

The Role of Technology in Mathematics Education: Promoting Student Achievement

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Abstract: In the age of the internet, technology has ingrained itself into every area of our lives and society, including education. Technology's influence on education has changed drastically, especially in the area of mathematics, since it continues to advance at a rapid rate. It greatly contributes to the promotion of student achievement. This article explores the many facets of technology's influence in mathematics education and shows how changes in technology have completely changed how math is taught and studied.

Keywords: Mathematics, Technology, Achievement, Online Resources

1. Introduction

The accessibility and availability of online learning platforms is one of technology's most significant contributions to mathematical education. These platforms provide students with possibilities to interact interactively with mathematical topics by offering a multitude of materials including video tutorials, interactive lectures, and virtual simulations (Bakker & Derry, 2011). Due to the accessibility of educational resources through online platforms, students may learn at their own speed and repeat difficult subjects as needed which positively impacts their development.

Additionally, instructional applications have become effective instruments for increasing math knowledge (Hegarty & Narayanan, 2018). These applications include tools that encourage student engagement and motivation, such as gamification components, adaptive tests, and real-time feedback. Gamification makes math learning engaging and rewarding by enabling students to take part in interactive games and challenges. By adapting information to student requirements, adaptive assessments personalize learning experiences and guarantee that each learner advances at their own rate. Real-time feedback assists students in identifying their areas of weakness and offers focused coaching to improve their arithmetic abilities.

Additionally essential to the transformation of mathematics teaching are interactive technologies. Students can utilize graphing calculators, geometry software, and virtual manipulatives to investigate mathematical

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ideas with the help of technology. With these tools, students may manipulate mathematical objects, experiment with different scenarios, and visualize abstract notions, which helps them grasp mathematical concepts better. Technology fills the gap between abstract ideas and practical applications by offering interactive and visual representations, making mathematics more approachable and accessible.

Technology has not only transformed the way we study but has also made math instruction more individualized. Artificial intelligence-driven adaptive learning systems evaluate student performance and offer personalized recommendations and resources based on each student's strengths and limitations. Students may concentrate on areas that need more attention, get tailored interventions, and advance at their own speed using this individualized method. Therefore, students can get a solid foundation in mathematics and increase their self-confidence.

The results of educational reform in mathematics have significantly improved because of technological integration. According to research, students who use technology in math classes are more motivated, have better conceptual comprehension, and have better problem-solving abilities. Technology appeals to a variety of learning styles and encourages active learning by presenting mathematical topics in interesting and interactive ways (National Council of Teachers of Mathematics, 2020). This improves information retention and application.

The use of cutting-edge technologies, resources, and platforms that promote student engagement, enable individualized learning experiences, and boost overall educational results has transformed mathematics teaching. It is essential for educators to embrace technological innovations as they happen and use them to provide engaging and interactive learning environments (Jimola & Adeleke, 2022). We can motivate a new generation of mathematically literate people with the abilities and competences required for success in the digital age by using the power of technology.

Enhanced Learning Platforms: The availability of online learning platforms is one of the major contributions of technology to mathematical education. These online materials are available anytime, anywhere, and include interactive courses, video lectures, and practice activities (Celik, Darici, Yildiz & Yucesdal, 2022). Students may work through the content at their own speed, reinforcing ideas and focusing on weak points. The ease of use and adaptability of online learning environments enable students to take charge of their education and encourage self-directed learning.

2. Educational Apps

Educational applications have gained popularity as a tool for mathematics instruction with the emergence of smartphones and tablets. These programs make learning mathematics more entertaining and accessible by offering interactive and interesting experiences. Students may engage in hands-on exploration of mathematical ideas through gamification and interactive simulations, leading to greater knowledge and retention. Educational applications also provide tailored learning routes that adjust to the requirements of each individual learner. These applications assess students' strengths and weaknesses using sophisticated algorithms and offer personalized practice sessions and feedback. This individualized method enables students to advance at their own rate and concentrate on growth areas. Students are more engaged and find learning mathematics more pleasurable because to interactive elements and real-time feedback.

Educational applications encourage autonomy and a deeper comprehension of mathematical ideas by giving students the tools to take charge of their own learning (Sengupta & Moyer-Packenham, 2019). As a result of providing individualized learning opportunities and encouraging student achievement, technology, in particular educational applications, has dramatically improved mathematics instruction.

Interactive Tools: The use of technology has expanded the scope of interactive mathematics learning (Lai, Headage, & Knezek, 2013). Students may view and manipulate mathematical objects using virtual manipulatives, graphing calculators, and geometry software, which helps to make abstract ideas more concrete. Students can get a greater knowledge of mathematical concepts because to the facilitation provided by these instruments for research and experimentation. Students may actively create their knowledge and improve their problem-solving abilities by using interactive tools, which will result in a deeper understanding of mathematics.

Real-world Applications: Technology also fills the gap between mathematical concepts learned in school and their practical applications. Students may relate mathematical ideas to real-world situations using interactive simulations and modeling tools, illustrating the value and usefulness of mathematics in a variety of professions. There are several advantages to involving students in real-world situations and data sets while teaching mathematics, many of which enhance their overall learning and growth. This method goes beyond standard classroom activities and textbook examples, enabling students to apply mathematical ideas to real-world contexts and consider their importance.

Students are exposed to the intricacies and difficulties that emerge in varied situations as they work on real-world problems. As they assess the issue, divide it into manageable chunks, and come up with solutions, kids develop critical thinking abilities. They learn to think creatively, link various mathematical ideas, and hone problem-solving skills that may be used to a variety of contexts.

Additionally, working with real-world data sets helps students to get a greater understanding of how mathematics plays a part in resolving complicated problems. They are aware of the importance of mathematics in understanding the world and making defensible judgments. Students learn how to apply mathematical modeling, statistical analysis, and data interpretation to several domains, including economics, science, engineering, and the social sciences, to acquire useful insights and answers.

Students' enthusiasm and engagement in mathematics are also increased when they work with real-world issues and data sets. The learning experience is made more meaningful and concrete by the exercises' practical significance. Mathematical ideas are directly applied, and students may observe how they are applied in practical settings. This link to the actual world piques students' interest, promotes a better comprehension of mathematical ideas, and inspires them to continue learning about mathematics.

Incorporating real-world issues and data sets into mathematics education is a potent strategy that fosters critical thinking skills, problem-solving prowess, and an understanding for the practical applications of mathematics. Students acquire important skills and information that go beyond the classroom by working on actual and difficult projects, enabling them to succeed in the real world.

Challenges and Considerations: Although integrating technology into mathematics instruction has many advantages, there are several issues that need to be considered. The digital gap, where inequities in access

to technology may obstruct prospects for egalitarian learning, is one major cause for worry. To close this gap, initiatives must be implemented, such as giving underserved populations access to gadgets and dependable internet service. In order to successfully incorporate technology into their teaching methods and ensure its best usage as a tool for improved learning, instructors also need proper training and support.

By embracing technology and its potential to revolutionize mathematics education, we can build dynamic and stimulating learning environments that enable students to develop their mathematical competence and critical thinking skills (Means, Baka, & Murphy, 2014).

Implementation Techniques: A variety of techniques may be used to integrate technology into mathematics instruction. In order to improve educators' digital literacy abilities and their capacity to incorporate technology into their teaching methods, professional development programs for teachers should be designed first. The main goal of this training should be to acquaint instructors with the numerous educational applications, online resources, and interactive technologies so they may choose and use the ones that are most suited to the requirements of their students.

Collaboration between curriculum developers, technological experts, and instructors is also essential. Together, these parties may decide on the best methods to integrate technology into the mathematics curriculum while keeping it in line with learning goals and academic standards. This partnership may lead to the creation of thorough lesson plans, engaging exercises, and tech-enhanced evaluations that improve student comprehension and engagement.

Furthermore, it is crucial to provide a welcoming and inclusive learning atmosphere. The use of technology in collaborative projects or online conversations that promote peer engagement and information sharing should be encouraged by teachers (Wang, 2016). In order to help students, feel competent and at ease using these tools, instructors should give them continual feedback and assistance as they navigate technology-based learning experiences. Here are several major justifications for why ensuring equal access to technology is important for reducing educational disparities:

Bridging the digital divide: The term "digital divide" refers to the difference in access to information and communication technologies (ICTs) across people and communities. Lack of access to digital tools places students from underprivileged families or underserved communities at a substantial disadvantage when compared to their classmates. This gap may worsen already-existing disparities and restrict their ability to pursue higher education.

Enabling equitable learning opportunities: The use of technology in education makes a wide range of materials and technologies available that can improve learning occasions (Pape & Hoshanot, 2001). It gives users access to digital textbooks, instructional websites, online libraries, and interactive learning tools. It guarantees a level playing field and equal chances for learning when all students have equal access to these resources, regardless of their socioeconomic background or geographic location.

Building 21st-century skills and digital literacy Digital literacy and competency are critical abilities for kids to excel academically and in their future employment in today's technology-driven society. Students from all backgrounds may acquire these abilities and become skilled at utilizing digital tools, conducting research, critically analyzing information, and interacting with others by offering equal access to

technological resources. The development of these vital abilities is hampered by unequal access to technology, which worsens the skills gap.

Supporting customized and adaptable learning: Technology can help provide learning opportunities that are individualized and adaptive to the requirements of each individual learner. Students may practice at their own speed, receive quick feedback, and receive individualized training with the use of online educational platforms and adaptive software. The advantages of individualized learning are lost if certain students do not have access to these technologies, which might impair their academic advancement.

Getting ready for a digital future with students: Inequitable access to technology has an influence on students' future opportunities as well as their current educational experiences. Digital literacy and technology competence are becoming more important abilities in today's workforce. By ensuring that all students have equitable access to technological resources, we provide them the tools they need to succeed in the digital age and compete on an even playing field for future possibilities.

Together, educational institutions, politicians, and communities must address these issues in order to close the digital gap. This can be accomplished by taking steps like giving underprivileged students access to devices and the internet, establishing technology-rich learning environments in classrooms, providing digital literacy training programs, and collaborating with organizations to secure funding and resources for technology initiatives.

In order to eliminate educational disparities, fair access to digital resources is essential. We can build a more inclusive and equitable learning environment where all students can utilize the advantages of technology in education, enabling them to realize their full potential regardless of their origins or circumstances. Additionally, instructors must find a balance between using technology and upholding a solid grounding in mathematical ideas, making sure that technology is used to enhance learning rather than to replace comprehension.

Technology's incorporation into mathematics education calls for a change in how assessments and evaluations are conducted. In a technologically advanced setting, traditional paper-and-pencil assessments might not be able to accurately capture students' grasp of mathematical ideas. Alternative assessment techniques should be used instead, such performance-based assignments, online tests, and projects that let students use technology to demonstrate their problem-solving and critical thinking skills.

To give a thorough assessment of students' development, both formative and summative evaluations must be considered. Throughout the course of the learning process, formative assessments can be carried out to track student performance, spot weak areas, and give prompt feedback. Summative tests, on the other hand, may be created to gauge students' general comprehension of mathematical ideas as well as their capacity to use them in practical situations.

3. Conclusion

The use of technology in mathematics education has a great deal of potential to change the educational process and enhance student performance. Using interactive tools, instructional applications, and online learning platforms, instructors may design tailored learning environments that meet the requirements of a

wide range of students. However, it is essential to address issues like the digital divide and provide teachers the right kind of assistance and training.

Technology may enable students to build a thorough knowledge of mathematics, improve critical thinking abilities, and get ready for success in an increasingly digital world with cautious implementation tactics and intelligent evaluation procedures. We can create a future where mathematics is approachable, engaging, and meaningful for all learners by embracing technology as a useful tool in mathematics teaching.

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