Original Research Article

Investigating Professional Development and Teaching Efficacy among Graduates of the Master of Science in Teaching Mathematics Program

Reformulation suggested:

Investigating Professional Development and Teaching Efficacy among the Master of Science Graduates in Mathematics’ Curriculum

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ABSTRACT

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| This study explored the relationship between professional development (PD) and teaching efficacy (TE) among Master of Science in Teaching (MST), major in Mathematics graduates of Davao Oriental State University. Grounded in Social Cognitive Theory, the research examined how ongoing training and development activities influence teaching confidence and effectiveness in the classroom. Using a descriptive-correlational design, the study collected data through a survey questionnaire answered by 25 Master of Science Teaching Mathematics graduates. Results showed a generally high level of PD (,) and TE (,) among respondents. The findings also revealed a moderate positive correlation (, ) between PD and TE, suggesting that teachers who engage more in relevant training tend to feel more effective in their teaching roles. Further analysis showed no significant differences in PD and TE when respondents were grouped by age (,;,) and years of teaching experience (,; ,). However, there was a significant difference in PD when respondents are categorized based on gender (,) but not in TE (,). The study highlights the value of targeted and continuous professional development in boosting teacher performance and confidence, ultimately contributing to better educational outcomes. |

*Keywords: master of science teaching mathematics, professional development, teaching*

*efficacy*

1. INTRODUCTION

Mathematics education remains a global challenge, with international assessments like PISA and TIMSS revealing consistently low student proficiency in many countries (OECD, 2019). In the Philippines, the problem is more pronounced—Filipino students ranked among the lowest in mathematics literacy, pointing to systemic issues such as outdated teaching methods, inadequate teacher training, and limited access to resources (Acido & Caballes, 2024; Cabural, 2024; Trinidad, 2020).

Teachers are central to addressing these challenges. Their competencies, confidence, and instructional strategies directly impact student outcomes (López-Martín et al., 2023). Professional development plays a key role in equipping teachers with relevant skills, reflective practices, and collaborative opportunities that enhance their teaching (Ng et al., 2019; Babu & Venkatesan, 2023). At the same time, teaching efficacy—teachers’ belief in their ability to influence student learning—has been linked to better classroom management, student engagement, and instructional effectiveness (Na & Isa, 2024; Zeb et al., 2024).

While the link between professional development and teaching efficacy is well-documented (Liu & Liao, 2019), little is known about how this relationship plays out in local contexts like Davao Oriental State University (DOrSU). This lack of localized research limits the ability of local educators and policymakers to make evidence-based improvements to teacher preparation programs.

This study aims to evaluate the MST Mathematics program of DOrSU by examining the professional development experiences and teaching efficacy of its graduates. It explores how well the program prepares teachers for the realities of the classroom and whether it fosters the confidence and skills needed to address students’ learning needs.

By identifying strengths and gaps in the program, this research offers actionable recommendations to better align teacher training with classroom demands. Ultimately, the goal is to help improve mathematics education at its foundation—by preparing more effective, confident, and innovative teachers.

2. OBJECTIVES

This paper focused on investigating the contribution of the Master of Science Teaching (MST) major in Mathematics program of Davao Oriental State University (DOrSU) in the efforts of its graduates currently teaching Mathematics in high school. Such teachers' professional development, strategies of teaching, and efficacy in the teaching of mathematics high school level students are under scrutiny. In this regard, it sought to address the following objectives:

1. To determine the level of professional development and teaching efficacy among MSTM graduates;
2. To determine if there is significant relationship of professional development and teaching efficacy;
3. To determine if there is any significant difference of professional development when respondents are grouped according age, gender and teaching experience;
4. To determine if there is any significant difference of teaching efficacy when respondents are grouped according age, gender and teaching experience; and

3. Literature Review

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**4. MATERIALS AND METHODS**

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* 1. **Research Design**

This study used a descriptive-correlational design aimed at understanding the characteristics of variables and exploring the relationships between them (Panniamogan & Dioso, 2024). The primary focus was to determine the significant relationship between professional development and teaching efficacy of Master of Science Teaching Mathematics graduates of Davao Oriental State University. Data collection involved descriptive surveys, using questionnaires to assess graduates’ professional development and their teaching efficacy.

* 1. **Research Instrument**

Two sets of questionnaires were used in this study. The questionnaire for professional development was based on five indicators—relevance to teaching practice, improvement in teaching skills, reflection and growth, collaboration and peer learning, and support and implementation—and was adapted from Mallilin and Laurel (2022). The questionnaire for teaching efficacy was also anchored on five indicators—classroom management efficacy, instructional strategies efficacy, student engagement efficacy, efficacy in assessing student understanding, and efficacy in meeting diverse student needs—and was adapted from Mohammad et al. (2011). In both questionnaires, respondents were asked to place a check mark in the box corresponding to their degree of agreement, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

* 1. **Respondents of the Study**

There are 65 graduates of the Master of Science in Teaching Mathematics (MSTM) program at Davao Oriental State University (DOrSU) from 2003 to 2024. However, only 25 graduates were successfully reached and agreed to participate in the study. This deviation from the total population is acceptable in cases involving small population sizes (Saunders, Lewis, & Thornhill, 2019).

* 1. **Data Gathering**

This study employed a systematic procedure to ensure the accurate collection and analysis of data. The process began with securing clearance from the Research Ethics Board, which reviewed and validated the ethical considerations of the survey instrument. Following this, a formal letter of request was prepared and submitted to obtain permission to conduct the study. This letter, requiring an official signature, signified authorization to proceed and ensured that participants were adequately informed and protected throughout the research process.

Upon receiving approval, the survey questionnaires were distributed to identified graduates of the Master of Science in Teaching (MST) program majoring in Mathematics. The data collected from the completed questionnaires underwent thorough analysis, utilizing appropriate statistical and analytical methods. The researcher systematically described and summarized the data to ensure clarity, accuracy, and comprehensiveness.

Findings were presented objectively, without manipulation, and organized in a manner that promotes transparency and ease of interpretation. This rigorous and ethical approach to data collection and analysis reinforces the integrity of the research process and supports the reliability of its results.

5. results and discussion

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5.1. results

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**5.1.1. Level of Professional Development**

Table 1 presents the summary of the professional development. It has five indicators namely: relevance to teaching practice; improvement in teaching skills; reflection and growth; collaboration and peer learning; and support and implementation. The findings reveal that the overall level of professional development among MST Mathematics graduates is very high (,), indicating that the measures described in the items were manifested at all times. This result is consistent with Ho et al. (2023), who emphasized the importance of equipping teachers with up-to-date skills to meet evolving educational demands and improve student outcomes.

Results revealed that relevance to teaching practice (, ) and improvement in teaching skills (, ) were rated very high, indicating that the professional development (PD) activities were timely and aligned with instructional needs. This supports the findings of Juma (2024) and Mustafa & Paçariz (2021), who emphasized the importance of aligning PD with classroom realities, particularly in mathematics education, where innovative strategies like problem-based learning are essential (Gradini et al., 2024).

Reflection and growth received the highest rating (, ), highlighting the graduates’ strong commitment to continuous improvement. This is consistent with Alnijres (2024) and Zakaria (2020), who identified reflection as a key factor in teacher development, though challenges in institutional support persist (Machost & Stains, 2023).

Collaboration and peer learning also scored high (, ), affirming the value of professional dialogue in enhancing teaching practices (Wagner et al., 2019). However, institutional constraints like time and support can limit its effectiveness (Pannell et al., 2019).

Support and implementation received the lowest, though still high, rating (, ), indicating a gap in sustained follow-up. This aligns with Sandholtz et al. (2023), who stressed that without continuous support, the impact of PD often diminishes. Strengthening implementation structures remains essential (Lee et al., 2024; Qazi, 2017).

Table 1. Level of the Professional Development

|  |  |  |  |
| --- | --- | --- | --- |
| **Factors of Professional Development** | **Mean**  **()** | **Std. Deviation ()** | **Level of Manifestation** |
| A. Relevance to Teaching Practice | 4.41 | 0.50 | Very High |
| B. Improvement in Teaching Skills | 4.40 | 0.52 | Very High |
| C. Reflection and Growth | 4.44 | 0.43 | Very High |
| D. Collaboration and Peer Learning | 4.35 | 0.44 | Very High |
| E. Support and Implementation | 4.04 | 0.78 | High |
| **Overall Professional Development** | **4.33** | **0.41** | **Very High** |

**5.1.2. The Level of Teaching Efficacy**

Table 2 illustrates the summary of the teaching efficacy. It also has five indicators specifically classroom management, instructional strategies, student engagement, assessing student understanding and meeting diverse student needs. The results indicate that the overall teaching efficacy of MST Mathematics graduates is very high (, ), with all indicators scoring high to very high levels of manifestation. This suggests that the graduates possess strong self-beliefs in their ability to effectively teach and support student learning—an essential factor in academic achievement, especially in mathematics (Küçükalioğlu & Tuluk, 2021).

Classroom management was rated very high (), aligning with studies that link effective classroom control to improved student engagement and learning outcomes (Paulines & Tantiado, 2024; Varszegi, 2022). High classroom management skills also reflect stronger teacher efficacy, which helps minimize disruptions and maintain focus, especially in mathematics classes (Shah, 2023; Yadav, 2021).

Instructional strategies also received a very high rating (), supporting findings that confident teachers tend to use innovative methods such as inquiry-based and collaborative learning (Jagnandan et al., 2024; Lee & Paul, 2023). These strategies are particularly valuable in mathematics, where engaging tools and differentiation enhance understanding (Hettinger et al., 2022; Bachtiar, 2024).

Student engagement scored very high (), consistent with evidence that teacher self-efficacy drives student motivation and participation (Zimu, 2024). Highly efficacious teachers often adopt interactive, student-centered approaches that boost interest and retention in math (Hidayatullah et al., 2024).

Assessing student understanding was also rated very high (), reinforcing the importance of formative assessments and authentic evaluation practices (Tashiro et al., 2021; Lumpkin, 2022). When used effectively, these tools help teachers adjust instruction to meet learners’ needs (Oliveira & Henriques, 2021; Gallavan, 2020).

Efficacy in meeting diverse student needs scored very high (), indicating graduates’ confidence in handling varied learners. However, this area remains challenging due to resource constraints and the complexity of inclusive teaching (Ranbir & Education, 2024; Meng, 2024). Addressing diverse needs requires differentiated strategies and systemic support (Devi, 2023).

Table 2. Level of Teaching Efficacy

|  |  |  |  |
| --- | --- | --- | --- |
| **Indicator** | **Mean** | **Std. Deviation** | **Level of Manifestation** |
| A. Classroom Management | 4.49 | .52 | Very High |
| B. Instructional Strategies | 4.52 | .45 | Very High |
| C. Student Engagement | 4.45 | .54 | Very High |
| D. Assessing Student Understanding | 4.37 | .55 | Very High |
| E. Meeting Diverse Student Needs | 4.47 | .54 | Very High |
| **Overall Teaching Efficacy** | **4.46** | **.42** | **Very High** |

**5.1.3. The Relationship Between Professional Development and Teaching Efficacy**

Table 3 demonstrated the result of the relationship between professional development and teaching efficacy of the MST Mathematics graduates. The findings revealed that professional development (PD) has varying degrees of correlation with different dimensions of teaching efficacy. Notably, the highest correlation was observed between support and implementation and both student engagement () and teaching efficacy as a whole (), both of which were interpreted as moderate relationships. These findings support the assertion by Walters (2023) that effective PD must be practical and continuous, addressing the actual challenges teachers face. The result implies that when PD initiatives are well-supported and implemented, they significantly enhance teachers’ ability to engage students and apply teaching strategies more confidently and effectively.

Additionally, improvement in teaching skills showed moderate correlations with instructional strategies (), student engagement (), and teaching efficacy (), albeit not all were statistically significant. This aligns with Darling-Hammond et al. (2020) and Cevik et al. (2021), who argue that PD programs that improve instructional skills positively influence efficacy, particularly in complex content areas like mathematics. These skills appear to bolster confidence in applying instructional methods, a key tenet of Bandura's Social Cognitive Theory, as internal beliefs influence how new knowledge is integrated into practice.

The results also suggest that relevance to teaching practice was moderately correlated with efficacy in meeting diverse student needs (). This supports Copur-Gencturk (2019), who emphasized the value of aligning PD with actual classroom needs to boost efficacy. When PD content is clearly connected to teaching realities, teachers are more likely to apply it effectively, especially in differentiated instruction.

In contrast, the reflection and growth dimension of PD showed no correlation or weak correlation with all dimensions of teaching efficacy. This finding diverges from studies by Wang (2023), which found that reflective practices enhance efficacy. This may indicate that reflective components of PD in the local context may be underdeveloped or not meaningfully integrated into daily teaching, thus having minimal impact.

Furthermore, collaboration and peer learning were weakly correlated with all aspects of teaching efficacy (highest ). While collaboration is known to foster a supportive teaching community (Juma, 2024), the weak relationship here may reflect a lack of structured or impactful collaborative PD efforts at DOrSU. This emphasizes the need for more intentional peer mentoring or team-based learning in professional development models.

Overall, the results show a moderate positive correlation () between professional development and teaching efficacy, though not statistically significant (). This implies a tendency for greater professional development to be linked with higher teaching efficacy, though not conclusively in this sample. Still, the finding is consistent with research highlighting that reflective and collaborative PD can boost instructional skills and confidence (Darling-Hammond et al., 2020; Walters, 2023). Teachers with stronger self-efficacy are also more likely to apply new strategies effectively (Wang, 2023; Yang, 2019), suggesting that professional development remains a potentially valuable contributor to teaching efficacy.

Table 3. The Relationship Between Professional Development and Teaching Efficacy

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Variables** | | **Classroom Mgt.** | **Instruc’l Strategies** | **Student Engagement** | **Assessing Student Understanding** | **Meeting Diverse Student Needs** | **Teaching Efficacy** |
| **Relevance to Teaching Practice** | Pearson Correlation | 0.11 | 0.11 | 0.23 | 0.04 | 0.42 | 0.23 |
| Sig. (2-tailed) | 0.61 | 0.58 | 0.26 | 0.86 | 0.04 | 0.27 |
| Interpretation | Weak | Weak | Weak | Negligible | Moderate | Weak |
| **Improvement in Teaching Skills** | Pearson Correlation | 0.20 | 0.36 | 0.33 | 0.30 | 0.33 | 0.37 |
| Sig. (2-tailed) | 0.34 | 0.08 | 0.10 | 0.14 | 0.10 | 0.07 |
| Interpretation | Weak | Moderate | Moderate | Moderate | Moderate | Moderate |
| **Reflection and Growth** | Pearson Correlation | 0 | 0.16 | 0.80 | 0.12 | 0.10 | 0.11 |
| Sig. (2-tailed) | 0.99 | 0.46 | 0.70 | 0.57 | 0.64 | 0.60 |
| Interpretation | No Correlation | Weak | Negligible | Weak | Weak | Weak |
| **Collaboration and Peer Learning** | Pearson Correlation | 0.15 | 0.10 | 0.07 | -0.04 | 0.25 | 0.13 |
| Sig. (2-tailed) | 0.46 | 0.62 | 0.74 | 0.84 | 0.23 | 0.53 |
| Interpretation | Weak | Weak | Negligible | Negligible | Weak | Weak |
| **Support and Implementation** | Pearson Correlation | .05 | .27 | .47 | .22 | .48 | .37 |
| Sig. (2-tailed) | .80 | .20 | .02 | .28 | .02 | .07 |
| Interpretation | Negligible | Weak | Moderate | Weak | Moderate | Moderate |
| **Professional Development** | Pearson Correlation | .13 | .28 | .36 | .19 | .45 | .35 |
| Sig. (2-tailed) | .53 | .18 | .08 | .37 | .03 | .09 |
| Interpretation | Weak | Weak | Moderate | Weak | Moderate | Moderate |

**5.1.4. Differences on Professional Development**

Table 4 shows the result of a professional development when grouped according to age and years of teaching experience. he results presented in Table 1 indicate that there are no significant differences in professional development scores when grouped by age () or years of teaching experience (). This suggests that professional development perceptions or engagement levels among MST Mathematics graduates are consistent regardless of their age or the length of their teaching careers Chit & Ye (2017). Such findings support the argument that professional development needs tend to be broadly similar across different career stages and age groups. This aligns with Kim et al. (2023), who noted that effective professional development should be inclusive and address universal instructional challenges rather than be limited by demographic factors such as age or experience.

Table 4. Professional Development Scores According to Age and Years of Teaching Experience

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Profile Variable** | **Test** | **df (Between, Within Groups)** | ***F*-value** | ***P*-value** |
| Age | ANOVA | (2, 22) | .148 | .863 |
| Years of Teaching Experience | ANOVA | (3, 21) | .131 | .941 |

Table 5 shows a statistically significant difference in professional development scores based on gender (). This indicates that male and female teachers perceive or engage with professional development differently, with the mean difference suggesting that male scores lower on professional development measures than female. This finding is consistent with research by Mitton-Kukner (2020), who emphasized that gender roles and societal expectations can influence participation in professional learning activities. It suggests that professional development programs may need to consider gender-specific factors to ensure equitable access and engagement.

*Table 5. Professional development Scores According to Gender*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Profile Variable** | **Test** | **df** | ***t*-value** | ***P*-value** | **Mean Difference** | **Std. Error** | **95% Confidence Interval** |
| Gender | *t*-test | 23 | -2.848 | .009 | -.406 | -.14 | [-.70, -.11] |

**5.1.5. Differences on Teaching Efficacy**

Table 6 indicates the results of teaching efficacy based on age and years of teaching experience. The results show that there are no statistically significant differences in teaching efficacy when grouped by either age () or years of teaching experience (). This means that, on average, teachers across different age groups and experience levels feel similarly confident in their teaching abilities, classroom strategies, and ability to engage students.

These findings support the idea that teaching efficacy may be shaped more by ongoing professional development and support systems rather than just age or experience (Yoo, 2016). According to Clark and Newberry (2018), teaching efficacy is strongly influenced by mastery experiences, feedback, and contextual support — which are not always tied to how long someone has been teaching.

Table 6. Teaching Efficacy Scores According to Age and Years of Teaching Experience

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Profile Variable** | **Test** | **Df (Between, Withing Groups)** | ***F*-value** | ***P*-value** |
| Age | ANOVA | (2, 22) | 1.55 | .236 |
| Years of Teaching Experience | ANOVA | (3, 21) | .83 | .49 |

Table 7 illustrates the findings of teaching efficacy according to gender. The t-test result for teaching efficacy based on gender shows no significant difference between male and female teachers (). This means that, on average, both genders report similar levels of confidence in their teaching strategies, classroom management, and student engagement.

Multiple studies found no significant differences between male and female teachers' efficacy scores (Lysinge, 2019). As Haverback (2022) emphasized through the lens of Social Cognitive Theory, self-efficacy develops from mastery experiences, vicarious learning, and feedback, which are accessible to teachers regardless of gender.

Table 7. Teaching Efficacy Scores According to Gender

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Profile Variable** |  | **Test** | **df** | ***t*-value** | ***P*-value** | **Mean Difference** | **Std. Error** | **95% Confidence Interval** |
| Gender |  | *t*-test | 23 | -.81 | .425 | -.138 | .17 | [-.11, .21] |

4. Conclusion

Based on the foregoing findings, the following conclusions are put forward.

1. The high level of professional development reported by MST Mathematics graduates implies that the program provides relevant, skill-enhancing, and collaborative learning experiences that support continuous teacher growth. However, the slightly lower rating in support and implementation suggests a need for schools and institutions to strengthen resource provision and follow-through to maximize the impact of professional development efforts. On the other hand, the consistently high level of teaching efficacy among MST Mathematics graduates implies that the program effectively equips its alumni with the skills and confidence needed for effective classroom instruction and student engagement. This suggests that maintaining and further enhancing the program’s focus on practical teaching strategies and learner-centered approaches can continue to strengthen teaching outcomes.
2. The results conclude that professional development has a moderately positive relationship with teaching efficacy, particularly when it is well-supported, aligned with actual teaching practice, and focused on improving instructional skills. However, the varying strengths of correlation across dimensions suggest that not all aspects of professional development equally influence teaching efficacy, highlighting the complex and multifaceted nature of how teachers internalize and apply professional learning in practice.
3. There is no significant difference in the level of professional development among MST Mathematics graduates when grouped according to age and years of teaching experience, indicating a consistent engagement with professional development across career stages. However, a significant difference was found based on gender, suggesting that male and female teachers perceive or engage with professional development differently, which may be influenced by gender-related roles or expectations.
4. There are no significant differences in the level of teaching efficacy among MST Mathematics graduates when grouped by age, years of teaching experience, or gender. This suggests that teachers’ confidence in their instructional abilities and classroom management is consistent across demographic profiles, supporting the notion that teaching efficacy is more strongly influenced by factors such as professional development and contextual support rather than demographic characteristics.

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