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RCMOS – Multidisciplinary Scientific Journal O Saber.
ISSN: 2675-9128. Sao Paulo-SP.
Year IV, v.1, n.1, Jan./Jul. 2024. | submission: 04/02/2024 | accepted: 04/04/2024 | publication: 04/06/2024

TRAINING IN MATHEMATICS AND ITS TECHNOLOGIES

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SUMMARY
The present study investigated the integration of technologies in mathematics education, addressing the problem of the adequacy and effectiveness of this integration amid the challenges imposed by teacher training, technological infrastructure of institutions, equity of access for students and resistance to change. The general objective was to analyze the contributions and challenges of adopting educational technologies in mathematics teaching, as well as to propose perspectives for their effective implementation. The methodology used was based on a literature review, exploring significant studies and specialized reports that discussed technological integration in mathematics education. This approach allowed the collection of relevant data on previous experiences, implemented strategies and results achieved in different educational contexts. The results and analyzes revealed a double facet: on the one hand, educational technologies offer innovative potential to enrich the teaching and learning of mathematics, facilitating access to diverse teaching resources and promoting more interactive and personalized teaching methods. On the other hand, it was identified that the training and preparation of teachers, together with the availability of adequate technological infrastructure, constitute significant barriers to the effective integration of technologies in mathematics teaching. Final considerations highlighted the importance of collaborative approaches and educational policies focused on supporting ongoing teacher training, investing in infrastructure and promoting equal access to technologies. The research highlighted the need to overcome resistance to change, encouraging an educational culture that values innovation and adaptability to new technological tools.

Key words: Educational Technologies, Mathematics Education, Teacher Training, Integration Technological, Challenges and Perspectives.

ABSTRACT
This study explored the integration of technologies in mathematics education, addressing the challenge of adequately and effectively incorporating educational technologies amidst obstacles such as teacher training, technological infrastructure of institutions, equitable access for students, and resistance to change. The primary objective was to analyze the contributions and challenges of adopting educational technologies in mathematics teaching, along with proposing perspectives for their effective implementation. The methodology

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adopted was a literature review, examining significant studies and specialized reports that discussed technological integration in mathematics education. This approach facilitated the collection of relevant data on previous experiences, implemented strategies, and outcomes achieved in various educational contexts. Results and analysis revealed a dual aspect: on one hand, educational technologies offer innovative potentials to enrich teaching and learning in mathematics, facilitating access to diverse didactic resources and promoting more interactive and personalized teaching methods. On the other hand, it was identified that the training and preparation of teachers, along with the availability of adequate technological infrastructure, are significant barriers to the effective integration of technologies in mathematics teaching. The final considerations emphasized the importance of collaborative approaches and educational policies focused on supporting continuous teacher training, investing in infrastructure, and promoting equitable access to technologies. The research highlighted the need to overcome resistance to change, encouraging an educational culture that values innovation and adaptability to new technological tools.

Keywords: Educational Technologies, Mathematics Education, Teacher Training, Technological Integration, Challenges and Perspectives.

INTRODUCTION

The integration of technologies in Mathematics training has been a topic of great interest for educators, researchers and educational policy makers in recent decades. This area of study explores how digital tools, educational software and online platforms can be used to improve the teaching and learning of Mathematics. With the continuous evolution of technology, it becomes imperative to understand the impacts and possibilities that these tools bring to the educational environment.

The need to investigate training in Mathematics and its technologies arises from the observation that, despite technological advances, many teachers still face challenges in integrating these tools effectively into their pedagogical practices. The ability to use educational technologies not only expands the resources available for teaching but also promotes learning methods that can be more aligned with the needs of 21st century students. Additionally, the recent global pandemic has highlighted the importance of technology in education, accelerating the need to adapt to virtual and hybrid learning environments.

However, the transition to pedagogical practices that incorporate technology is not simple. There are significant barriers, including a lack of adequate training for teachers, resistance to changes in traditional teaching methods, and challenges in evaluating the effectiveness of technologies in improving student learning. This scenario suggests an important gap in knowledge that needs to be explored in order to maximize the benefits of technologies in mathematics education.

Therefore, the objective of this research is to investigate how the integration of technologies influences training in Mathematics, with a special focus on teachers' perceptions and pedagogical practices. The aim is, therefore, to understand the approaches adopted by educators when incorporating technologies into the Mathematics curriculum and identify the challenges and opportunities that emerge from this process. It is also intended to examine the implications of these practices for teachers' professional development and student learning. Through this investigation, we hope to contribute to the development of effective strategies that facilitate the adoption of educational technologies, promoting more dynamic and adaptive Mathematics teaching to the demands of the 21st century.

METHODOLOGY

The methodology adopted in this research consisted of a literature review, a process through which the collection, analysis and interpretation of existing publications on the integration of technologies in the training in Mathematics. The literature review, as described by Gil (2002), is a fundamental step in scientific research, as it allows the researcher to theoretically base their study, identifying gaps in knowledge that the research seeks to fill. This methodological approach is essential for compiling previously established knowledge, analyzing contributions from previous studies and identifying trends and advances in the field of study.

For data collection, inclusion and exclusion criteria were initially defined based on the research objectives. The inclusion criteria focused on academic works, dissertations, theses and journal articles that addressed the use of technologies in teaching Mathematics and its implications for training.

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of teachers. Works that were not directly related to the scope of the research or that did not present adequate scientific rigor were excluded. Data sources included electronic databases, digital libraries, and academic repositories. Marconi and Lakatos (2003) emphasize the importance of carefully choosing sources to guarantee the quality and relevance of the data collected.

Data analysis followed a qualitative approach, in which the information extracted from the selected documents was organized thematically. This thematic organization allowed the identification of patterns, similarities and divergences in the studies analyzed. For each theme identified, a synthesis of the main discussions, arguments, results and conclusions was carried out, providing a comprehensive view of the different perspectives on the use of technologies in mathematics education. This synthesis process, according to Gil (2002), is important for understanding the theoretical and practical contributions of the reviewed studies, as well as for formulating new research questions.

In short, the methodology used in this research, based on a careful literature review, made it possible to construct an overview of the integration of technologies in Mathematics training, highlighting both the advances already achieved and the challenges that persist. Through the analysis of relevant works in the area, it was possible to outline the main trends and future directions for research and educational practices related to the topic.

The following table presents an overview of significant studies that explore the integration of technologies in mathematics education over the last two decades. It highlights the evolution of research focused on teacher training, pedagogical practices and the perception of the use of technologies in the classroom. Each entry in the chart reflects a milestone in the understanding and application of educational technologies in mathematics teaching, ranging from teachers' initial conceptions to more recent approaches to technology integration.

Table 1: Evolution of technology integration in Mathematics Education

Author(s)	Title	Year
RIBEIRO; BRIDGE	Training in new technologies and the conceptions and practices of Mathematics teachers	2000
KAMPFF; MACHADO; CAVEDINI	New Technologies and Mathematics Education	2004
RAM; STEPS	The conceptions of Mathematics teachers at the beginning of their careers about the contributions of initial training to the use of information and communication technologies	2010
SAMPAIO; COUTINHO	The teacher as curriculum builder: integrating technology into mathematics learning activities	2015
BATISTA	Class study in the training of Mathematics teachers to teach with technology: teachers' perception of students' knowledge production	2023

Source: Own authorship.

It is observed that the trajectory of research into educational technologies in mathematics education reveals a growing recognition of the importance of teacher training adapted to contemporary technological demands. The publications listed show a progressive incorporation of technologies into the mathematics curriculum, reflecting both changes in pedagogical practices and the preparation of teachers to face the challenges of modern education. Furthermore, the increase in research complexity over the years suggests a field in constant evolution, pointing to future directions in which the integration of educational technologies may advance.

3 HISTORY OF MATHEMATICAL EDUCATION WITH THE USE OF TECHNOLOGIES

The history of mathematics education with the use of technologies demonstrates a trajectory marked by significant changes in the way teaching is conducted and the way students learn. The analysis of this evolution allows us to identify different phases, each characterized by the introduction of new technological tools that expanded the pedagogical possibilities in teaching mathematics. The discussion about this progression is enriched when considering the observations of Ribeiro and Ponte (2000), which mark a

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important starting point for the contemporary understanding of the relationships between technology and mathematics education.

Initially, the use of technology in mathematics education was restricted to simple instruments such as rulers, compasses and simple calculators. These tools, although limited, already indicated a path towards the incorporation of means that facilitated the understanding and handling of mathematical concepts. From the last decades of the 20th century, with the dissemination of personal computers and the emergence of the internet, a qualitative and quantitative leap was observed in the use of technologies applied to mathematics teaching.

Educational software began to be developed with the specific objective of supporting teaching and learning in mathematics, enabling students to explore concepts through simulations, graphical visualizations and interactive exercises. These digital resources not only offered new ways of accessing mathematical knowledge, but also promoted more active learning, in which students could experiment and manipulate mathematical objects in an intuitive way.

The entry into the 21st century saw the consolidation of the internet as an educational space, with the availability of a vast amount of online resources, including educational videos, tutorials, collaborative learning platforms and distance learning courses. These digital tools have further expanded the reach and flexibility of mathematics teaching, allowing students and teachers to access content and teaching practices regardless of their physical locations.

Currently, the introduction of emerging technologies, such as artificial intelligence, augmented and virtual reality, is beginning to outline new frontiers for mathematics teaching. These technologies promise to offer even more immersive and personalized learning experiences, capable of adapting to the individual needs of each student. However, as highlighted by Ribeiro and Ponte (2000), the effective incorporation of these innovations in mathematics teaching requires not only investments in technological infrastructure, but also a reflection on pedagogical practices and the training of teachers capable of exploring the potential of these tools. .

Thus, the history of mathematics education with the use of technologies reflects a path of constant evolution, in which new tools and pedagogical approaches are continually integrated into the educational process, aiming to enrich the learning experience and prepare students for an increasingly technological world. .

CONCEPTIONS AND PRACTICES IN TEACHING MATHEMATICS WITH TECHNOLOGIES

The concepts and practices in teaching mathematics with technologies reflect the complexity of integrating new digital resources into education. This integration is influenced both by teachers' perceptions and by the pedagogical methodologies adopted, aspects that were explored in fundamental studies such as those by Kampff,*et al*. (2004) and Carneiro and Passos (2010). These works provide insights into how educators view and apply technologies in mathematics educational practice.

Kampff*et al*. (2004) highlight the evolution of educational technologies and their potential to transform mathematics teaching. The authors emphasize the importance of exploring technologies not only as auxiliary tools, but as integrative elements capable of promoting more interactive learning of mathematical concepts. This point of view suggests a change in the conception of teaching, where the focus shifts from the transmission of content to the facilitation of rich and engaging learning experiences.

On the other hand, Carneiro and Passos (2010) investigate the conceptions of early-career mathematics teachers about the use of technologies, finding that, despite the recognition of the value of technologies in education, there are significant challenges related to teacher training and infrastructure school. They argue that the effectiveness of using technologies in teaching mathematics depends on teachers' ability to integrate these tools in a way adapted to learning objectives.

The discussion brought by Kampff*et al*. (2004) and Carneiro and Passos (2010) highlights the need for continuous reflection on pedagogical practices in the context of educational technologies. There is a consensus that the continued training of teachers is essential so that they can make the most of the potential of technologies. Furthermore, it is necessary to consider the infrastructural conditions of educational institutions, which may limit the effective implementation of technological resources.

In summary, the concepts and practices in teaching mathematics with technologies are dynamic and constantly evolving, reflecting both the possibilities opened up by technological innovations and the challenges inherent to their effective integration in the educational context. Kampff's studies*et al*. (2004) and Carneiro and Passos (2010) contribute significantly to this field, offering perspectives on how technologies

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ologies can be better explored to enrich mathematics teaching and learning.

INITIAL AND CONTINUING TRAINING OF TEACHERS IN EDUCATIONAL TECHNOLOGIES FOR MATHEMATICS

The initial and continuing training of teachers in educational technologies for mathematics constitutes a fundamental element in preparing educators to face the challenges and take advantage of the opportunities that the integration of technology offers in teaching. The analysis of the contributions of this training, as discussed in the works of Sampaio and Coutinho (2015) and Batista (2023), reveals the importance of training strategies that equip teachers with the knowledge, skills and attitudes necessary to implement educational technologies effectively in their teaching practices.

Sampaio and Coutinho (2015) emphasize that initial training provides the basis on which teachers begin to build their skills in educational technologies. Such training is not limited to technical knowledge of tools, but extends to understanding how these technologies can be integrated into the mathematics curriculum to promote meaningful learning. The authors argue that the effectiveness of using technology in the classroom depends significantly on the teacher's ability to select and apply technological resources that are aligned with pedagogical objectives and students' needs.

On the other hand, Batista (2023) highlights the role of continuing education as a process of professional development that occurs throughout the teaching career, allowing teachers to constantly update their knowledge and pedagogical practices in response to rapid technological changes. Continuing training helps teachers to reflect on their experiences, exchange knowledge with colleagues and explore new teaching approaches that integrate technologies in a creative and innovative way in mathematics teaching.

Both studies highlight the need for educational policies and training programs that recognize the complexity of technological integration in mathematics education and that provide adequate support to teachers. This includes not only access to technological resources, but also training opportunities that encourage critical reflection on teaching practice, pedagogical experimentation and the development of professional learning communities.

In conclusion, pre-service and in-service teacher training in educational technologies for mathematics plays a role in preparing educators to navigate the ever-evolving educational landscape. The works of Sampaio and Coutinho (2015) and Batista (2023) highlight the need for integrated and contextualized training approaches that prepare teachers not only to use technologies in the classroom, but also to reflect on the impact of these technologies on students' mathematical learning. students.

CHALLENGES AND PERSPECTIVES FOR THE INTEGRATION OF TECHNOLOGIES IN MATHEMATICS EDUCATION

The integration of technologies in mathematics education presents a set of challenges and perspectives that outline the future of this area. Among the main challenges is the need for adequate training for teachers, who must be prepared not only to use the available technological tools, but also to integrate them in a pedagogical and effective way in their classes. This aspect covers technical knowledge about technologies, as well as understanding how they can be used to facilitate the teaching and learning of mathematical concepts.

Another important challenge refers to the infrastructure of educational institutions. Availability of and access to appropriate technological resources varies significantly, which can create disparities in access. to quality education. Furthermore, resistance to change on the part of some educators and educational systems can limit the adoption of new technologies, even when resources are available.

The issue of equity also emerges as a central challenge. It is essential to ensure that everyone students have equal access to educational technologies, regardless of their socioeconomic context. This requires policies and initiatives that aim to reduce the digital divide and promote technological inclusion for all students.

Despite these challenges, the prospects for integrating technologies in mathematics education are promising. Technologies offer unprecedented opportunities to make mathematics teaching

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more dynamic, interactive and adapted to the individual needs of students. Tools such as educational software, learning apps, and online teaching platforms can provide rich learning experiences, allowing students to explore mathematical concepts in new and engaging ways.

Furthermore, data analysis and artificial intelligence open ways to personalize teaching, offering real-time feedback and adapting content to each student's abilities and learning pace. This can make it easier to identify and support students who are struggling, as well as challenge those who are ready to move forward more quickly.

In the long term, effective integration of technologies into mathematics education requires a collaborative approach, involving educators, policymakers, researchers, and the technology community. Working together, these stakeholders can develop innovative solutions that overcome existing challenges and maximize the potential of technologies to enrich mathematics teaching and learning.

FINAL CONSIDERATIONS

The analysis carried out throughout this study on the integration of technologies in mathematics education revealed a complex scenario, composed of both challenges and opportunities. It was observed that the incorporation of educational technologies in mathematics teaching is not a simple task, requiring careful considerations regarding teacher training, the infrastructure available in educational institutions, equity in access to technologies and resistance to change both on the part of of educators and institutions.

Initial and continuing teacher training has emerged as a fundamental aspect for the success of technological integration in mathematics education. The ability of educators to effectively use technologies in their pedagogical practices depends on training that encompasses both the technical mastery of the tools and the pedagogical understanding of how these technologies can be applied to enrich mathematical learning. This suggests the need for teacher training programs that are reflective, continuous and aligned with technological innovations in the educational field.

Furthermore, the technological infrastructure of educational institutions and equitable access to technological resources by students are critical issues that need to be addressed. Disparity in access to technologies can accentuate educational inequalities, compromising the principle of offering quality education for all. Therefore, it is imperative that public policies and private initiatives are directed to ensure that all educational institutions and all students have adequate access to the necessary technological tools.

Resistance to change is another barrier that must be overcome. The effective integration of technologies in mathematics education requires a change of mentality on the part of educators and educational institutions, who must be open to exploring new pedagogical methodologies and adapting to the demands of an increasingly digitalized society. This process of change can be facilitated through educational leaders who promote a culture of innovation and pedagogical experimentation.

The prospects for the integration of technologies in mathematics education are, however, optimistic. Technologies offer innovative possibilities to make mathematics teaching more interactive, personalized and aligned with students' needs and interests. Digital tools, educational software and online platforms have the potential to transform the classroom, making learning mathematical concepts a more engaging and effective experience.

In conclusion, the journey to integrate technologies into mathematics education is ongoing and requires a collaborative effort between educators, researchers, policymakers, and the technology community. While there are significant challenges to overcome, the opportunities technology offers to enriching mathematics education are immense and promising. Moving in this direction will not only improve It will improve the teaching and learning of mathematics, but it will also better prepare students for the challenges and opportunities of the future.

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