Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 6, 1228-1239
2024
Publisher: Learning Gate
DOI: 10.55214/25768484.v9i1.2203

Utilizing pre-service mathematics teachers to implement effective teaching and learning practices during their field experience

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Abstract: This study aimed at analyzing the best practices for teaching and learning mathematics among pre-service mathematics teachers during their field training. The purpose is to assess how these practices align with contemporary learning standards. The sample consisted of 170 pre-service teachers from public universities in northern Jordan, selected through simple random sampling to ensure diverse representation. A structured observation checklist, comprising 37 items across four areas—constructivist-based learning, mathematical communication and representation, problem-solving and thinking development, and challenges faced by pupils. The methodology focused on observing and assessing teaching practices during field training. The findings showed that the teaching practices of pre-service mathematics teachers were generally ineffective, with most practices falling under "moderate" or "low" categories based on learning standards. Specifically, there was a lack of focus on raising active involvement in constructing mathematical concepts, which contradicts modern trends in education that promote active learning. In conclusion, the study highlights the need for enhancements in the training of pre-service teachers, recommending more intensive programs that develop innovative teaching strategies. These strategies are essential for enhancing the overall quality of mathematics education. The practical implications suggest that teacher training programs must be restructured to emphasize active learning and more effective engagement with children during mathematics instruction.
Keywords: *Field experience, Learning Practices, Pre-service mathematics teachers, Primary mathematics.*

1. Introduction

The advancement of societies in science and technology is closely associated to progress in mathematics. Societies with high development levels must demonstrate a solid foundation in mathematical knowledge, as mathematics is essential in various scientific fields. Consequently, fostering mathematical competence from an early age is essential for preparing learners for future scientific and technological advancements. This underlines the importance of mathematics education in primary and basic curricula, particularly in early grades, where building mathematical skills is vital [1, 2, 3].

Global reform movements in mathematics education have established standards aimed at improving teaching practices. These standards address the nature of student tasks, the roles of teachers and pupils, the learning environment, and the analysis of teaching and learning [30, 31, 32]. Effective mathematics instruction should promote both conceptual and procedural understanding, enabling pupils to apply mathematics in real-world situations. Furthermore, the standards highlight essential mathematical processes such as problem-solving, communication, representation, modeling, reasoning, and connections both within and outside mathematics.

The shift from traditional rote learning to a constructivist, inquiry-based approach rests on several assumptions: mathematics is viewed as a human science shaped through social interaction; knowledge is

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constructed through investigation; learning is a constructive process requiring both social and individual engagement; and education supports student discoveries in an active environment conducive to problem-solving [11]. Jordan's educational reform movement emphasizes the mathematics curriculum's role in foundational education, aiming to develop pupils' conceptual and procedural knowledge and foster positive attitudes toward mathematics [33, 34]. Effective teaching should promote independent thinking rather than focusing solely on calculations [7, 8]. Teachers advocate for practices that prioritize planning, student engagement, motivation, and real-world connections." [3, 4, 5, 6]

Learning environments practices significantly influence pupils' learning progress and academic achievement, with research consistently linking teachers' practices to improvements in pupils' mathematical performance. Teachers must create environments that raise a deep understanding of mathematical concepts, enabling pupils to apply their knowledge to real-world problems. This requires a learner-centered approach, incorporating constructivist methods, communication of mathematical ideas, and problem-solving [41, 42]. Additionally, addressing learning difficulties and understanding pupils' errors is crucial [26, 37].

Constructivist learning emphasizes pupils' active roles in connecting new ideas to previous knowledge [9, 10], as mastery of previous knowledge is vital for understanding new content [22, 24, 25]. This approach encourages a collaborative classroom environment that promotes dialogue and idea exchange, fostering deeper engagement with mathematical problems [35, 37, 38].

In constructivist learning, teachers play key roles in selecting and designing meaningful mathematical activities, which significantly impact effective learning [42, 43]. They must facilitate both individual and cooperative learning tasks, linking mathematics to pupils' life experiences and local environments. Connecting mathematics with real-life contexts enhances student performance and motivation [21, 22, 23, 38, 39]. Arthur et al. [10] note that failing to make these connections negatively affects pupils' mathematical performance.

Constructivist practices support the development of critical thinking and problem-solving skills, aligning with the core goals of mathematics education [2]. Problem-solving skills are essential competencies that mathematics teachers must cultivate, and their success depends on the teacher's knowledge of problem-solving strategies, the use of diverse algorithms, and the creation of classroom scenarios that encourage observation and inductive thinking. Razak et al. [26] emphasize that effective practices include asking probing questions and guiding pupils to recall concepts to solve challenges. Teachers should encourage pupils to explore multiple strategies, helping to avoid reliance on keywords, which can lead to errors [31].

The development of problem-solving skills is closely linked to pupils' growth in mathematical communication. The effectiveness of a teacher's practices in this area depends on providing pupils with varied opportunities to use the language of mathematics, including written and spoken symbols, and to represent ideas through tangible objects, images, diagrams, and real-life scenarios [40]. The interactions between external representations (mathematical terms and tangible objects) and internal representations (the cognitive structures formed by pupils) are crucial for effective learning [23].

Moreover, developing language skills is vital in mathematics education, as difficulties in understanding the language of mathematical problems can hinder performance. The linguistic structure of verbal problems affects pupils' ability to solve them [31]. According to Piaget, pupils in early primary grades operate in the "concrete operational stage," where their thinking is grounded in tangible interactions [40, 41]. Therefore, the use of learning tools should focus on helping pupils transition from abstract to concrete understanding [33, 38].

However, many teachers face challenges in diagnosing pupils' mathematical errors, often attributing them to a lack of knowledge without considering the pupils' cognitive readiness. Thus, there is a serious need to provide opportunities for pupils to reflect on and correct their mistakes, necessitating ongoing monitoring and understanding of their mathematical development. Research shows that ineffective teaching practices can hinder pupils’ progress in mathematics [39, 40].

Educational literature consistently highlights the necessity of effective teacher preparation before entering the profession. The development of teaching skills is directly linked to the quality of field training, which is a cornerstone in preparing student-teachers for the classroom [43, 44].

Despite existing studies addressing the quality of mathematics education, there is a clear research gap regarding the influence of effective field training on mathematics teaching practices, especially in learning contexts that reflect the needs of schools and local communities. Therefore, this study aims to assess the level of mathematics teaching practices performed by pre-service mathematics teachers for first to third-grade pupils.

2. Statement of the Study

Recognizing the critical significance of field training, Jordanian universities have increasingly prioritized improving the quality of teacher preparation before service. This ensures that future teachers acquire essential teaching skills necessary for effective instruction. Effective teacher preparation is crucial for equipping teachers to plan, implement, and evaluate learning situations. This study aims to assess the performance level of pre-service mathematics teachers in mathematics teaching practices. The study specifically seeks to address the following two questions:

1. What is the performance level of pre-service mathematics teachers in implementing effective teaching and learning practices during their field experience?
2. Does the performance level of pre-service mathematics teachers in implementing effective teaching and learning practices vary based on different areas of practice, which include constructivist-based learning, mathematical communication, representation of mathematical ideas, problem-solving and fostering thinking, as well as the difficulties faced by pupils and their proposed solutions?

3. Significance of the Study

This study is significant due to its focus on the critical phase of field training for pre-service mathematics teachers, which allows them to apply the knowledge, skills, values, and attitudes acquired during their theoretical preparation. To the researchers' knowledge, no evaluation studies have been conducted on teacher preparation programs at Jordanian Universities in Jordan. The findings of this study may provide valuable insights into the future performance of pre-service mathematics teachers in teaching mathematics and offer feedback to those responsible for the classroom teacher preparation programs at Jordanian Universities, particularly regarding the achievement of program objectives related to mathematics education.

Additionally, the study offers practical education supervisors a specific observation checklist to monitor mathematics teaching practices, addressing a gap in existing tools that focus on general teaching skills. The findings may also guide decision-makers at the Ministry of Education in assessing the practical performance of pre-service mathematics teachers and highlight the need for training courses upon their employment. Furthermore, this study aims to contribute to future educational research on pre-service teacher preparation.

4. Methodology

4.1. Participants

The study focused on classroom teacher students enrolled in field training programs at public universities in northern Jordan. A simple random sample of 170 pre-service mathematics teachers was selected through random drawing from the lists of registered students. The distribution of the sample according to their academic standing was as follows: 40 students (23.5%) with an excellent record, 70 students (41.2%) with a very good record, and 60 students (35.3%) with a good record. This balanced representation across different performance levels ensures the adequacy of the sample size for the study's objectives.

DOI: 10.55214/25768484.v9i1.2203

4.2. Instrument of the Study

To achieve the purposes of this study, the researchers employed classroom observation checklist as the primary data collection method. An observation checklist was developed following a thorough review of the educational literature related to international mathematics curriculum standards, teaching standards in mathematics, the general and specific outcomes of primary stage mathematics in Jordan, and national standards for teacher professional development. This development was also informed by the researchers' teaching experience. The final observation checklist consists of 37 items distributed across four key domains:

1. **Constructivist-Based Learning**: This domain assesses practices related to group organization based on tasks, individual task assignments, time management, group monitoring, and the creation of an environment conducive to discovering mathematical ideas. It emphasizes independent learning, relational understanding, and the connection of mathematical concepts to real-life situations.
2. **Mathematical Communication and Representation of Mathematical Ideas**: This section evaluates the teacher's ability to communicate effectively with pupils and represent mathematical ideas using appropriate verbal and written language. It includes the use of listening skills and various assessment methods to evaluate student work.
3. **Problem Solving and Developing Thinking**: This domain examines teaching practices that foster a problem-solving environment. It includes utilizing steps to solve verbal arithmetic problems, diversifying solution methods, employing open-ended questions, fostering inductive thinking, and encouraging observation and comparison to uncover relationships between mathematical concepts.
4. **Difficulties faced by pupils and their proposed solutions**: This section focuses on the teacher's ability to identify and address mathematical problems encountered by pupils. It assesses the extent to which the teacher follows up on student work, addresses their needs, identifies and corrects mistakes, encourages self-correction, and recognizes collective and individual learning difficulties.

All items within these domains were formulated into observable and measurable behavioral descriptors. The observation checklist utilized a three-level scale to assess the degree of teacher practice, rated as "high" (3), "medium" (2), and "low" (1). To ensure the validity of the observation checklist, it underwent review by experts in mathematics education as well as in measurement and evaluation. The experts confirmed the appropriateness of the instrument for achieving its objectives, recommending the reformulation of some items for enhanced clarity.

4.3. Psychometric Characteristics of the Observation Checklist

To establish both validity and reliability, a pilot study was conducted with a group of 11 classroom teacher students enrolled in a training program, using the observation checklist. Feedback and responses from these participants were crucial in refining and modifying the final version of the instrument. Various methods were employed to confirm the construct validity of the observation checklist, thereby improving its effectiveness for the study.

4.3.1. Indicators and Coefficients of Construct Validity

McDonald's omega and composite reliability (CR) are widely recognized methods for assessing the reliability of the observation checklist. The findings presented in Table 1 indicate that McDonald's omega values range from 0.871 to 0.913, while CR values range from 0.857 to 0.906, both exceeding the recommended threshold of 0.7. This suggests that the observation checklist exhibits substantial internal consistency. Additionally, the average variance extracted (AVE) values range from 0.588 to 0.645, surpassing the 50% threshold. Regarding discriminant validity, the final column of Table 2

ISSN: 2576-8484
Vol. 8, No. 6: 1228-1239, 2024
DOI: 10.55214/25768484.v9i1.2203

demonstrates that the square root of the AVE exceeds the minimum value of the loading factor, confirming that the observation checklist is both reliable and valid.

Table 1.
Validity indicators and associated coefficients for construct evaluation.

Component	Initial eigenvalues		
	Total	**% of variance**	**Cumulative %**
Constructivist-based learning	3.426	85.662	85.662
Mathematical communication, and representation of mathematical ideas	0.251	6.263	91.925
Problem solving and developing thinking	0.176	4.399	96.324
Difficulties faced by pupils and their proposed solutions	0.147	3.676	100.000

To confirm the construct validity of the observation checklist, the final version was administered to the study sample, and a confirmatory factor analysis (CFA) was performed on the items within their respective dimensions. This model explored the relationships among the 37 items, which are distributed across four domains. An exploratory factor analysis (EFA) was conducted first to assess item loadings within their respective domains. Following the criteria established by AlAli and Al-Barakat [36], item loadings were required to meet or exceed the 0.40 threshold for inclusion.
As illustrated in Figure 2, all items loadings exceeded this threshold within their corresponding domains, indicating a high level of factor loading for each item. Furthermore, the findings demonstrated strong correlations among the domains of the observation checklist. Consequently, the observation checklist retained its original structure, consisting of four domains: the first domain with 15 items, the second domain with 7 items, the third domain with 8 items, and the fourth domain with 7 items.

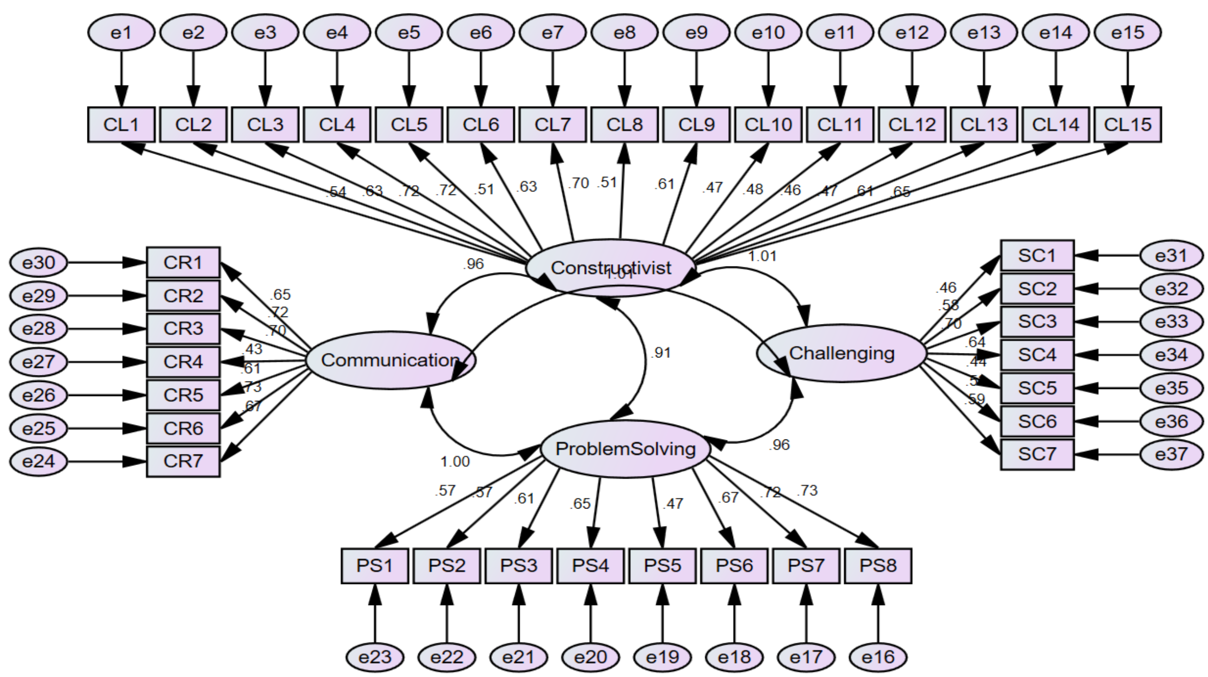

Figure 2.
Findings of the confirmatory factor analysis for the model examining the relationship between observation checklist items and their associated domains.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
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4.4. Data Collection

Following the acquisition of informed consent from the pre-service mathematics teachers, each participant's mathematics classes were observed for two sessions, each lasting 45 minutes, during the final month of their semester-long training program. To ensure a comprehensive assessment, the observed classes covered various mathematical content areas, including numbers and operations, measurement, and geometry, with a sufficient time gap between the observations of each teacher's first and second classes. Consequently, a total of four observation checklists were completed for each student teacher by the researchers independently.

To evaluate inter-rater reliability, the intraclass correlation coefficient was calculated for the observers' assessments of teaching practices for each class period, yielding agreement coefficients of 0.91 and 0.86 for the first and second periods, respectively. Furthermore, Cooper's equation was used to determine the agreement coefficients between the observers' estimates for the two periods, resulting in coefficients of 0.89 and 0.85 for the first and second periods, respectively.

4.5. Data Analysis

The means and standard deviations of the observers' estimations of teaching and learning practices were calculated for each pre-service teacher based on four estimates for each practice included in the observation tool. Each practice was scored on a scale ranging from 1 to 3. These arithmetic means were then converted to percentage means for further analysis. To interpret the findings related to the first research question, the following benchmarks were established: an arithmetic mean below 1.49 indicated a low degree of practice, a mean between 1.50 and 2.39 indicated a medium degree, and a mean of 2.40 or higher indicated a high degree of practice. Thus, an arithmetic mean of 2.40, corresponding to 80%, signifies an educationally acceptable level of practice.

6. Results of the Study

6.1. Results of First Question

The first research question aimed to determine the performance level of pre-service mathematics teachers in mathematics teaching practices during their practical training. To address this question, the arithmetic means and standard deviations of the practice scores for each domain of teaching practice were calculated separately for the study sample. The findings, summarized in Table 2, present the arithmetic means and standard deviations for the teaching practices across different study areas and the overall instrument.

Table 2.
Arithmetic means and standard deviations of teaching practices for pre-service mathematics teachers across study domains and overall.

Domain	Means	St. dev.	Degree of practice
Communication and representation of mathematical ideas	2.09	0.39	Moderate
problem-solving and developing thinking	1.85	0.36	Moderate
constructivist-based learning	1.83	0.40	Moderate
difficulties faced by pupils and their proposed solutions	1.78	0.36	Moderate
Overall	1.88	0.36	Moderate

The findings presented in Table 2 indicate that the mean scores across the observation checklist categories were relatively close, ranging from 1.78 to 2.09. The overall mean of the observation checklist, which is 1.88, suggests that the performance of the trainee teachers in teaching mathematics to pupils in the first three grades of primary education was generally at an "average" level across all assessed dimensions. Below is the analysis of each domain separately:

1. **Communication and Representation of Mathematical Ideas**: This domain achieved the highest mean score (2.09), indicating a relative strength in teacher performance. However, being categorized within the "average" range suggests there is room for improvement. Effective communication and representation of mathematical ideas are essential for fostering deep understanding among pupils.
2. **Problem Solving**: This domain achieved a mean score of 1.85, reflecting an "average" level of practices. Problem solving is a fundamental aspect of mathematics education, as it enhances critical thinking and the ability to apply concepts.
3. **Constructivist Learning**: The findings indicate that this domain achieved a mean score of 1.83. Constructivist learning relies on pupils' interaction with content in ways that enhance deep understanding. Thus, the low mean score may suggest that the teaching methods employed do not provide sufficient opportunities for active learning and exploration.
4. **Student Challenges and Solutions**: This category achieved the lowest mean score (1.78), indicating clear challenges in addressing the difficulties faced by pupils. The inability to provide appropriate support in this domain may hinder pupils' academic progress, necessitating the development of suitable intervention strategies to address their learning needs.

6.2. Findings of the Second Question

This question seeks to determine the extent to which the performance level of pre-service mathematics teachers in implementing effective teaching and learning practices varies across different areas of practice (constructivist-based learning, mathematical communication, representation of mathematical ideas, problem-solving and developing thinking, as well as the difficulties faced by pupils and their proposed solutions). To achieve this, the means and standard deviations for the performance of the study participants on the observation checklist as a whole and for each individual area were calculated. Table 3 illustrates this:

Table 3.
Means and standard deviations of the study participants' performance according to observation checklist domains.

Domains	N	Mean	St. dev.
Mathematical communication and representation of ideas	170	2.09	0.39
Problem-solving and developing thinking	170	1.85	0.36
Constructivist-based learning	170	1.83	0.40
Difficulties faced by pupils and their proposed solutions	170	1.78	0.36
Overall	680	1.88	0.36

Table 3 shows that the estimates of the teaching and learning practices in mathematics for pre-service teachers vary depending on the practice domain. This indicates that there are differences between the mean scores of pre-service mathematics teachers' practices based on the domain of practice (constructivist-based learning, mathematical communication and representation of ideas, problem-solving and developing thinking, and the difficulties faced by pupils and their solutions). To determine whether these differences are statistically significant, a one-way ANOVA with repeated measures was used. Table 4 illustrates this.

Table 4.
Findings of the one-way ANOVA with repeated measures.

Source of variance	Sum of squares	df	Mean square	F value	Sig. level
Between groups	1.465	3	0.366	9.906	0.067
Within groups	33.700	676	0.045		

ISSN: 2576-8484
Vol. 8, No. 6: 1228-1239, 2024
DOI: 10.55214/25768484.v9i1.2203

Source of variance	Sum of squares	df	Mean square	F value	Sig. level
Total	65.185	679	0.832		

Table 10 shows no statistically significant differences (p ≤ .01) in the means of pre-service mathematics teachers' performance attributable to the different domains of practice (constructivist-based learning, mathematical communication and representation of ideas, problem-solving and developing thinking, and the difficulties faced by pupils and their proposed solutions).

7. Discussion

The findings reveal that observers' assessments of mathematics teaching practices among pre-service mathematics teachers were categorized as "average" across all domains, with notable variations in specific areas. This indicates a clear connection between practice levels and activities related to mathematical communication, problem-solving, and addressing learning difficulties within a constructivist framework.

Notably, the domain of mathematical communication and representation received the most favorable evaluations. This reflects the verbal and written communication skills that pre-service mathematics teachers develop through their university coursework. Mathematics textbooks for the first three grades emphasize representing concepts using diverse linguistic models, including visual aids and real-life contexts. These resources guide teachers in employing various communication methods. However, the theoretical knowledge of the constructivist approach does not adequately prepare pre-service mathematics teachers for effective classroom implementation. Research shows that teacher preparation programs often lack sufficient integration of problem-solving strategies, identification of learning difficulties, and appropriate interventions [11, 12, 13, 14]. This gap highlights the urgent need for a more cohesive, practice-oriented curriculum.

The analysis of pre-service mathematics teachers' practices within the constructivist learning domain indicated a wide range of weak to moderate performance. Such variation suggests that while certain aspects of their practices demonstrate "medium" levels, others fall into the "low" category. This disparity indicates that current teaching practices may not sufficiently foster effective learning, particularly given the foundational importance of these aspects in constructivist theory [30, 32, 35, 36].

A significant barrier identified is the inadequate preparation of the classroom environment. Failing to create a conducive atmosphere for exploring mathematical ideas can hinder pupils' acquisition of essential concepts and skills. In constructivist theory, the classroom setting plays a critical role in influencing cognitive and emotional development, making its preparation essential for effective learning experiences [15, 17, 19,20].

Moreover, pre-service mathematics teachers confirmed insufficient focus on providing individualized learning tasks and promoting independent learning. This neglect adversely impacts pupils' acquisition of mathematical knowledge, especially in early childhood education, where the extent of provided learning opportunities is crucial for development [16, 18, 24, 25]. The quality of constructivist activities was also found lacking; observational findings showed that these activities promoted only average levels of relational understanding and critical thinking. Khasawneh et al., [42] indicated that many mathematics teachers rely heavily on closed questions focused on factual recall, rather than engaging pupils in higher-order thinking, which contradicts contemporary educational principles that emphasize active engagement with mathematical concepts.

Additionally, the integration of local context into learning activities was inadequate. Pre-service mathematics teachers exhibited moderate practices in linking mathematical concepts to real-life situations, which may undermine pupils' appreciation of mathematics and its relevance in daily life. This disconnect likely stems from a widespread misconception that mathematics is an abstract discipline, further alienating pupils from its practical applications [20, 21].

Moreover, the insufficient emphasis on cooperative learning was a notable concern, with average scores for practices related to this approach being the lowest. Effective mathematical learning necessitates collaborative engagement, allowing pupils and teachers to collectively plan and execute tasks. Social constructivism emphasizes interaction-both verbal and through play-in facilitating mathematical learning. Furthermore, cooperative learning fosters positive attitudes toward mathematics, highlighting the urgent need for pre-service mathematics teachers to incorporate this approach into their instructional practices [27, 28, 29].

In summary, the observed "average" practice scores in mathematical communication and representation underline a critical area for improvement. The effectiveness of communication significantly influences learners' ability to engage with problems. Improving these skills is essential for developing pupils' mathematical knowledge, as fruitful problem-solving relies on their comprehension of the problem's language and context.

The study emphasizes the importance of effective teaching practices in mathematics for helping children grasp the meaning and structure of problems. Current practices that fail to achieve an acceptable level of effectiveness can impair pupils' learning quality. Meaningful understanding is linked to the teacher's use of diverse communication tools, which is essential for catering to children's varying mental levels.

The findings indicate weaknesses in pre-service mathematics teachers ' preparation for problem-solving and developing critical thinking skills. Classroom observations revealed a reliance on direct transmission of knowledge while neglecting essential strategies for fostering problem-solving abilities. The over-reliance on textbooks further limited effectiveness, as it often does not accommodate diverse learners. Building mathematical knowledge requires varied learning opportunities centered on thinking processes and exploring relationships between concepts [1, 2, 4, 9].

Addressing pupils' difficulties indicated notable weaknesses in teachers' roles, adversely impacting students' learning. Insufficient attention to mathematical errors significantly affects performance. Observations indicated that some pre-service mathematics teachers corrected mistakes themselves, highlighting gaps in their preparation that likely stem from a lack of specialized courses on teaching mathematics.

Overall, these findings highlight the necessity for enhanced training and support for pre-service mathematics teachers to improve their teaching practices and, consequently, the learning outcomes for their pupils.

8. Conclusions and Recommendations

Based on the findings of this study, the researchers conclude that the preparation of pre-service classroom teachers for teaching mathematics at the early primary level was ineffective. The pre-service mathematics teachers ' practices fell short of the educationally acceptable standard (80% or above), being categorized as "medium" or "low." A noteworthy issue identified was the lack of engagement in fostering children's active involvement in constructing mathematical concepts, which contradicts contemporary learning approaches emphasizing active learning through cooperative and individual tasks.

Furthermore, the observed teaching practices did not effectively incorporate constructivist learning principles, indicating a lack of awareness among pre-service mathematics teachers regarding the practical application of learning theories. This gap contributed to their limited abilities in choosing effective problem-solving strategies, ultimately hindering children's comprehension of mathematical methods. The ineffective usage of learning tools, such as pictures and models, further diminished opportunities for meaningful student engagement. Additionally, there was insufficient emphasis on developing mathematical thinking, a crucial aspect of effective mathematics education, and a failure to adequately address pupils' learning difficulties or propose targeted strategies for correcting recurring mistakes.

In light of these conclusions, the researchers recommend numerous key actions. First, reviewing the curriculum to allocate specific courses on teaching mathematics, separate from broader methods courses, is essential. This would ensure that pre-service mathematics teachers receive focused training on the unique challenges of mathematics instruction. Second, organizing practical workshops that demonstrate the application of constructivist principles and effective problem-solving strategies in classroom settings would provide pre-service mathematics teachers with the necessary tools and confidence to enhance their teaching practices.

Moreover, it is vital to provide training for pre-service mathematics teachers to recognize and address the learning difficulties faced by children in mathematics. Incorporating activity design workshops that relate mathematical concepts to real-life situations can further enrich the learning experience. Strengthening the supervisory role of cooperating teachers will also be crucial for effectively mentoring pre-service teachers, ensuring they develop the necessary competencies in mathematics instruction.

Lastly, future research should explore learning practices for in-service teachers and conduct experimental studies on constructivist teaching methodologies to enhance mathematics instruction further. By focusing on these areas, the aim is to foster a more effective approach to teaching mathematics that better prepares pre-service mathematics teachers and improves student outcomes.

This study mainly relied on observation checklist, which may limit the depth of insights gained. Incorporating interviews in future research could provide richer perspectives on the experiences and perceptions of pre-service mathematics teachers. Exploring these areas will help deepen the understanding of effective mathematics teaching practices and contribute to the ongoing development of teacher education programs.

Declarations

Funding: This work was financially supported by the Deanship of Scientific Research, King Faisal University, Saudi Arabia [grant number KFU241917].

Acknowledgments: We would like to express our sincere gratitude to all the respondents who participated in this study for their time and valuable contributions. Our thanks also extend to the Deanship of Scientific Research at King Faisal University for their financial support of this research.

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