



Mathematics Proficiency and Teaching Capabilities of Pioneering Mathematics Major Graduates of K-12 Curriculum

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ABSTRACT

A research study was conducted to address the challenges faced by mathematics pre-service teachers in an online learning environment. The study aimed to explore the relationship between mathematics proficiency and teaching capabilities among these teachers, who were the first graduates of the K-12 curriculum in an online setup. Quantitative methods were used to analyze the data, including mean, standard deviation, Pearson-r correlation, and regression analysis. Questionnaires and demonstration ratings were used to collect the data from the participants. The findings revealed that the respondents had an average level of mathematics proficiency, while their teaching capabilities were rated as high. However, there was no significant relationship found between mathematics proficiency and teaching capabilities. The study highlights the importance of developing the knowledge and skills of future educators to ensure quality education for future learners. The results can inform the development of measures, policies, and guidelines to enhance the teaching practices of future educators and improve the overall learning experience.

Keywords: mathematics proficiency, teaching capabilities, education, pre-service teachers, K-12 curriculum

INTRODUCTION

From being the pioneers of the K to 12 Curriculum, the students faced another first time as of 2020. The COVID-19 pandemic forced college students into virtual instruction, including Education interns who faced challenges adapting to online learning. This shift to online classes has significantly impacted the teaching curriculum and students' learning. As the first cohort to experience internships in this new setup, our research examines the relationship between mathematics proficiency and teaching capabilities of these interns in online classes.

According to Lee and Kung (2018), students in Taiwan faced difficulties transitioning from face-to-face to online learning systems, as they no longer had immediate access to learning interventions from teachers or peers. Similarly, Cleofas (2020) found that college students in the Philippines needed help with online learning, recognizing the importance of real-world experiences and training for acquiring necessary skills and knowledge. Fabito et al. (2020) discovered that students needed clarification from professors and lacked dedicated study areas for online activities, which were top barriers to virtual learning. Talidong and Toquero (2020) noted that the COVID-19 crisis impacted education in Mindanao, with universities and colleges facing challenges transitioning to virtual learning and students hesitating to adopt online-blended approaches. These factors affect the experiences and abilities of education interns, who miss out on real-world experiences and conventional practicums in their transition to virtual learning.

The researchers consider this a gap that needs to be addressed to understand online learning and have specific measures to achieve the Philippine Professional Standard for Teachers (PPST) that would benefit the pre-service teachers and the education students. Supported by the above statements, studies, reports, and literature, the researchers are considering the interns' learning situations that pushed them to virtual instructions, their knowledge, skills, and teaching competence.

Statement of the Problem

This study aims to determine the mathematics proficiency and teaching capabilities of pre-service teachers in online learning set up. Significantly this study will seek to answer the following questions:

1. What is the level of Mathematics proficiency in terms of:
 - 1.1 adaptive reasoning;
 - 1.2 strategic competence;
 - 1.3 conceptual understanding;
 - 1.4 productive disposition; and

- 1.5 procedural fluency?
2. What is the level of Teaching Capabilities in terms of:
 - 2.1 Lesson Planning;
 - 2.2 Lesson Delivery?
3. Is there a significant relationship between the level of Mathematics proficiency and Teaching Capabilities?

Hypothesis

Ho₁: There is no significant relationship on the mathematics proficiency and teaching capabilities of interns online.

METHOD

This research uses a quantitative research approach, especially a descriptive-correlational method. Descriptive correlational research aims to describe the relationship among variables rather than infer the cause-and-effect relationships. Descriptive correlational studies help describe how one phenomenon is related to another. This study employed a convenient sampling method. A questionnaire was used to collect data from the respondents to determine their math proficiency. There are two distinct data collection methods. The intern's math ability/skill level was assessed using a questionnaire which is a standardized and adopted test. While gathering data regarding their teaching capabilities, the researchers will interpret the pre-service teachers' online demonstration teaching evaluation instrument during their field studies. Mean, standard deviation and Pearson-r were utilized in this study.

RESULTS AND DISCUSSION

Table 1. Level of Mathematics Proficiency of the Pre-Service Teachers.

Mathematics Proficiency	SD	Mean	Description
Adaptive Reasoning	0.58	2.79	Average
Strategic Competence	0.77	1.86	Low
Conceptual Understanding	0.76	1.43	Very Low
Productive Disposition	0.73	4.71	Very High
Procedural Fluency	0.97	2.21	Low
Overall	0.42	2.60	Average

As presented in the table above, the highest mean, 4.71 with a standard deviation of 0.73, is the respondents' Productive Disposition, which can be depicted as very high. The lowest mean of the respondents can be seen in their Conceptual Understanding, which is 1.43 with a standard deviation of 0.76. Strategic Competence with a mean of 1.86, Procedural fluency with a mean of 2.21, and Adaptive reasoning with a mean of 2.79. The overall mean of the mathematics proficiency of the respondents is 2.60, with an overall standard deviation of 0.42 which can be described as average.

The researchers found that the respondents had average adaptive reasoning skills, indicating their ability to think logically and justify conclusions. However, they identified a need for improvement in the strategic competence indicator, particularly in problem-solving and presenting mathematical facts effectively. The conceptual understanding of the respondents needed to be improved, with limited comprehension and connection of mathematical concepts. On the other hand, the respondents demonstrated a high level of productive disposition, perceiving mathematics as valuable and having confidence in their abilities. Procedural fluency had low mastery, highlighting the need for better skill and precision in mathematical operations. Overall, the researchers concluded that the respondents' mathematics proficiency was average, with areas that required further improvement and familiarity with formula-based problems.

According to the study of Siegfried (2012), the participants that were deemed to have solid and productive dispositions, it exhibited characteristics while engaging in the math tasks like determination, unstoppable effort, multi-modal approach, honesty, passion about the excitement of mathematics, and the belief that anyone could achieve success. The study by Awofala (2017) showed that students' procedural fluency was higher than their conceptual understanding and word problems in real-world applications. Also, opportunities to develop conceptual understanding are present in about half the lessons but also could be of better quality. Those opportunities to develop mathematical proficiency are limited because learners are not engaging in adaptive reasoning.

Table 2. Level of the Teaching Capabilities of Pre-Service Teachers.

Teaching Capabilities	SD	Mean	Description
Lesson Planning	0.00	4.00	High
Lesson Delivery	0.08	4.07	High
Overall	0.04	4.04	High

Table 2 displays the level of the teaching capabilities of the respondents. Table 2 displays the level of the teaching capabilities of the respondents. The results indicate that the highest obtained mean score of 4.07 tells that Lesson Delivery implies that pre-service teachers are adept at delivering vivid descriptions that convey the lesson's premise. On the other hand, Lesson Planning showed a good performance with a mean of 4.00. The participants effectively conveyed the aims, and the learning assessment was visible in the course plan. On the other hand, these respondents also have to be introduced to a diverse selection of instructional methods to use a range of effective teaching in their classrooms. The overall mean level of the teaching capabilities of the respondents is 4.04. This shows that the pre-service math teachers did an excellent job of implementing various efficient instructional strategies that would suit the needs of the learners. Moreover, as evidenced by their lesson plans and methods for delivering the lessons, these respondents were highly clear about their instructional objectives for the session.

In support of the claim, Lee (2019) explained that ethical decision-making is vital to students' education and teaching quality for educators. Professionals with the good ethical background are guided by a list of moral guidelines that give them a strong sense of morality, compassion, and rationality. Ikeobi (2010 as cited in Abanikanda 2019) reiterated that they are more effective in enhancing conceptual understanding. It should be noted that instructional materials can be used to teach any lesson, regardless of how dry the subject matter may appear. According to Lomibao (2016), the efficiency and effectiveness of the learning experience are contingent on the quality of the teacher; therefore, enhancing teacher quality is essential for enhancing students' learning outcomes.

Table 3. Significance of the Relationship between Mathematics Proficiency and Teaching Capabilities of Pre-Service Teachers.

CORRELATIONS	r	p-value	Decision on Ho	Interpretation @ 0.05 level
Adaptive Reasoning & Lesson Planning	.000	1.000	Fail Reject	Not Significant
Strategic Competence & Lesson Planning	-.319	.267	Fail Reject	Not Significant
Conceptual Understanding & Lesson Planning	.000	1.000	Fail Reject	Not Significant
Productive Disposition & Lesson Planning	.000	1.000	Fail Reject	Not Significant
Procedural Fluency & Lesson Planning	-.402	.154	Fail Reject	Not Significant
Adaptive Reasoning & Lesson Delivery	.147	.616	Fail Reject	Not Significant
Strategic Competence & Lesson Delivery	.497	0.71	Fail Reject	Not Significant
Conceptual Understanding & Lesson Delivery	-.366	.198	Fail Reject	Not Significant
Productive Disposition & Lesson Delivery	.702	.005	Reject	Significant
Procedural Fluency & Lesson Delivery	.279	.334	Fail Reject	Not Significant
Attitude & Knowledge	-.211	.468	Fail Reject	Not Significant

There is no significant relationship between mathematics proficiency and the teaching capabilities of pre-service teachers. As presented in the table above, in the significance of the relationship of each variable, the Adaptive Reasoning and Lesson Planning with an $r=.000$ and p-value of Strategic Competence and Lesson Planning with $r=-.319$ and p-value of .267. Conceptual Understanding and Lesson Planning with $r=.000$ and p-value of 1.000. Productive Disposition and Lesson Planning with $r=.000$ and p-value of 1.000. Procedural Fluency and Lesson Planning with $r=-.402$ and p-value of .154. Adaptive Reasoning and Lesson Delivery with $r=.147$ and p-value of .616. Strategic Competence and Lesson Delivery with $r=.497$ and p-value of 0.71. Conceptual Understanding and Lesson Delivery with $r=-.366$ and p-value of .198. Productive Disposition and Lesson Delivery with $r=.702$ and p-value of .005. Procedural Fluency and Lesson Delivery with $r=.279$ and p-value of .334. The Attitude and Knowledge with $r=-.211$ and p-value of .468. These pairs of variables fail to reject the H_0 , meaning it is insignificant at the 0.05 level.

The data presented were obtained from the Pre-Service Teachers' Test Questionnaire result for Math Proficiency and the Teaching Demonstration result for Teaching Capabilities. It is shown that each correlation between Mathematics Proficiency and Teaching Capabilities failed to reject the H_0 , meaning they are insignificant. Thus, each pair of correlations does not affect the other in any way. The respondents may have low to average Mathematics Proficiency but have a remarkable ability in terms of their Teaching Capabilities. Though it was said on the result that the two variables were not significant, the researchers still think that Pre-Service teachers should improve each of their Mathematics Proficiency skills because improving them will also help improve their Teaching Capabilities and may be able to teach more efficiently and effectively.

A student's possession of math proficiency is indicative of long-range success. Five strands of mathematical proficiency must be considered (MacGregor, 2013). Mathematics teachers' teaching performance in light of the requirements for developing mathematical proficiency is moderate (Al-Qarni and Shalhoub, 2019). These standards, which describe the mathematical processes through which pre-K-12 students acquire and apply mathematical knowledge, should not be considered separate material or strands of the mathematics curriculum; instead, they are fundamental components of all mathematics learning and instruction (Irfan et al., 2020). Despite substantial differences in construct conceptualization, labeling, and operationalization, several empirical studies can be related to this approach of regarding teacher knowledge and skills as integrated facets of teacher competence underlying classroom performance in terms of instructional quality, which is hypothesized to affect student achievement, in particular the studies by Krauss et al. (2020).

Conclusion

The researchers found that the pre-service teachers have an average mathematics proficiency level, with productive disposition being the highest and conceptual understanding being the lowest. The study also showed that pre-service math teachers could effectively implement various teaching strategies to meet the needs of learners. However, the analysis revealed no significant relationship between mathematics proficiency and teaching capabilities among pre-service teachers. The correlations between the different strands of mathematical proficiency and teaching capabilities did not significantly impact each other.

Recommendations

The Commission on Higher Education should develop guidelines to improve mathematics proficiency and teaching capabilities for education students, especially in online learning. The School of Teachers Education needs to separate the development of mathematics proficiency and teaching capabilities, focusing on improving math majors' proficiency. Pre-service teachers, including math interns, should continue enhancing their mathematics proficiency for effective teaching. BSED Mathematics students are encouraged to improve their proficiency and teaching capabilities to excel in the online learning environment. Future researchers should use reliable research instruments, refer to this study, and expand their research to explore the significance of mathematics proficiency and teaching capabilities with additional variables.

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