

Role of ICT for Mathematics Teaching

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Abstract: Mathematics has traditionally been taught using the chalkboard method, but in recent years, many new teaching methods have emerged, including the use of Information and Communication Technology (ICT). Online platforms like BYJU'S, Vedantu, Toopr, and Doubtnut are increasingly being used by students for mathematics learning, with advantages such as flexibility, interactive features, and access to a wealth of resources. However, there are also some challenges associated with using ICT in mathematics teaching, such as the need for reliable internet connectivity, the risk of distraction and reduced engagement, and concerns about the quality and effectiveness of online resources. This paper aims to explore the various ways in which ICT is being used to teach mathematics, and to provide an analysis of the pros and cons of this approach.

Keywords: ICT, Collaborative learning, Visual aids.

Introduction: Mathematics is often considered the most fundamental of all fields of study, with its scientific basis lending itself to unique insights into the natural phenomena of the world around us. Despite this, some teachers may lack a deep understanding of mathematical concepts and theories, and it is important to address any such discrepancies. With the rise of computer technology and online resources, there has been a growing interest in replacing teachers with digital tools. However, the assumption that students will benefit simply from access to software and hardware is a dangerous one, perpetuating the myth that technology is a panacea for educational issues. Moreover, this mindset has led some students to become disrespectful and dismissive of their teachers, with the mistaken belief that they can learn everything they need to know from online apps and search engines. Thus, while ICT may be a useful tool for online teaching, it is important to recognize the potential downsides and limitations of this approach.

The use of ICTs in mathematics teaching has several advantages, including the ability to offer visual and interactive representations of mathematical concepts. The integration of visual aids, such as diagrams, graphs, and simulations, has been found to enhance students' understanding of complex mathematical concepts. For example, Drijvers et al. (2010)¹ found that the use of dynamic geometry software resulted in a deeper understanding of geometric concepts. Additionally, ICTs facilitate real-time feedback and assessment, allowing teachers to monitor student progress and provide timely feedback. For instance, Dorfman and Mayfield (2015)⁵ discovered that the use of an online assessment tool helped teachers identify student misconceptions and adjust their teaching accordingly. Moreover, ICTs foster collaborative learning opportunities, enabling students to work together on mathematical problems and projects. English and Sriraman (2010)² reported that the use of online collaborative tools enhanced students' problem-solving and communication skills. Thus, the literature highlights the potential benefits of integrating ICTs in mathematics teaching.

Methodology: This study utilized a survey method to investigate the use of Information and Communication Technology (ICT) in mathematics teaching, as well as the barriers that teachers face in integrating ICT into their teaching practices. The survey was conducted during the COVID-19 pandemic and was administered to mathematics teachers in schools and colleges in Haryana. The survey was distributed through a Google form, and a total of 173 responses were received and analyzed using Excel. The questionnaire was structured into several sections, including the teacher's profile, their use of ICT, professional development activities, their experience with ICT, barriers faced by teachers, and the students' experience with ICT.

Benefits of ICT in Mathematics Teaching: The benefits of using ICT in mathematics teaching can be summarized as follows:

Visual and Interactive Representations: ICT tools offer visual aids like graphs, diagrams, and simulations that help students understand complex mathematical concepts. Dynamic geometry software, for instance, helps students develop a deeper understanding of geometric concepts.

Collaborative Learning: The utilization of ICT tools in mathematics education creates opportunities for collaborative learning, enabling students to collaborate on mathematical

problems and projects. Online collaborative tools can facilitate the development of important skills, such as problem-solving and communication, as students work together to achieve their common goals.

Personalized Learning: ICT tools offer personalized learning experiences that cater to individual student needs. Adaptive learning software, for instance, adjusts the learning pace and level of difficulty to match the student's proficiency.

Accessibility: Sriraman (2010)³ found that ICT tools offer greater accessibility to mathematics education, especially for students in remote areas or with physical disabilities. Online learning platforms, for instance, offer flexible and convenient access to mathematics education.

Engaging and Motivating: Das (2019)⁶ found that ICT tools offer engaging and motivating learning experiences that enhance student interest and participation in mathematics education. Gamification, for instance, makes learning mathematics fun and interactive.

Overall, the use of ICT in mathematics teaching has several advantages, including enhanced learning outcomes, improved student engagement, and increased accessibility to mathematics education.⁸

Constraints/ Limitations of ICT in Teaching: There are several limitations and constraints that both teachers and students face when using ICT in teaching. For instance, inadequate ICT facilities and lack of ICT training or knowledge may make it difficult for teachers to effectively use ICT tools. Even when professional development courses are provided, they may not adequately address the specific needs of teachers or help them integrate ICT tools into their teaching experiences⁷. Additionally, issues such as poor internet connectivity and equipment malfunction can further hinder the use of ICT in teaching. Students may also face challenges such as poor infrastructure and internet connectivity, as well as a lack of knowledge on how to use ICT tools effectively. Moreover, Kopcha (2012)⁴ found the misuse of internet facilities or ICT tools can be a problem, and the transformation of knowledge may be incomplete due to limited face-to-face interactions. Teachers may also face constraints when creating digital content, as the scope of explanation may be restricted by time limits, and the content may be too complicated or not self-explanatory for students to understand easily.

Result and Discussion: After analyzing data collected from Mathematics Teachers in schools and colleges across Haryana, it was observed that a majority (71%) of the respondents regularly used computers, indicating a high level of computer literacy. Additionally, 66% of teachers expressed satisfaction with various ICT applications. When it came to using ICT in the classroom, 52% of the respondents used WhatsApp to share data with their students, while 43% used ICT as presentation tools, 7.3% used it as a graphical visualizing tool, 6% used it for online demonstrations, and 2% used it for other purposes. However, about 20% of the respondents did not use ICT in the classroom. Table 1 shows percentage of use of ICT in classroom. In terms of internet usage, 58.5% of the respondents used it for browsing, 24.1% used email, 17.8% used chat rooms, 7% used it for discussion forums, and 3% used it for other purposes. However, 17.1% of respondents did not use the internet. Table 2 shows percentage of use of ICT by teachers. Regarding online teaching, only 19% of students were found to be learning from online teaching. Moreover, while 21% of teachers expressed satisfaction with the internet facilities provided by their institutions for online teaching, only 8% found the online teaching tools to be good. Furthermore, 9% of teachers found online teaching to be stressful, while 27% of students found it to be stressful as well. However, the majority (59%) of respondents still preferred face-to-face communication as opposed to remote teaching.

Table 1: Use of ICT in Classroom

Activity	Via WhatsApp	Presentation tools	Graphical visualizing tool	Online demonstrations	Other purposes	None
Response (%)	52	43	7.3	6	2	20

Table 2: Use of Internet by Teachers

Activity	Browsing	Email	Chat rooms	Discussion forums	Other purposes	None
Response	58.5	24.1	17.8	7	3	17.1

(%)						
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The results suggest that Mathematics Teachers in Haryana schools and colleges are proficient in using computers and ICT in the classroom. However, some teachers may benefit from additional training and support to increase their usage of ICT. WhatsApp is a widely used platform for sharing data with students, while internet usage is not yet universal among teachers. The preference for face-to-face communication over online teaching highlights the need for further investment in the development of effective online teaching tools and resources.

Conclusion: This paper discusses the use of ICT in mathematics teaching. The benefits of using ICT in mathematics teaching include visual and interactive representations of mathematical concepts, real-time feedback and assessment, collaborative learning opportunities, personalized learning experiences, greater accessibility to mathematics education, and engaging and motivating learning experiences. However, there are also limitations and constraints, including inadequate ICT facilities and training, poor internet connectivity, and equipment malfunction. The paper suggests that although ICT can serve as an effective means of teaching mathematics, it is crucial to acknowledge its possible disadvantages and constraints. The methodology used in the study is a survey of mathematics teachers in schools and colleges in Haryana, and the paper provides an analysis of the results.

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