrt{x}$ e) $4x^3$ | 16 | 72.8 | Beginning |
| 25. In a gymnastics meet Kim had a score of 8.1 on vault, 7.5 on beam, and 7.8 on bars. What must be scored on floor to have an all around average of 7.7?<br>a) 7.6 b) 7.4 c) 215.7 d) 7.8 e) 7.5 | 20 | 76 | Developing |
| 26. $\frac{x+4}{4x} - \frac{4}{x} =$ ______<br>a) $\frac{1}{4x}$ b) $\frac{x-12}{4x}$ c) $\frac{1}{4}$ d) $-3$ e) $\frac{x-3}{x}$ | 10 | 68 | Beginning |
| 27. $(3a-5b)^2 =$ ______<br>a) $9a^2 - 15ab + 25b^2$<br>b) $9a^2 - 30ab + 25b^2$<br>c) $3a^2 - 5b^2$<br>d) $9a^2 - 15ab - 25b^2$<br>e) $9a^2 + 25b^2$ | 18 | 74.4 | Beginning |
| 28. If $2x - 3 < 4x - 3$, then ____<br>a) $x < -3$ b) $x > 0$ c) $x > -1$ d) $x < 1$<br>e) $x < -1$ | 18 | 74.4 | Beginning |
| 29. If $m^2 = m + 6$, then $m =$ _____<br>a) 0 or -3 b) 3 or -2 c) -6 or 1<br>d) -3 or 2 e) -1 or 6 | 26 | 80.8 | Approaching Proficiency |
| 30. The perimeter of a rectangle is 240 feet. If the length is 12 feet, then the width is<br>a) 20 feet. b) 108 feet. c) 114 feet. d) 216 feet.<br>e) 228 feet. | 44 | 95.2 | Advanced |

| | | | |
|---|---|---|---|
| 31. If $5b-2a=2-b$, then $a=$ _____ <br> a) 1-3b b) 3b-1 c) 6b-1 d) 3b-2 e) 2-3b | 38 | 90.4 | Advanced |
| 32. $16^{1/2}-16^{0}=$ _______ <br> a) 8 b) 0 c) 7 d) 3 e) -8 | 26 | 80.8 | Approaching Proficiency |
| 33. If the point (-2, 3) lies on the line whose equation is $ax+4y=2$, then $a=$ _____ <br> a) -7 b) -5 c) $\frac{10}{3}$ d) -8 e) 5 | 30 | 84 | Approaching Proficiency |
| 34. The slope of the line $5x+7y-4=0$ is <br> a) $\frac{7}{5}$ b) $\frac{5}{7}$ c) $-\frac{7}{5}$ d) $-\frac{5}{7}$ e) $\frac{4}{7}$ | 16 | 72.8 | Beginning |
| 35. $3[-2x-3(x-x^2)+4]-x=$ _______ <br> a) $9x^2-16x+12$ <br> b) $9x^2+16x-12$ <br> c) $-9x^2-16x+12$ <br> d) $-9x^2+16x+12$ <br> e) none of these | 20 | 76 | Developing |

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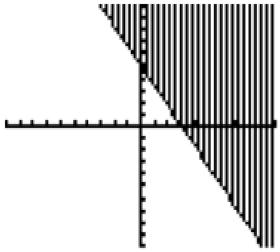
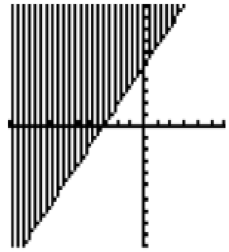
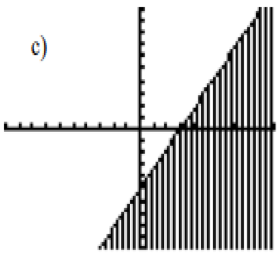
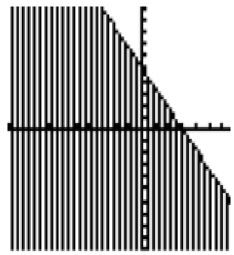
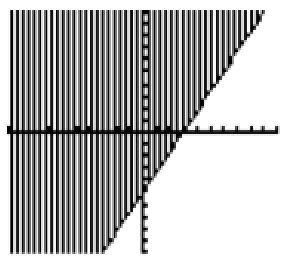
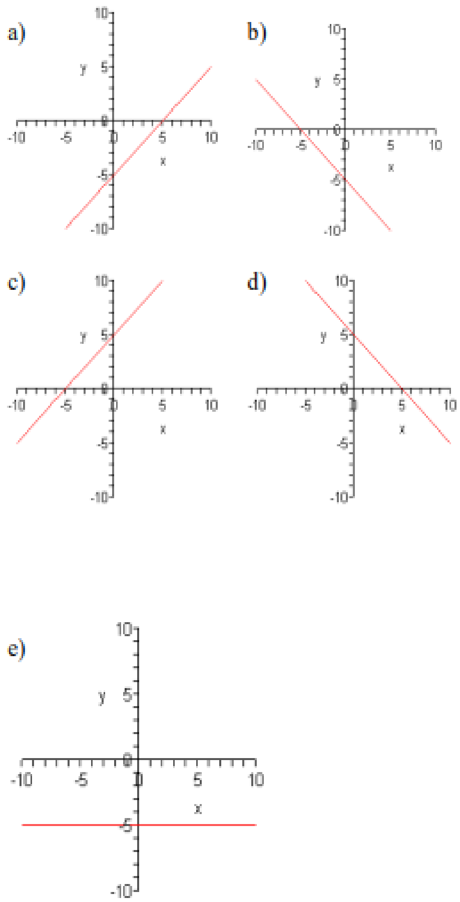
| 36. The graph of $5x-3y \geq 15$ on a standard window is<br>a)  b) <br>c)  d) <br>e)  | 24 | 79.2 | Developing |
| 37. $\frac{12a^6b^4+4ab^6}{2ab^2}=$<br>a) 8 b) $6a^5b^2+4ab^6$ c) $6a^6b^2+2b^4$<br>d) $6a^5b^2+2b^4$ e) $6a^5b^2+2b^3$ | 16 | 72.8 | Beginning |
| 38. $\frac{x^2-9}{x^2+4} \div \frac{x+3}{x+2} =$ ______<br>a) $\frac{x-3}{x+2}$ b) $\frac{-3}{2}$ c) $\frac{(x-3)(x+2)}{x^2+4}$<br>d) $\frac{x+3}{x+2}$ e) $\frac{-x-6}{4}$ | 26 | 80.8 | Approaching Proficiency |

| | | | |
|---|---|---|---|
| 39. To get to work from my home, I travel 8 miles north and then turn west and travel 6 miles. If I could travel in a straight line from my home to work, how much distance would I save? a) 2 miles b) 4 miles. c) 10 miles. d) 14 miles. e) 86 miles. | 26 | 80.8 | Approaching Proficiency |
| 40. The value of $x$ in the solution to the system $\begin{cases} x+2y=5 \\ 2x-y=5 \end{cases}$ is ______ a) 3 b) 2 c) -1 d) 1 e) 0 | 30 | 84 | Approaching Proficiency |
| 41. $\sqrt[3]{27a^5y^{12}}$ = a) $3a^2y^9$ b) $9a^2y^9$ c) $3ay^4\sqrt[3]{a^2}$ d) $3ay^4\sqrt{a^2}$ e) $9ay^4\sqrt[3]{a^2}$ | 50 | 100 | Advanced |
| 42. One of the solutions to the equation $x^2+20=-4x$ is a) $-20$ b) $-24$ c) $-2+4i$ d) $2+4i$ e) $4i$ | 48 | 98.4 | Advanced |
| 43. If $\log_2 16 = x$, then $x$ = _____ a) 8 b) 4 c) 14 d) $\frac{1}{8}$ e) $\frac{1}{4}$ | 42 | 93.6 | Advanced |
| 44. If $f(x)=-2^{x+4}$, then $f(-2)=$ a) $-\frac{15}{4}$ b) $\frac{15}{4}$ c) $\frac{17}{4}$ d) $-4$ e) $4$ | 16 | 72.8 | Beginning |
| 45. If $\sqrt{2x+3}-x=0$, then $x$ = _____ a) 0 or $\frac{-3}{2}$ b) $-1\pm i\sqrt{2}$ c) 3 d) -1 e) 3 and -1 | 20 | 76 | Developing |
| 46. $t^4-8t^2+16$ factors completely over the reals into a) $(t+2)^2(t-2)^2$ b) $(t^2-4)^2$ c) $(t^2+4)(t^2-4)$ d) $(t^2-8)(t^2-2)$ e) $(t-2)^4$ | 10 | 68 | Beginning |

| | | | |
|---|---|---|---|
| 47. If $\frac{x}{x+1} = \frac{x+6}{x+1} - \frac{8}{x}$ then $x =$ ______<br>a) $-4$ b) $-1$ c) $4$ d) $\frac{-1}{4}$ e) $\frac{7}{4}$ | 18 | 74.4 | Beginning |
| 48. The graph of the parabola $y = 3x^2 + 12x + 5$ is symmetric with respect to the line<br>a) $y=-7$ b) $y=7$ c) $x=-2$ d) $x=2$<br>e) $x=12$ | 18 | 74.4 | Beginning |
| 49. Of the following graphs, which best represents the solution of the inequality $2x+3<5$?<br>a)  <br>b)  <br>c)  <br>d)  <br>e)   | 26 | 80.8 | Approaching Proficiency |

| | | | |
|---|---|---|---|
| 50. Which of the following best represents the graph of $x + y = 5$?  | 44 | 95.2 | Advanced |
| **Mean** | **27.6** | **82.08** | **Approaching Proficiency** |
| **Standard Deviation** | **12.1** | **9.69** | |

| Legend: | Level of Proficiency | Equivalent Numerical Value |
|---|---|---|
| | Beginning | 74% and below |
| | Developing | 75-79% |
| | Approaching Proficiency | 80-84% |
| | Proficient | 85-89% |
| | Advanced | 90% and above |

It can be gleaned from Table 2 that the combined frequency of "Approaching Proficiency" and below is 36 out of 50, which implies that the majority of the respondents are at lower proficiency levels, indicating that there are significant opportunities for improvement in their mathematical skills. Specifically, 72% of the respondents fall under the "Beginning," "Developing," or "Approaching Proficiency" levels, which suggests that targeted instructional interventions are needed in these areas to help raise their proficiency. On the other hand, 28% of the respondents fall under the "Advanced" category, indicating a solid understanding of the material and readiness for more complex tasks. This distribution points to specific areas where instructional support and strategies can be tailored to enhance student outcomes.

**Table 2. Proficiency Distribution of Teacher-Respondents in the Mathematics Proficiency Test**

| Level of Proficiency | f | % |
|---|---|---|
| Beginning | 15 | 30 |
| Developing | 8 | 16 |
| Approaching Proficiency | 13 | 26 |
| Proficient | 0 | 0 |
| Advanced | 14 | 28 |
| Total | 50 | 100.00 |

In the context of this monograph, which focuses on **Mathematics Proficiency, and Teaching Effectiveness of Non-Mathematics Major Teachers Teaching Mathematics**, this level of proficiency suggests that teacher-respondents have foundational competence in mathematics. However, they may require targeted support and capacity-building activities to enhance their confidence and effectiveness in delivering mathematics instruction. This aligns with the need for professional development programs that empower non-mathematics majors to bridge gaps in their expertise and further improve their teaching strategies for mathematics.

### B. Teaching Effectiveness of the Teacher-Respondents

Table 3 below presents the teaching effectiveness of the teacher-respondents. In Statement/Indicator 1, *"Applies knowledge of content within and across curriculum teaching areas,"* the mean score is 3.2, interpreted as "Organizing." This suggests that the teacher demonstrates a limited application of knowledge in integrating content across different areas of the curriculum. While the teacher has foundational knowledge, the ability to connect and apply this knowledge effectively across multiple subjects remains an area for growth. More work is needed to strengthen this application, ensuring that the teacher can draw meaningful connections between various content areas for more cohesive learning experiences.

For Statement/Indicator 2, *"Uses a range of teaching strategies that enhance learner achievement in literacy and numeracy skills,"* the mean score is 3.44, which falls within the "Organizing" stage. This indicates that the teacher is employing some teaching strategies aimed at improving literacy and numeracy, but the range of strategies and their consistent application could be expanded. To enhance the effectiveness of literacy and numeracy skills instruction, the teacher could incorporate more diverse and targeted strategies that cater to varying student needs.

In Statement/Indicator 3, *"Applies a range of teaching strategies to develop critical and creative thinking, as well as other higher-order thinking skills,"* the mean score is 3.28, also interpreted as "Organizing." This shows that the teacher is somewhat effective in using teaching strategies to foster critical and creative thinking, but the approach may still lack sufficient variety or depth. To strengthen this, the teacher could further refine their teaching methods to actively promote higher-order thinking skills such as analysis, evaluation, and synthesis, engaging students in more complex thought processes.

For Statement/Indicator 4, *"Manages classroom structure to engage learners, individually or in groups, in meaningful exploration, discovery and hands-on activities within a range of physical learning environments,"* the mean score is 3.24, interpreted as "Organizing." The teacher is capable of managing classroom structure but may not fully maximize opportunities for active, hands-on learning across different physical learning environments. More dynamic and inclusive strategies could be employed to ensure that learners are engaged in exploratory activities that promote deeper understanding.

In Statement/Indicator 5, *"Manages learner behavior constructively by applying positive and non-violent discipline to ensure learning-focused environments,"* the mean score is 3.4, interpreted as "Organizing." This suggests that the teacher applies positive discipline strategies, but there may still be areas where consistency or effectiveness can be improved. Enhancing these techniques will help ensure that the learning environment remains supportive and conducive to focused student engagement.

For Statement/Indicator 6, *"Uses differentiated, developmentally appropriate learning experiences to address learners' gender needs, strengths, interests and experiences,"* the mean score is 3.32, which is again within the "Organizing" stage. The teacher demonstrates a basic attempt at differentiating instruction based on learners' diverse needs, but there is room for further refinement in tailoring lessons to meet these varying needs. A more individualized approach would better address each learner’s strengths, interests, and experiences, leading to improved outcomes.

Lastly, in Statement/Indicator 8, *"Selects, develops, organizes, and uses appropriate teaching and learning resources, including ICT, to address learning goals,"* the mean score is 3.4, interpreted as "Organizing." The teacher uses teaching resources, including ICT, to support learning goals, but may not fully maximize the potential of these resources. There is an opportunity to enhance the integration of digital tools and teaching materials to more effectively meet the diverse learning needs of students.

**Table 3. Teaching Effectiveness of the Teacher Respondents**

| Statement/Indicator | Mean Score | Level Name |
|---|---|---|
| 1. Applies knowledge of content within and across curriculum teaching areas | 3.2 | Organizing |
| 2. Uses a a range of teaching strategies that enhance learner achievement in literacy and numeracy skill | 3.44 | Organizing |
| 3. Applies a range of teaching strategies to develop critical and creative thinking, as well as other higher-order thinking skills | 3.28 | Organizing |
| 4. Manages classroom structure to engage learners, individually or in groups, in meaningful exploration, discovery and hands-on activities within a range of physical learning environment | 3.24 | Organizing |
| 5. Manages learner behaviour constructively by applying positive and non-violent discipline to ensure learning-focused environments | 3.4 | Organizing |
| 6. Uses differentiated, developmentally appropriate learning experiences to address learners' gender needs, strengths, interests and experiences | 3.32 | Organizing |
| 7. Plans, manages and implements developmentally sequenced teaching and learning processes to meet curriculum requirements and varied teaching contexts | 3.8 | Developing |
| 8. Selects, develops, organizes, and uses appropriate teaching and learning resources, including ICT, to address learning goals | 3.4 | Organizing |
| 9. Designs, selects, organizes, and uses diagnostic, formative and summative assessment strategies consistent with curriculum requirements | 3.76 | Developing |

These findings suggest that more advanced strategies and deeper integration of teaching methods are needed. Further professional development in specific areas will help foster more effective teaching practices and lead to improved student engagement and learning outcomes.

In Statement/Indicator 7, *"Plans, manages, and implements developmentally sequenced teaching and learning processes to meet curriculum requirements and varied teaching contexts,"* the mean score is 3.8, interpreted as "Developing." This means that the teacher demonstrates a range of pedagogical aspects that are sometimes aligned with the learners' developmental needs. While the teacher shows an ability to plan and implement lessons based on curriculum requirements and the diverse contexts in which teaching occurs, the alignment with the developmental stages of learners may not be fully consistent. There is an opportunity to refine the sequencing of lessons and make them more responsive to the varying developmental needs of the students, ensuring that all learners benefit from the instructional process.

In Statement/Indicator 9, *"Designs, selects, organizes, and uses diagnostic, formative, and summative assessment strategies consistent with curriculum requirements,"* the mean score is 3.76, also interpreted as "Developing." This indicates that the teacher demonstrates a range of assessment strategies, such as diagnostic, formative, and summative assessments, that are sometimes aligned with the learners' needs. The teacher is capable of using a variety of assessment methods to gauge learner progress and adjust instruction as needed. However, these assessments may not always fully align with the learners' developmental stages or address all their individual needs consistently. As the teacher refines their assessment strategies and ensures they more effectively reflect students' developmental requirements, their practice can evolve toward greater effectiveness.

Both indicators suggest that while the teacher is capable of demonstrating key teaching practices, there is a need for further refinement to ensure that teaching strategies and assessments are fully tailored to meet the developmental needs of all learners in a consistent and effective manner.

### C. Relationship Between Mathematics Proficiency and Teaching Effectiveness of the Teacher-Respondents

Table 4 presents the relationship between mathematics proficiency and teaching effectiveness among non-mathematics major teachers teaching mathematics. The results reveal a strong positive and statistically significant relationship between the two variables ($\rho = 0.711$, $p = 0.000$, $\alpha = 0.01$). This finding indicates that teachers with higher levels of mathematics proficiency tend to demonstrate higher levels of teaching effectiveness. The strength of the correlation suggests that content knowledge is a critical factor influencing instructional quality, particularly in mathematics.

**Table 4. Significant Relationships among Self-Efficacy, Mathematics Proficiency and Teaching Effectiveness**

| Variable | Teaching Effectiveness | | |
|---|---|---|---|
| | Coefficient | p-value @0.01 (2-tailed) | Evaluation |
| Mathematics Proficiency | ρ = 0.711 | 0.000 | Significant |

Legend: (Spearman, 1904)

**ρ = +1**: Perfect positive correlation

**ρ between 0.70 and 0.90**: Strong positive correlation

**ρ between 0.50 and 0.69**: Moderate positive correlation

**ρ between 0.30 and 0.49**: Weak positive correlation

**ρ = 0**: No correlation

**ρ between -0.29 and -0.50**: Weak negative correlation

**ρ between -0.51 and -0.69**: Moderate negative correlation

**ρ between -0.70 and -0.89**: Strong negative correlation

**ρ = -1**: Perfect negative correlation

This result implies that teachers who possess stronger mathematical proficiency are better equipped to deliver lessons with clarity, accuracy, and coherence. Such teachers are more capable of explaining abstract concepts, selecting appropriate examples, anticipating learners' misconceptions, and adjusting instructional strategies to support understanding. Consequently, mathematics proficiency appears to serve as a foundation upon which effective teaching practices are built, especially in classrooms handled by non-mathematics major teachers.

The findings of this study are consistent with existing theoretical and empirical literature. Schoenfeld and Kilpatrick (2008) emphasized that effective mathematics teaching requires a deep and connected understanding of mathematical content, which enables teachers to engage learners in meaningful mathematical thinking rather than rote procedures. The strong relationship observed in the present study supports their assertion that mathematical proficiency is integral to instructional effectiveness.

Similarly, the results align with the findings of Altarawneh and Marei (2021), who reported that higher mathematical proficiency among preservice classroom teachers was significantly associated with stronger instructional performance. Although their study focused on preservice teachers, the present findings extend this relationship **to** in-service non-mathematics major teachers, suggesting that mathematical proficiency remains a key determinant of teaching effectiveness regardless of teachers' academic specialization.

The findings are also supported by Sadeghi, Richards, and Ghaderi (2020), who found that measured teaching effectiveness is closely linked to teacher proficiency rather than perceived effectiveness alone. This reinforces the importance of objectively assessing both mathematics proficiency and teaching effectiveness, as done in the present study through a standardized mathematics test and classroom observation tools.

However, the results of this study also provide an important contribution by contextualizing these relationships within the realities of out-of-field teaching**.** While qualitative studies such as that of Moral and Timosa (2024) highlighted the resilience, adaptability, and coping strategies of non-mathematics major teachers, the present study offers quantitative evidence that variations in mathematics proficiency are significantly associated with variations in teaching effectiveness. This suggests that while perseverance and commitment are valuable, they may not fully compensate for gaps in content knowledge.

In contrast to studies that focus primarily on student outcomes or teacher perceptions, this study directly measures teachers' mathematics proficiency and links it to observed teaching effectiveness. As such, it fills a gap in the literature by providing empirical support for the argument that improving mathematics proficiency among non-mathematics major teachers is essential for enhancing instructional quality. The findings underscore the need for targeted professional development programs that strengthen both content knowledge and pedagogical skills to support teachers assigned to teach mathematics outside their field of specialization.

## 5. IMPLICATIONS TO TEACHING

The findings of this study reveal a strong and statistically significant relationship between mathematics proficiency and teaching effectiveness among non-mathematics major teachers teaching mathematics. This result carries important implications for classroom instruction, teacher development, and institutional policy.'

First, the strong positive correlation between mathematics proficiency and teaching effectiveness suggests that strengthening teachers' content knowledge should be a priority in improving mathematics instruction. While pedagogical skills are essential, they cannot fully compensate for gaps in conceptual understanding. Teachers who possess deeper mathematical knowledge are more capable of explaining abstract concepts clearly, addressing learners' misconceptions, selecting meaningful examples, and facilitating higher-order thinking. Therefore, professional development programs should not focus solely on teaching strategies but must include structured content enhancement sessions in key mathematical domains.

Second, teacher deployment policies may need to be revisited. Although administrative realities sometimes require assigning non-mathematics major teachers to mathematics classes, schools and divisions should ensure that such assignments are accompanied by targeted support systems. This may include mentoring by mathematics specialists, collaborative lesson planning, access to curated instructional resources, and regular content-based workshops. Without structured support, teachers may rely heavily on textbooks and procedural teaching, which can limit learners' conceptual understanding.

Third, pre-service teacher education institutions may consider integrating stronger mathematics content components even for non-mathematics education programs. Given the prevalence of out-of-field teaching, preparing future educators with a minimum level of mathematics proficiency becomes a practical necessity rather than an optional enhancement. Bridging courses or enrichment modules in mathematics may better equip future teachers who may eventually handle mathematics subjects.

Fourth, classroom observation and evaluation systems should recognize the interconnected nature of content knowledge and teaching performance. Observation tools may be refined to capture not only instructional delivery but also accuracy of explanations, conceptual clarity, and responsiveness to student misconceptions. Strengthening evaluation frameworks can help schools identify areas where teachers require further content reinforcement.

Fifth, the findings highlight the need for sustained professional learning communities (PLCs) within schools. Non-mathematics major teachers teaching mathematics can benefit from collaborative discussions with mathematics specialists, shared lesson studies, and reflective practices that deepen both content knowledge and pedagogical competence. Improving mathematics proficiency should be viewed as an ongoing professional journey rather than a one-time training intervention.

Finally, an important implication of this study extends beyond basic education institutions and directly involves higher education institutions (HEIs), particularly university instructors and professors in mathematics and teacher education programs. Given the limited availability of mathematics content-focused seminars and specialized trainings in some DepEd divisions, universities may take a proactive role in bridging this gap through extension activities. Faculty members in mathematics and education departments are in a strategic position to design and conduct community-based extension programs aimed at upskilling non-mathematics major teachers who are assigned to teach mathematics. Such extension initiatives may include short courses on foundational mathematics concepts, problem-solving workshops, refresher modules on key secondary mathematics topics, and mentoring programs that integrate content enhancement with pedagogical strategies. By leveraging university expertise and research-based practices, HEIs can support DepEd teachers in strengthening their mathematical proficiency in a structured and sustained manner.

This collaborative approach not only addresses immediate instructional needs but also reinforces the civic and professional mandate of universities to serve the community. Extension programs focused on mathematics proficiency can become a sustainable model of partnership between SUCs and DepEd, ultimately contributing to improved classroom instruction and learner achievement.

Taken as a whole, improving mathematics proficiency among non-mathematics major teachers is not merely an academic concern; it is a strategic approach to strengthening mathematics education and improving learner outcomes.

## 6. CONCLUSIONS

This monograph examined the mathematics proficiency and teaching effectiveness of non-mathematics major teachers teaching mathematics and investigated the relationship between these two variables. The findings revealed that mathematics proficiency is significantly and strongly associated with teaching effectiveness. Teachers who demonstrated higher levels of mathematics proficiency were more likely to exhibit effective instructional practices in the classroom.

The results affirm theoretical perspectives suggesting that strong content knowledge forms the foundation of effective teaching. They also extend existing literature by providing empirical evidence within the context of in-service non-mathematics major teachers, a group that remains underrepresented in quantitative research. While previous studies have emphasized teacher preparedness and lived experiences, this study quantitatively confirms that variations in mathematics proficiency correspond to variations in observed teaching effectiveness.

The findings suggest that out-of-field teaching in mathematics presents both challenges and opportunities. Although non-mathematics major teachers may demonstrate resilience and adaptability, sustained improvements in instructional quality require deliberate efforts to strengthen mathematical content knowledge. Addressing this need through structured professional development, supportive deployment policies, and enhanced teacher preparation programs may contribute meaningfully to improving mathematics instruction.

In conclusion, mathematics proficiency is not an isolated attribute but a central pillar of teaching effectiveness in mathematics classrooms. Strengthening teachers' content knowledge is a practical and necessary step toward enhancing the quality of mathematics education, particularly in contexts where non-mathematics major teachers are assigned to teach the subject.

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