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Training of Future Primary School Teachers to Develop Mathematical Abilities of Students

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Abstract

The study aims to develop a modern and effective methodology for training future primary school teachers. The following methods of scientific cognition were used in the study: analysis, comparison, synthesis, deduction, classification, longitudinal method and survey. The system approach was also used. The study reviewed such classical educational theories as constructivism, Vygotsky's concept and Leontiev's activity theory. A review of perspectives on the use of modern technologies for mathematics education led to the conclusion that it is unconditionally necessary to use these technologies to bring educational curricula up to date. The study examined the concepts of education personalisation and active learning, identifying perspectives for applying individualisation methods and game tools in mathematics education. It also explored ways to enhance primary school teachers' pedagogical competencies through professional education, experience sharing, reflection, and interaction with pupils. Based on this, a methodology for training future primary school teachers to develop students' mathematical abilities was developed. The methodology included individual needs diagnostics, learning individualisation, modern technology integration, active learning methods, project activities, and communication skills development. The methodology's effectiveness was confirmed through approbation, and a survey showed that learning with this approach was a positive experience for students.

Keywords: teacher training methodology; individualisation of training; pedagogical competencies; programme actualisation; digital literacy in education.

1 Introduction

The rapid integration of digital tools in the educational process necessitates the development of new teaching strategies. However, many primary school teachers face challenges in incorporating these technologies effectively into their mathematics instruction due to insufficient training and low digital literacy. The gap between technology advancement and teacher readiness restricts the successful incorporation of digital technologies in mathematics education. Resolving this issue is vital for enhancing instructional efficacy and ensuring that students develop fundamental mathematical abilities required for success in future professions such as engineering, information technology, and science.

Despite the availability of programmes and methodologies, there are still challenges in preparing future teachers to effectively develop mathematical skills in children [12]. Often existing curricula do not provide sufficient depth of training for future primary school teachers in the development of mathematical abilities among students, or outdated methods may be used that are not conducive to full and interesting learning of mathematics by children and their active involvement in the learning process [25]. The introduction of modern technologies in schools intensifies the problem, since numerous educators lack the required digital skills to effectively employ these tools in their teaching strategies [13]. Addressing these problems is essential for enhancing the quality of training for teachers and encouraging in students a lasting interest in mathematics and an understanding of its relevance in modern society. Mathematical literacy among kids is essential for securing the future economic and social prosperity of society [22].

Pedagogical aspects of training future primary school teachers to develop students' mathematical abilities were revealed by Almenbetova et al. [2]. Their research highlighted the necessity for prospective educators to possess the ability to cultivate an engaging educational environment and customise the learning experience to the individual requirements of each student. This underscores the significance of teacher adaptability and responsiveness, which are essential for enhancing students' mathematical competencies, a concept that corresponds with the study's emphasis on advancing teacher training in mathematics education.

In a study by Xursanova et al. [20], an analysis of different approaches to teaching mathematics in primary grades was conducted. They substantiated the importance of an individual approach to each student and the use of special methods that address the individual characteristics and level of development of each child. This accentuates the significance of customising pedagogical approaches, which is vital for incorporating contemporary technology into mathematics education to address the varied learning requirements of individuals.

Komar et al. [15] emphasised a flexible approach in training future primary school teachers to deal with complex pedagogical situations. The research demonstrated that educators utilising flexible strategies may promptly and assuredly address various classroom difficulties. This research is relevant to the current study, as it underscores the necessity for teacher training programs to prepare educators for the challenges of integrating new technology and pedagogical techniques in the classroom.

Kinzhibayeva et al. [9] surveyed teachers regarding the use of instructional technology in mathematics lessons in primary schools and preschool classrooms. The results indicated that the majority of educators acknowledge the capacity of digital technologies to augment learning and enhance student performance. This research advocates for the incorporation of contemporary educational technology into the teacher training curriculum, consistent with the objective of this study to provide future educators with the requisite abilities to utilise these tools profi-

ciently in their profession. In a study of digital literacy in future teachers, Aidarbekova et al. [1] determined that digital resources improve educational quality and facilitate the development of learning abilities in primary school children. This conclusion highlights the necessity of equipping future educators with essential digital literacy skills, a primary emphasis of this study, to enable them to effectively integrate technology into the educational process and address the demands of the digital era.

Consideration of other authors' studies indicates the interest of the scientific community in the issues of improving the quality of education and bringing training programmes to modern requirements, but the topics covered in previous works have not fully disclosed all the necessary changes in the teacher training programme to meet the new educational challenges. In this regard, the study aims to update the educational programme of future primary school teachers to meet modern standards and trends.

2 Materials and Methods

The deductive method was the theoretical foundation of the study, informing assumptions about essential qualities and competencies for prospective primary school educators. The systemic approach examined the educational process comprehensively, considering the interactions between learning material, pedagogical strategies, student requirements, and results. The study analysed the impact of several elements within the educational environment on the development of professional competencies, facilitating the formulation of a technique for training future educators to enhance students' mathematical skills. The categorisation approach categorised activity descriptions in the methodology into six facets.

The empirical part of the study was conducted based on the Faculty of Psychology and Pedagogy of Zhetysu University named after I. Zhansugurov and Taraz Pedagogical Institute in 2019–2022. A total of 196 students participated in the study. The average age of the participants was 19.4 years. For the experiment, the participants were divided into two groups:

- Experimental (91 people) (Zhetysu University named after I. Zhansugurov).
- Control (105 people) (Taraz Pedagogical Institute).

The participants of the experimental group were informed on the task of testing the effectiveness of the new methodology of training future primary school teachers and voluntarily participated in special training sessions covering the basic principles and practical skills of the developed approach. The participants of the control group continued training under traditional programmes. All participants provided written consent to participate in the experiment under conditions of confidentiality and compliance with all ethical norms of experimenting.

The survey method was used to obtain a subjective assessment of the quality and effectiveness of the methodology for training future primary school teachers from the students who participated in the testing of the methodology. The questions proposed to the respondents implied both a rating from 1 to 5 and a detailed answer or comment:

1. What is your general impression of the methodology of training future primary school teachers to develop students' mathematical abilities? (From 1 to 5, where 1 is very negative and 5 is very positive).

2. Are the teaching methods presented in the methodology effective? (From 1 to 5, where 1 is inefficient and 5 is very positive).
3. Do you consider the proposed methods of training in pedagogical practice useful and applicable? (From 1 to 5, where 1 is not at all useful or applicable, 5 is very useful and applicable).
4. Did the methodology make a positive contribution to your professional growth? (From 1 to 5, where 1 is none and 5 is very positive).
5. What was the impact of the methodology on the level of your student's achievements? (From 1 to 5, where 1 is negative and 5 is positive influence).
6. Does the methodology meet modern educational requirements? (From 1 to 5, where 1 is "no" and 5 is "yes").
7. How would you assess the level of communication and interaction within the group participating in the experiment? (From 1 to 5, where 1 is very low and 5 is very high).

Since the developed methodology was intended to be implemented over a long period (over three academic years, from 2019 to 2022), a longitudinal study was used to examine the long-term effects of its implementation. The comparison method was used to compare the academic performance of students from the experimental and control groups. To conceptualise the data obtained during the survey, the method of analysis was applied. It identified the main areas in which students have difficulties or show interest. The synthesis method was used to formulate the methodology of training future teachers of primary grades, as well as to combine all the information obtained during the study to formulate reasonable conclusions.

3 Results

Modern technology used in mathematics teaching is essential both to match educational programmes with the digitalisation demands of students and their parents and to effectively prepare students for the use of technology in the modern world [28]. The key factor becomes an understanding of how these technologies can be integrated into the learning process, creating effective teaching methods. Interactive programs provide dynamic mathematical tasks, engaging students in interesting and practical challenges; they allow personalisation of learning, considering the individual needs and pace of students, and developing their mathematical skills and thinking. Online resources provide access to a variety of materials including video lectures, visualisations, games and challenges, enriching the learning experience interactively. Educational applications, including mobile applications, provide a flexible and accessible form of learning, helping to increase student motivation [21]. Comprehension of how modern educational technologies can best be integrated into mathematics learning becomes a key aspect of developing modern educational strategies and pedagogies.

Personalisation of learning is relevant both in mathematics and for children's learning in other subjects [8]. The need to adapt approaches to the individual needs of learners pushes educators to use different personalisation methods in this area, using key strategies to achieve the goal. Personalised learning represents an important aspect in which the teacher must tailor the curriculum to each student, accounting for their level of knowledge and rate of learning [32]. This approach promotes effective learning of mathematical concepts. Differentiation of tasks and materials as a component of the personalisation of learning enables teachers to adapt the level of difficulty of

tasks to the individual needs and background of each student. In this way, differentiation creates conditions for more effective learning of mathematical concepts.

The integration of games and active methods in mathematics teaching is essential to stimulate students' interest and effectively master mathematical concepts [3]. Games, as an educational tool, are based on the principles of interactivity, cooperation and practical application of knowledge [29]. They promote the formation of mathematical skills through game situations that stimulate logical thinking and arouse interest in the subject [7]. Project-based methods, in turn, are oriented towards the practical application of mathematical knowledge in real-life situations. The theoretical basis of project-based learning in mathematics emphasises the importance of contextuality and practical applicability, which activates the learning process and promotes deep learning. Active methods, which combine different forms of learning, from open lessons to role-playing, aim to make the learning process more dynamic and engaging. Active learning methods have the potential to stimulate creative thinking, develop communication skills and improve learning of mathematical concepts.

Developing the pedagogical competencies of primary school teachers is a complex process through a variety of methods and strategies [10]. Professional education is crucial in this process, and participation in workshops, training and courses in mathematics and teaching methods ensures the continuous updating of pedagogical skills. Learning new teaching methods and the latest research in mathematics education become the foundation for effective teaching, while teamwork provides teachers with opportunities to share experiences and valuable information [16]. The teaching team, being a source of support, also contribute to the development of pedagogical competencies, while participation in pedagogical councils and discussion of learning outcomes enriches the professional experience and promotes the adoption of innovative teaching methods [5]. Research activities, in turn, contribute to the active development of pedagogical competencies by conducting their research in the field of mathematics education and sharing the results with colleagues, while constant updating of knowledge and tracking changes in the educational system allows primary school teachers to stay abreast of the latest trends and keep their teaching methods up-to-date. Participation in professional communities enhances interaction and sharing of experiences, which provides teachers with access to valuable ideas and successful practices, contributing to their professional development.

Reflection and self-evaluation are known to be essential elements in the process of developing teaching competencies [18]. Analysing lessons, highlighting strengths and areas for improvement, regularly reviewing the effectiveness of one's professional activity - all this is aimed at improving the quality of the educational process. Individualisation of learning involves the teacher developing skills to work with students with different levels of proficiency [31]. The creation of individualised tasks and materials, and the use of differentiated learning, support pupils with different needs [6]. Feedback from students provides important information for teachers about how their methods are perceived by students: actively collecting feedback allows them to better understand students' needs and adapt their teaching methods. Developing communication skills is an important element of successful mathematics teaching. Communicating effectively with students, stimulating their interest in the subject, and creating a supportive educational atmosphere contribute to effective learning. Modern education requires unique competencies from primary school teachers to effectively develop students' mathematical abilities [26]. Table 1 presents a methodology aimed at preparing future teachers for this important task.

Table 1: Methods of training future primary school teachers to develop students' mathematical abilities.

Aspect	Description	Implementation
Determining individual needs	Use tests, interviews, and projects for assessing mathematical knowledge and achievements.	Include standardised tests, practical exercises, and project tasks to assess and develop logical thinking.
Individualisation of training	Adapt learning materials to different paces and backgrounds. Use differentiated assessment methods.	Organise practice using individual plans, provide research support, and regularly update programs based on feedback.
Integration of modern technologies	Use digital technologies and tools in teaching. Develop interactive lessons and explore VR and cloud technologies.	Introduce courses on educational technologies, update curricula, and provide access to self-study resources and mentoring programs.
Active learning methods	Incorporate game techniques, engage students, and develop discussions based on game scenarios.	Integrate game-based methods into the curriculum, develop students' skills, and create an assessment system tailored to game methods.
Project activities	Develop structured project assignments with research elements. Support students in data analysis and presentations.	Integrate project activities into training programs, provide resources, and create methods to evaluate creative and research projects.
Communication skills development	Develop the ability to express mathematical ideas clearly and support communication skills.	Implement courses to develop communication skills, including tasks for writing mathematical concepts and presenting ideas.

The developed methodology was tested on a group of students. Table 1 establishes a thorough process for instructing prospective primary school educators in the successful enhancement of children's mathematical competencies. The methodology underscores the customisation of education, the incorporation of contemporary technology, and the utilisation of active learning techniques. A fundamental aspect of the process is assessing individual needs using several evaluations, such as standardised exams and interviews, to guarantee the precise identification and accommodation of each student's learning requirements. This facilitates the customisation of pedagogical approaches to accommodate varied student backgrounds, learning modalities, and advancement rates, so assuring a more personalised and efficacious educational experience.

The technique emphasises the significance of integrating contemporary technology, including digital tools, cloud-based resources, and virtual simulations, into mathematics instruction. These technologies are seen as crucial for student engagement, enhancing educational results, and equipping them for the digital landscape. Active learning methodologies, such as game-based learning and project-orientated activities, are used to enhance student involvement and promote the development of practical mathematical competencies. The enhancement of communication abilities is emphasised to guarantee that prospective educators can proficiently articulate mathematical topics and interact with pupils meaningfully. The technique necessitates ongoing revisions to teaching programs and materials, fostering a dynamic and adaptable approach to teacher training that corresponds with contemporary educational trends and technology. Figure 1 shows the

academic results of the experimental participants.

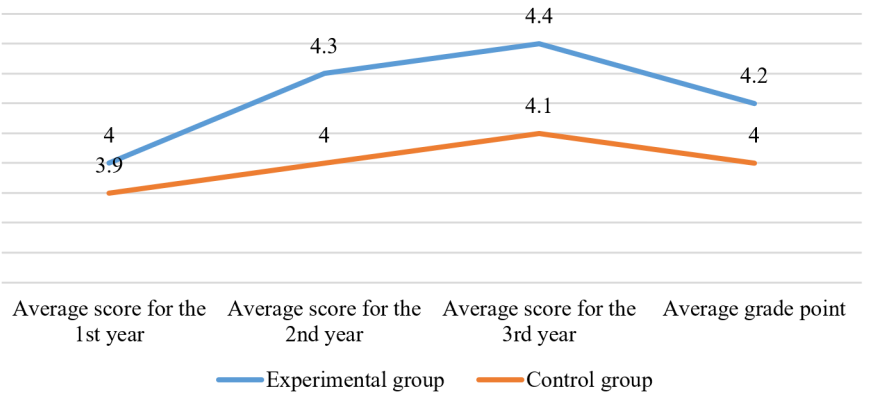

Figure 1: Academic performance of students from the experimental and control groups.

Students in the experimental group demonstrated a steady increase in mean scores from 4 on the 1st year to 4.4 on the 3rd year. The overall average score for this group (4.2) indicates that the students who underwent the training programme performed well throughout their studies. The average scores of students in the control group also showed an increase from 3.9 on the 1st year to 4.1 on the 3rd year. The overall average score for this group (4) indicates that students who underwent traditional training programmes also achieved good results but with a slight lag behind the performance of the experimental group.

Figure 1 illustrates a considerable difference in the academic advancement of the experimental and control groups. Both groups had an increasing trajectory in their average scores throughout the three years. However, the experimental group showed a more significant enhancement, especially in the second and third years. This implies that the new strategies utilised in the experimental group, including the incorporation of contemporary teaching methods and individualised learning, enhanced the learning experience. In contrast, the control group had a substantial yet gradual improvement, suggesting that conventional training approaches may not have significantly influenced the students' academic advancement. The findings demonstrate that the experimental group exhibited a more rapid improvement and attained a superior level of academic performance by the conclusion of the study, highlighting the potential efficacy of the suggested teaching style.

The individual results of the students in the experimental group reflected the diversity in their academic success. Student No. 8 demonstrated a steady increase in average scores over the three years. With initial score of 4.4 on the 1st year, the results improved on the on the 2nd year (4.5) and on the 3rd year (4.7), which may indicate the positive impact of the training techniques on learning. At the same time, student No. 15, who started with a lower mean score on the 1st year (3.7), also demonstrated improvement, reaching a mean score of 4.1 on the 3rd year, indicating individual differences in students' responses to the application of preparation techniques and the importance of personalising the educational process to achieve optimal results. An anonymous survey of experimental group participants offered insights into their perceptions of the methodology. The average scores of the main criteria of the methodology are presented in Figure 2. The average grades of all students, along with the general trend, are presented in Figure 3.

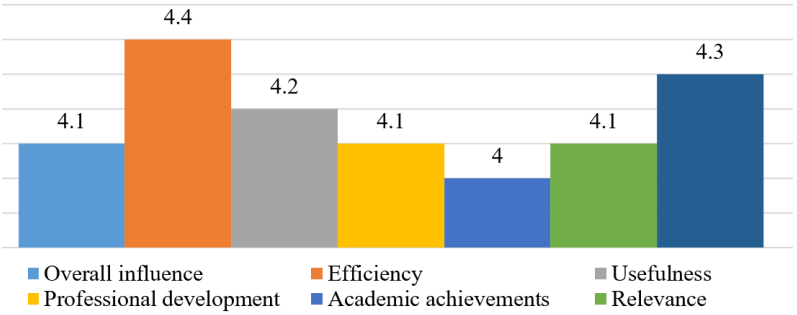

Figure 2: Average scores of the methodology indicators according to the subjective assessment of students of the experimental group.

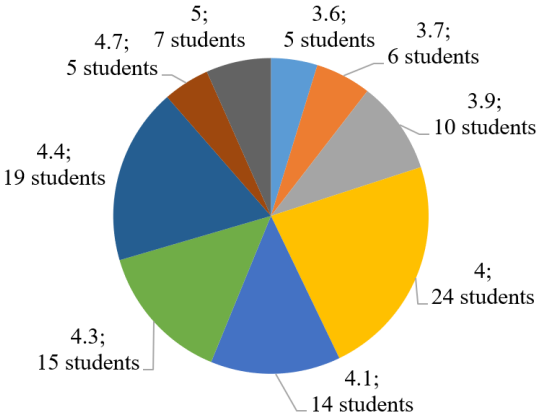

Figure 3: Average grades of all students with a general trend.

The survey findings from the experimental group indicate a predominantly positive view of the training program designed to enhance mathematical skills. The program's overall evaluation received a commendable score of 4.1, reflecting substantial satisfaction and favourable results from the approach. The high efficiency rating of 4.4 is particularly significant, indicating the students' strong conviction that the teaching tactics were extremely helpful in enhancing their learning experience. This may be linked to the contemporary instructional techniques and individualised strategies integrated into the curriculum. Academic accomplishments and communication received favourable ratings (4.1), indicating that the curriculum not only elevated academic performance but also strengthened students' capacity to express mathematical concepts. Other factors, such as relevance, usefulness, and professional development, garnered marginally lower, still commendable ratings (4), indicating that the technique was generally pertinent and advantageous in equipping students for prospective teaching practices.

Figure 3 indicates that the majority of students (24) attained an average grade of 4, signifying steady advancement throughout the program. A large segment of the sample (19 students) achieved a grade of 4.4, indicating that a subgroup of the cohort derived considerable advantages from the training, maybe due to enhanced engagement or compatibility with the instructional methods. The grade distribution indicates that although the majority of students perceived the technique as effective, a minority achieved lower scores $(3.6 - 3.9)$, highlighting individual differences in learning styles, engagement, and reactions to the instructional approaches. These findings emphasise the favourable acceptance of the technique while also indicating the necessity for increased personalisation to meet the varied requirements of all learners and enhance outcomes

for each student. The findings indicate that the program significantly enhanced academic performance and fostered essential professional skills. However, there is potential for improvement in personalised support.

In conversation, the participants in the experimental group praised the overall impression of the programme, expressing satisfaction and positive emotions from participation. Many noted that the teaching methods presented in the programme were effective and applicable in their future teaching practice. They pointed out the positive impact of the programme on their educational experience, as participation allowed them to learn interesting and practical material that helped them to better understand mathematics and its application in their teaching practice. Several participants commented on the innovative approach to teaching which made the learning process more engaging and interactive. The students interviewed often expressed the view that the experience of effective communication within the study group helped them to develop an important set of communication skills that are a key resource for effective teaching in the future.

Communication within the group served as a kind of training for students, allowing them not only to learn techniques of effective communication but also to develop skills of mutual understanding, tolerance and cooperation. This experience of group interaction was aimed at developing the technical aspects of communication, and the ability to empathise and understand the needs of other participants in the educational process. One of the participants in the experiment suggested that effective communication skills are fundamental to building interactions with students, colleagues and parents. Effective communication, developed in the process of interaction in the learning environment, became a tool for successful learning and education in the school environment, i.e. intragroup communication not only formed communication skills but also created a basis for future professional success in the educational sphere.

Learning new ways to individualise learning was highlighted by some participants as a meaningful contribution to their professional development and an opportunity in the future to be prepared for the individual needs of each student, which is a significant contribution to the overall effectiveness of the educational and learning process. The ability to differentiate between learning styles and rates would enable them to interact more effectively with diverse groups of learners and contribute to a more supportive and inclusive educational environment in general. In terms of professional development, many participants in the programme expressed specific aspects that they considered key to their future efforts in education.

Some students commented that participation in the programme had enabled them to master not only the theoretical aspects of mathematics education but also practical teaching skills. They pointed to the importance of differentiated teaching methods and the creation of individualised tasks, which they deemed necessary when working with the diverse needs of each student. Other students emphasised the experience they had gained in using modern technology to teach mathematics such as interactive whiteboards and educational applications. They identified these skills as key in modern education and expressed the belief that this would enable them to successfully adapt to current trends. Comments were also received regarding the benefits of learning to practise communicating effectively with students and creating a supportive educational environment. Students stated that the practice of reflecting on their teaching practice provided them with an opportunity to recognise their strengths and areas for further improvement.

4 Discussion

The research highlighted the necessity of using contemporary technology and instructional strategies in the education of prospective primary school educators. These characteristics were identified as vital for cultivating an extensive variety of abilities necessary for effective future teaching. The survey findings indicated that the implementation of new teaching approaches markedly elevated students' engagement in the learning process and improved their proficiency in mastering the content. Students notably valued how these methods enhanced their comprehension of the material and rendered studying more captivating. The study emphasised the role of contemporary teaching methods, especially in mathematics education, in enhancing successful teacher training procedures and underscored the significance of these approaches for the preparation of future educators.

To highlight other problems and aspects of the modern educational system, studies by other authors were considered. Kalogeropoulos et al. [14] investigated two primary schools that used remote mathematics instruction during the COVID-19 epidemic, emphasising the utilisation of internet platforms, interactive techniques, and learning organisation. Their study emphasised that schools employing innovative methods, including engaging practices and fostering individual learning, were the most effective. These findings underscore the necessity for contemporary pedagogical approaches and flexible educational frameworks. Achievement in mathematics education necessitates contemporary technologies, high-quality teacher preparation, active parental engagement, and readily available instructional materials [24]. The researcher identified inquiry-oriented and independent learning as beneficial for remote mathematics instruction. This corroborates the methodologies suggested in this research, affirming their validity. These findings align with the approach in the current research, which prioritises the integration of contemporary technology and active learning strategies in teacher training to promote student involvement and autonomy. The use of online learning platforms and interactive pedagogical approaches in this study and Kalogeropoulos et al.'s research indicates that the integration of digital technologies and their proper application is essential for attaining excellent educational results.

A study of the effectiveness of prospective primary school teachers in teaching mathematics by scholars Leavy et al. [17] aimed to measure teachers' beliefs about their effectiveness and to identify factors influencing these beliefs. The study revealed that the effectiveness of prospective teachers was significantly influenced by their beliefs about their ability to teach mathematics. The degree of confidence in personal skills and knowledge is important for successful teaching, and beliefs about one's efficacy may change due to various factors [4]. This finding supports the effectiveness of the methods proposed in this paper to improve self-confidence for teachers, namely participation in professional societies, reflection and communication with students to obtain feedback. Personal experience in teaching mathematics, level of training in this area, and support from supervisors and colleagues can have a significant impact on the beliefs of future primary school teachers.

Wei et al. [33] conducted a thorough review of empirical research regarding the instruction of mathematical modelling in elementary education. Research indicates that mathematical modelling may be seamlessly included in the primary curriculum, enabling young learners to comprehend and utilise its essential ideas. The research indicated that utilising effective pedagogical tactics markedly enhances students' engagement in mathematics and their comprehension of its practical applications. Moreover, the developed interactive teaching strategies can contextualise mathematical modelling within everyday scenarios. Successful implementation of these ideas requires adequate training for students and cooperation from educators and school administration. They established that mathematical modelling may substantially improve students' interest and

comprehension of mathematics. This was included in the present study's method by recommending interactive teaching methods that link mathematical principles to real-world applications. The presented methodology builds upon the research of [33] by emphasising the formulation of pedagogical techniques that both introduce and implement mathematical modelling in practice, thus assisting prospective educators in effectively incorporating this approach into their instruction.

Gebremariam and Gedamu [11] investigated how educators might improve learning via diverse evaluation techniques. They examined normative assessment methods, feedback mechanisms, and differentiation tactics, emphasising the robust connection between assessment and learning processes. Involving students in assessments is essential since effective techniques not only measure knowledge, but also promote motivation, self-regulation, and reflection. This integration fosters enhanced learning, endorsing suggested modifications in mathematics pedagogy. The research revealed other beneficial strategies that provide a supportive learning environment, including engaging students in goal-setting and employing varied feedback techniques customised to individual requirements. A systematic plan is essential for enhancing learning methodologies, incorporating both teacher professional development and institutional assistance [30]. The present study aligns with Gebremariam and Gedamu's emphasis on assessment methodologies, integrating differentiated and inquiry-based learning strategies to involve students in a more comprehensive educational experience. By incorporating evaluation procedures into the learning process, this study reinforces the significance of the recommended approaches in improving students' mathematical abilities, as evidenced by the aforementioned studies.

Rodriguez-Jimenez et al. [23] investigated the influence of information and communication technology (ICT) on mathematics instruction and learning in elementary education. They examined several ICT tools, such as software, interactive materials, online platforms, and gaming apps, evaluating their efficacy in improving student engagement and mathematical literacy. The research indicated that the utilisation of ICT resulted in heightened interest in mathematics, improved conceptual visualisation, personalised learning experiences, and enhanced student engagement. Although the advantages of ICT were emphasised, the research failed to consider possible disadvantages, like diminished attention spans and dependence on technology. To enhance the efficacy of ICT in mathematics education, a balanced strategy incorporating conventional teaching approaches is advised. The current research directly integrates ICT tools into the pedagogical practices for prospective primary school educators, equipping them with practical expertise in these technologies. It also emphasises the necessity of a balanced approach, wherein the utilisation of ICT enhances conventional techniques, hence fostering a more complete and sustainable learning environment.

Sitopu et al. [27] highlighted the need of integrating mathematics literacy into basic school courses. This integration improves kids' critical abilities, mathematics performance, and understanding of fundamental ideas, underscoring the necessity for early exposure to mathematical literacy to cultivate vital talents in children. Therefore, extensive teacher preparation is essential for properly integrating mathematical literacy into elementary education [19]. This integration enhances mathematical competence while fostering critical thinking, problem-solving, and communication abilities. This study's recommended approach surpasses conventional teaching techniques, focusing on the comprehensive development of pupils and preparing future educators with the essential information and abilities to innovate educational practices. They highlighted the significance of mathematical literacy in elementary education, which corresponds with the overarching objective of this study's technique to cultivate critical thinking and problem-solving abilities in pupils. By integrating mathematical literacy into teacher training, the present study provides future educators with the skills essential for its effective implementation in classrooms, thereby supporting the development of well-rounded learners.

The authors of all the studies reviewed were unanimous on the need for the educational system to meet the challenges of modernity, including both educational programmes and approaches in the context of school education and the training of future teachers in higher education.

5 Conclusions

The study revealed important aspects of training future primary school teachers to develop students' mathematical abilities. The review of modern learning theories and integration of educational technologies and approaches conducted made it possible to create a methodology for the training of future teachers, oriented towards the effective interaction of modern teaching methods and traditional pedagogical approaches. The developed methodology emphasised the actualisation of education following the requirements of the modern world and included courses and specialisations covering the basics of working with modern educational technologies in the context of mathematics education, the use of interactive programmes, online resources and educational applications to enrich the learning process and stimulate students' interest in the subject. An important aspect of the methodology was also the introduction of game methods into the structure of the curricula. The study concluded that effective modern mathematics education demands both deep subject knowledge and active integration of innovative technologies and methods to foster creativity and critical thinking.

According to the student survey, the integration of modern educational technologies, such as interactive platforms and online resources, significantly contributed to their professional development and learning outcomes. The surveyed students also positively evaluated the possibility of personalised learning and the use of interactive methods, which improved the learning of mathematical concepts. Students praised communication within the group, highlighting this aspect as an important element of successful educational practice and indicated that effective communication promoted a deeper understanding of the material. Thus, the development of communication skills is extremely important for a future educator, and the ability to interact effectively in an educational environment is a key element of a successful career in education.

Further research should address how the integration of technology into the educational process affects the effectiveness of future teacher education, including the evaluation of the effectiveness of online educational resources, virtual tools and distance learning methods. Research into these aspects will provide a better understanding of how modern technology can influence the training of future teachers and will improve the quality of their professional preparation.

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Conflicts of Interest The authors declare no conflict of interest.

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