CHAPTER TWO

Pre-Service Teachers' Self-Efficacy in Teaching Mathematics at Senior Primary Phase

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Abstract: This chapter investigates the self-efficacy levels of pre-service mathematics teachers at the senior primary phase within a Namibian teacher education context. Employing a quantitative research approach with a descriptive design, the study examined the confidence levels of 27 randomly selected third- and fourth-year pre-service teachers from one campus of the University of Namibia. Data were collected using a closed-ended questionnaire with Likert scale items adapted from the Fennema-Sherman scales, focusing on self-efficacy attributes. The findings revealed that while most pre-service teachers expressed confidence in designing effective lesson plans, using technology, and managing classrooms, notable challenges persisted. These included limited access to teaching aids, learner misconceptions, and difficulties in time management. Self-efficacy was found to be significantly influenced by content knowledge, pedagogical strategies, classroom management skills, mentorship, and observational learning. The study highlights the importance of robust teacher training programmes that integrate technology, mentorship, and practical teaching experiences. Recommendations include expanding micro-teaching opportunities, providing access to teaching resources, and exploring the role of demographic factors in shaping teacher self-efficacy. The findings aim to inform teacher education programmes and contribute to the preparation of confident and competent mathematics educators.

Keywords: Self-efficacy, pre-service teachers, mathematics education, teacher training, teaching strategies.

1. Introduction

Teacher self-efficacy is a critical factor influencing educational outcomes, defined as teachers' beliefs in their ability to affect learner engagement and achievement (Lazarides et al., 2018). Mok and Moore (2019) highlight a positive association between teacher self-efficacy and teaching effectiveness, emphasising that teachers with higher self-efficacy are more effective educators. Rooted in Bandura's social cognitive theory, self-efficacy is shaped by how individuals think, feel, and behave, as well as by the support they receive (Bandura, 2019; Verma, 2022). Teachers with strong self-efficacy exhibit greater openness to innovative methods, better planning, and adaptability when facing challenges, resulting in improved teaching quality and learner outcomes (Li, 2023; Holzberger & Prestele, 2021).

Research underscores the multifaceted nature of self-efficacy. While high self-efficacy positively correlates with classroom management, learner motivation, and academic achievement, it can also mitigate teacher burnout and attrition (Bal-Taştan et al., 2018; Lazarides et al., 2020).

Teachers with high self-efficacy are more likely to adopt learner-centred approaches, use collaborative strategies, and integrate technology effectively (Mitchell, 2021). Conversely, low self-efficacy may hinder performance, particularly when external rewards are minimal (Tzur et al., 2016). Olawale and Hendricks (2024) explored mathematics teachers' perceptions of their teaching practice and self-efficacy, considering factors such as educational background, teaching phases, school type, and gender. The findings highlight that school type and educational background significantly influence teachers' performance and accomplishments. Despite strong subject matter knowledge, low self-efficacy in teaching practices can hinder teachers from achieving expected success and performance levels (Olawale & Hendricks, 2024).

Pre-service teachers, in particular, often experience fluctuating levels of self-efficacy influenced by prior teaching experience, mentorship, and contextual factors (Liu et al., 2021; Zhang et al., 2021). Effective teacher education programmes can bolster pre-service teachers' self-efficacy by fostering their confidence, knowledge, and instructional skills (Hendricks et al., 2024; Ruiz, 2024). Innovative teaching practices, such as the flipped classroom model, have been shown to strengthen self-efficacy among pre-service teachers (Ding et al., 2023). Furthermore, mentorship and positive field experiences play a crucial role in preparing pre-service teachers for the complexities of the teaching profession (Terfa et al., 2022).

The importance of teacher self-efficacy extends beyond individual educators. Collective teacher efficacy, defined as the shared belief of a group of teachers in their ability to influence learner outcomes, highlights the broader impact of teacher collaboration and school-wide practices on student achievement (Lazarides et al., 2020). A teacher's attitude toward their profession, coupled with their sense of self-efficacy, significantly affects their job satisfaction and professional growth, ultimately contributing to improved educational outcomes for learners (Kiralp & Bolkan, 2016; Segarra & Julià, 2022).

Given the pivotal role of teacher self-efficacy in shaping educational practices and outcomes, this study aims to explore the self-efficacy levels of mathematics pre-service teachers in Namibian primary schools. By examining the factors influencing their self-efficacy, the study seeks to inform teacher education programmes and contribute to the preparation of effective, confident educators capable of fostering meaningful learner engagement and achievement.

1.1 Problem statement

Pre-service teachers face significant challenges in adjusting to new school environments and applying their subject knowledge to effective pedagogical practices. These difficulties are further compounded by increasing student populations and chaotic school systems (McLennan et al., 2021). Low self-efficacy among pre-service teachers is often exacerbated by inadequate preparation, limited teaching experience, and negative feedback from peers or superiors (Mozahem et al., 2021). Additionally, individual attitudes and beliefs about education and learning play a crucial role in shaping self-efficacy (Hendricks et al., 2024). Self-efficacy directly

impacts the effort, perseverance, and resilience of aspiring teachers, particularly when faced with challenging tasks such as solving complex mathematics problems. It is a critical component of the learning process, influencing the ability to overcome obstacles and achieve success. Although self-efficacy has been a subject of study for decades, there is a noticeable gap in research that determines the level of self-efficacy among pre-service teachers specifically within a Namibian context. This study aims to fill that gap by measuring the self-efficacy levels of mathematics pre-service teachers. Unveiling the self-efficacy levels of pre-service teachers could aid in developing the motivation, persistence, and skills needed to influence student learning outcomes and foster academic success positively.

1.2 Research questions

The following research question guided the study: What is the Self-Efficacy level of pre-service teachers in teaching mathematics at the Senior Primary school phase?

2. Methodology

This study employed a quantitative research approach with a descriptive design to measure the self-efficacy levels of pre-service mathematics teachers at the senior primary school phase. The focus was on determining the confidence levels of pre-service teachers in their ability to teach mathematics effectively. The target population comprised 97 third- and fourth-year students from one campus of the University of Namibia. This group was selected because they were in the final stages of their teacher education programme and had practical experience teaching mathematics in schools during their teaching practice. A random sampling method was used to select a sample of 27 mathematics pre-service teachers for the study. Data were collected using a closed-ended questionnaire containing Likert-scale items. The questionnaire items were adapted from the Fennema-Sherman Scales, specifically focusing on the self-efficacy attribute. It was administered online via Google Forms, allowing participants to complete and submit their responses electronically. Descriptive statistics were utilised to analyse the data and determine the self-efficacy confidence levels of the pre-service teachers in teaching mathematics.

3. Presentation of Results

This section presents the results of pre-service teachers' self-efficacy. Table 1 presents the demographics of the participants.

Table 1: Distribution of participants in accordance with their biographical variable

Gender		Academic year	
Male	Female	3rd	4th
13	14	4	23

According to Table 1, 13 (48.1%) of the participants were male and 14 (51.9%) were female. Four (14.8%) of the respondents were third-year students, while 23 (85.2%) were fourth-year students. This distribution indicates that most participants were nearing the end of their teacher

preparation programmes and in their final year of study. Due to the more thorough education and hands-on experience they acquire in the later phases of their academic careers, fourth-year students are more likely to have greater classroom experience than third-year students, as indicated by their higher representation.

Table 2: Pre-service teachers' self-efficacy levels

Abilities	**Strong disagree**		**Disagree**		**Neutral**		**Agree**		**Strong agree**	
	N	%	N	%	N	%	N	%	N	%
I am confident in instructing learners and providing an alternate explanation when students are confused about mathematical topics.	3	11	-	-	6	22	11	41	7	26
I can design good lesson plans for teaching mathematics that are interesting and effective.	2	7	1	4	6	22	5	19	13	48
I am confident in my ability to respond to learners' inquiries on mathematical subjects.	3	11	-	-	5	19	6	22	16	59
I am confident in my ability to properly run a mathematics lesson.	2	7	1	4	7	26	7	26	10	37
I am skilled at teaching mathematics using technology.	-	-	-	-	8	30	10	37	9	33
I am confident in my ability to prevent disruptive behaviour in the classroom.	2	7	2	7	2	7	7	26	14	52

The findings from Table 2 indicate that 11% of the pre-service mathematics teachers lack confidence in their competence to instruct students and give them alternative explanations in mathematics topics when they find themselves confused, as evidenced by the small number of respondents who chose "strongly disagree." More respondents (22%) chose "neutral," indicating a reasonable level of confidence among some participants. However, the majority of about 41% chose "agree," indicating high trust in their communication and educational abilities. Of the participants, 26% chose "strongly agree," indicating that a sizable proportion of respondents felt very confident in teaching mathematical concepts. Overall, the statistics show that most pre-service teachers are confident in their competence to instruct and respond to the questions of senior primary students in mathematics.

Table 2 shows trends in the responses of pre-service teachers' capacity to create interesting and successful lesson plans for teaching mathematics. According to the results, the category "strongly disagree" garnered only 7% of the participants, indicating that only a small percentage of respondents strongly disagree with the statement. Out of all the categories, the response

option "disagree" had the lowest frequency of 4%, suggesting that it was the least popular choice for this degree of disagreement. An average number of respondents (22%) chose the "neutral" option, suggesting that many pre-service teachers are undecided about the statement. This trend implies that a sizable portion of respondents might have ambivalent or neutral opinions about their own ability to create engaging and successful mathematics lesson plans. The "agree" category was chosen by 19%, suggesting that more respondents agreed with the statement. Finally, the "strongly agree" option had the most votes, about 48%, indicating that those who were extremely confident in their capacity to create such lesson plans agreed the most. With "strongly agree" being the most common response, these findings highlight a clear trend toward greater levels of agreement among respondents.

Pre-service teachers' confidence levels are often high when it comes to answering students' questions about mathematical topics. According to the results in Table 2, "Strongly disagree" was the least popular response, at 11%, suggesting that few pre-service teachers who participated are unconfident in this area. Interestingly, there were no recorded answers for "disagree," indicating that no participant expressed a lack of confidence. An average of 19% and 22% of the participants chose "neutral" and "agree," respectively. This indicates that some pre-service teachers have mixed feelings about their confidence. Since "strongly agree" received the most responses, from 59% of the participants, it is clear that the majority of pre-service teachers strongly believe they are capable of handling senior primary-level arithmetic problems.

The results in Table 2 show that, among those who are confident in their ability to conduct a mathematics lesson, 7% of the participants chose "strongly disagree," while 4% indicated the "disagree" category. Both "neutral" and "agree" received 26% of the responses, while "strongly agree" had the highest percentage, at 37%. This trend suggests that having a strong belief in one's ability to teach mathematics can boost confidence in delivering successful lessons. However, subject knowledge and prior teaching experience are likely additional factors that influence confidence in teaching mathematics at the senior elementary level. Therefore, a thorough evaluation should consider these influencing factors, even if self-belief plays a major role in teaching confidence.

The results from Table 2 show how pre-service teachers' self-assessed proficiency in using technology to teach mathematics was distributed among five degrees of agreement. "Strongly disagree" and "disagree" were not chosen at all, indicating that none of the respondents were unconfident in their ability to use technology to teach mathematics. About 30% of the participants chose "neutral," suggesting that a sizable percentage of respondents remain unsure or unconvinced of their competence in this area. Interestingly, 37% and 33% chose "agree" and "strongly agree," respectively, indicating that many pre-service teachers have a favourable opinion of their use of technology in mathematics classes. Overall, these results point to a range of viewpoints, with many respondents indicating varying or neutral degrees of confidence in their abilities.

Based on the statement regarding confidence in preventing disruptive behaviours in the classroom, 7% of participants chose "strongly disagree," "disagree," and "neutral," respectively. A larger proportion, 26%, chose "agree," while 52% chose "strongly agree," indicating that most pre-service teachers have confidence in preventing disruptive behaviour in the classroom.

3.1 Discussion of findings

The findings of this study provide valuable insights into the self-efficacy levels of pre-service mathematics teachers at the University of Namibia, particularly regarding their confidence to instruct students, develop lesson plans, manage classroom behaviour, and use technology in teaching mathematics. These results align with existing literature, emphasising the critical role of teacher self-efficacy in shaping educational outcomes (Lazarides et al., 2018).

The results revealed that most participants exhibited high levels of confidence in their ability to instruct students and provide alternative explanations when learners encountered confusion. A combined 67% of respondents (41% "agree" and 26% "strongly agree") indicated confidence in their instructional capabilities. These findings align with Mok and Moore (2019), who highlight the positive correlation between teacher self-efficacy and teaching effectiveness. High self-efficacy levels equip teachers to engage learners effectively and adapt their teaching strategies to diverse learning needs (Li, 2023).

The participants displayed a strong belief in their capacity to create engaging and successful lesson plans for teaching mathematics, with 48% selecting "strongly agree." However, the neutral response rate of 22% suggests that a portion of respondents were uncertain about their skills in this area. This ambivalence might reflect a need for enhanced training in lesson planning during teacher education programmes (Ruiz, 2024). The strong confidence expressed by the majority supports the findings of Holzberger and Prestele (2021), who assert that teachers with high self-efficacy are better planners and more adaptable in their teaching approaches.

A notable 59% of participants expressed strong confidence ("strongly agree") in their ability to address learners' mathematical queries, while no participants selected "disagree." This result reflects the participants' preparedness to tackle classroom challenges, corroborating findings by Bal-Taştan et al. (2018) and Lazarides et al. (2020), which emphasise that high self-efficacy enhances classroom management and academic achievement.

The majority of participants demonstrated confidence in leading mathematics lessons, with 37% choosing "strongly agree" and an additional 26% selecting "agree." However, a significant proportion (30%) reported neutral or lower confidence levels. These findings suggest that while self-belief is crucial, other factors, such as subject knowledge and teaching experience, may also influence confidence levels, as noted by Zhang et al. (2021). Effective mentorship and hands-on teaching opportunities during teacher training can address this variability (Terfa et al., 2022).

The findings indicated a favourable view of technology integration in mathematics instruction, with 33% "strongly agreeing" and 37% "agreeing." However, the 30% neutral response rate suggests that some pre-service teachers remain uncertain about their proficiency in this area. As Mitchell (2021) and Ding et al. (2023) highlight, incorporating innovative practices such as technology use in teacher education programmes can enhance confidence and instructional quality.

The study found that most participants (78%, combining "agree" and "strongly agree") were confident in their ability to prevent disruptive behaviour in the classroom. This result aligns with Lazarides et al. (2020), who underscore the role of teacher self-efficacy in fostering effective classroom management. The findings also emphasise the importance of equipping pre-service teachers with strategies to maintain a positive learning environment, as noted by Kiralp and Bolkan (2016).

These findings highlight the generally high levels of self-efficacy among pre-service mathematics teachers at the University of Namibia, particularly in instructional competence, lesson planning, and classroom management. However, areas such as technology integration and lesson planning still show variability, suggesting a need for targeted interventions in teacher education programmes. Aligning with Bandura's (2019) social cognitive theory, these results affirm that fostering self-efficacy through mentorship, field experiences, and innovative teaching practices is essential to preparing effective, confident educators who can positively influence learner outcomes.

4. Conclusions and Recommendations

This study investigated the self-efficacy levels of pre-service mathematics teachers at the senior primary phase in Namibia, revealing both challenges and strengths in their preparation for teaching mathematics. The findings indicate that while pre-service teachers expressed confidence in key areas such as lesson planning, conducting mathematics lessons, and integrating technology into instruction, they also faced notable challenges. These included the limited availability of teaching resources, learner misconceptions, and time management difficulties.

The study underscores the multifaceted nature of self-efficacy, shaped by factors such as content knowledge, pedagogical strategies, classroom management skills, personal teaching experiences, and mentorship. These findings align with Bandura's social cognitive theory and existing research that highlights the importance of teacher self-efficacy in fostering educational outcomes (Lazarides et al., 2018; Mok & Moore, 2019). Despite these challenges, the participants' confidence in their teaching abilities suggests that targeted interventions can significantly enhance their self-efficacy and teaching effectiveness.

To enhance pre-service teachers' self-efficacy in teaching mathematics, teacher education programmes should provide comprehensive training in the use of teaching aids and technology

through workshops, seminars, and hands-on practice. Structured mentorship programmes should be established, enabling experienced educators to guide pre-service teachers in lesson planning, classroom management, and addressing learner misconceptions. Opportunities for micro-teaching and reflective practice should be expanded, allowing pre-service teachers to build confidence and refine their instructional skills through practical experience. Access to adequate teaching resources, including study guides and digital tools, must be ensured to support effective teaching. Additionally, future research should explore how factors such as gender and academic background influence pre-service teachers' self-efficacy and examine the long-term impact of teacher education programmes on their professional development and teaching performance. These measures collectively aim to prepare confident, competent educators capable of fostering meaningful learner engagement and achievement in mathematics.

5. Declarations

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Conflicts of Interest: The authors declare no conflict of interest.

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accessible and engaging ways. Moreover, these findings are consistent with research by Bakar et al. (2020), which found that using digital tools like GeoGebra enhanced pre-service teachers' ability to connect mathematical concepts with real-life applications. This capability to connect theory with practice is vital for effective teaching, as it encourages students to see the relevance of mathematics in their daily lives.

4.2.2 Pedagogical Knowledge (PK)

PK delineates the distinctive "general purpose" knowledge pertinent to pedagogy. It comprises a set of competencies that teachers must cultivate to effectively manage and organise instructional activities to achieve specified learning goals (Koehler et al., 2013). Analysis of PK abilities among the PSTs in visualising and teaching mathematical concepts using both digital and non-digital tools prior to the interventions revealed an average score of 28, placing them in the low category. Table 5 indicates that PSTB, with a score of 20, falls into the very low category. PSTD (score: 32), PSTE (score: 28), PSTI (score: 30), PSTK (score: 32), and PSTO (score: 26) are categorised as low. The results suggest that PSTs possess limited pedagogical knowledge necessary for effective student instruction (Table 5). In addition, Table 6 presents a clear overview of the scores for each component in the PK subsection across all PSTs. The data indicates that the performance of each component is classified as low, with an average score of 2.14 within this category (Table 6).

As indicated by the results, the low scores across all components of PK suggest that PSTs are inadequately prepared to deliver subject content effectively to their students. This was also evident during the interviews. Some PSTs indicated that they relied solely on traditional methods, such as freehand drawings, and expressed lower confidence in their ability to explain complex mathematical ideas effectively. They identified the absence of appropriate visualisation tools as a significant barrier. One PST lamented during the interview:

> *I was not that confident; I could not visually explain complex concepts. My confidence was a bit low because I lacked visualisation tools. I think this lack of tools might have impacted the overall effectiveness of my lesson* (PSTD).

The analysis of PK abilities among the PSTs post-intervention yielded an average score of 75, categorising it as good. Table 6 indicates that PSTB (score of 68), PSTO (score of 70), PSTD (score of 80), PSTE (score of 78), PSTI (score of 76), and PSTK (score of 75) are also categorised as good. The results demonstrate that the PSTs effectively mastered teaching following the intervention (see Table 5). Additionally, Table 6 presents a clear overview of the scores for each component of the PK aspect following the intervention for all PSTs. The data indicate that each component's ability is classified as efficient, with an average score of 3.44 falling within the very good category (see Table 6).