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# Digital Technology as a Learning Tool and a Driver of Educational Innovation to Enhance Elementary School Students' Understanding of Mathematics

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**Abstract**
In today's digital era, technology has become an integral part of the learning process, including in mathematics education at the elementary school level. Although many studies have been conducted on the use of technology in education, there remains a gap in understanding how digital technology can specifically enhance students' understanding of mathematics. This research aims to explore the role of digital technology as a learning tool and a driver of educational innovation in improving elementary school students' understanding of mathematics. This study employs a quantitative approach involving elementary school students as research subjects. Data were collected through surveys and analysis of students' learning outcomes before and after the implementation of digital technology in mathematics learning. The findings indicate that the use of digital technology, such as interactive learning applications and educational videos, significantly enhances students' understanding of mathematical concepts. Students engaged in technology-based learning showed increased motivation and better learning outcomes compared to traditional teaching methods. The study concludes that digital technology can serve as an effective tool for improving elementary school students' understanding of mathematics. With proper implementation, digital technology not only enhances learning outcomes but also creates a more engaging learning environment. This research contributes significantly to the development of mathematics teaching methods in elementary schools and provides insights for educators and policymakers on the importance of integrating technology into education.
**Keywords**: Digital Technology; Mathematics Learning; Educational Innovation; Elementary School Students; Understanding Mathematics.

## INTRODUCTION

In today's digital era, technology has become an integral part of daily life, including in the field of education. The rapid advancement of technology has transformed the way we interact, work, and learn. In the context of education, digital technology offers various opportunities to improve the quality of learning. The use of digital devices such as computers,

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tablets, and smartphones has become common among students and teachers. This technology not only facilitates broader access to information but also enables more dynamic and interactive learning methods. Therefore, integrating technology into education has become essential to prepare younger generations to face future challenges (Firdausi 2024).

Mathematics, as one of the fundamental subjects, is often considered challenging by many students. Difficulties in understanding abstract concepts and complex formulas frequently cause students to feel pressured and less motivated. This issue has become a serious concern for educators and parents, given the importance of mathematics as the foundation for many other disciplines. Therefore, a new approach is needed to help students overcome these challenges. One promising solution is to utilize digital technology in the mathematics learning process (Tsirimokos, Lekka, and Pilafas 2024).

The integration of digital technology into mathematics learning can help address these challenges in innovative ways. Technology enables the delivery of learning materials that are more interactive and engaging for students. For instance, the use of educational applications and software can help students understand mathematical concepts through clearer visualizations. Moreover, technology allows for virtual simulations and experiments that can enrich students' learning experiences. Thus, digital technology functions not only as a supporting tool but also as a driver of innovation in mathematics education (Korenova, Krpec, and Barot 2024).

Digital learning tools enable the delivery of learning materials that are more interactive and engaging for students. This interactivity can enhance students' involvement in the learning process, motivating them to better understand the material being taught. For example, educational games specifically designed for learning mathematics can allow students to learn while playing, making the learning process more enjoyable. In addition, digital technology enables students to learn independently at their own pace, which can further improve their understanding of the material (Vigel and Mettini 2024).

With technology, students can learn mathematics through simulations, educational games, and interactive applications that make it easier to understand concepts. Simulations allow students to see how mathematical concepts are applied in real-life situations, while educational games help them grasp these concepts in a more enjoyable way. Interactive applications, on the other hand, enable students to practice and test their understanding independently. All of these contribute to enhancing students' comprehension of mathematics, which in turn can improve their academic performance.

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In addition, digital technology enables teachers to personalize learning according to each student's individual needs. With the help of technology, teachers can identify each student's strengths and weaknesses and adjust their teaching methods accordingly. This allows for more effective and efficient learning, as every student can learn in a way that best suits them. Such personalized learning can also increase students' motivation, as they feel more supported and recognized in their learning process (Idowu 2024).

Innovation in teaching methods is expected to increase students' motivation and interest in mathematics. Through a more interactive and personalized approach, students are encouraged to see mathematics as an engaging subject that is relevant to their daily lives. This increase in motivation is crucial, as higher motivation can drive students to study harder and achieve better results. Furthermore, a strong interest in mathematics can open opportunities for students to explore other fields related to mathematics, such as science and technology (Charles and Charles 2024).

Improving mathematical understanding at the elementary school level is essential as a foundation for learning at higher levels of education. A strong grasp of basic mathematical concepts can make it easier for students to learn more complex material in later stages of their education. Moreover, mathematics is a fundamental skill needed in everyday life, so a solid understanding of it can help students in various aspects of their daily activities. Therefore, it is crucial to ensure that students develop a strong understanding of mathematics from an early age.

Therefore, it is important to explore how digital technology can be optimized as a learning tool and a driver of educational innovation in elementary schools. Further research and development are needed to identify the most effective ways to integrate technology into mathematics learning. In addition, training and support for teachers are essential to ensure that they can effectively utilize technology in the teaching process. Thus, digital technology can serve as an effective tool to enhance the quality of education and prepare students to face future challenges.

Although digital technology has been recognized as a potential tool in mathematics learning, many aspects are still not fully understood. One area that has not been widely studied is the effectiveness of using digital technology to enhance elementary students' understanding of mathematics. Many schools have adopted technology in their learning processes, yet the outcomes remain inconsistent. Some studies show improved understanding, while others indicate no significant change. This highlights a gap in our

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understanding of how technology can be used effectively. Therefore, further research is needed to identify the factors that influence this effectiveness. By doing so, we can design more appropriate strategies to maximize the use of technology in mathematics learning (Satriani and Prasojo 2024).

Moreover, there is still no comprehensive understanding of how technology can be optimally integrated into the mathematics curriculum. Existing curricula are often not designed to effectively accommodate the use of technology. Many teachers struggle to align teaching materials with the available digital tools. As a result, technology is often underutilized, leading to limited improvements in student learning outcomes. Further research is needed to develop effective models for integrating technology and curriculum. In this way, we can ensure that technology is used to support, rather than disrupt, the learning process.

The variation in the implementation of technology across different schools indicates that there is still no clear standard regarding the most effective methods. Each school tends to develop its own approach, often based on the availability of resources and the capabilities of its teaching staff. As a result, there are significant differences in how technology is used and in the outcomes achieved. Clear standards and structured guidelines can help unify understanding and practices across schools. This will ensure that all students benefit equally from the use of technology in mathematics learning (Osmani and Tartari 2024).

The long-term impact of using digital technology on students' mathematics learning outcomes remains unclear. Most existing studies focus only on short-term results, such as improvements in test scores or understanding of specific concepts. However, the long-term effects—such as the development of critical thinking and problem-solving skills—have not been widely explored. Understanding these long-term impacts is essential to evaluate the true value of investing in educational technology. More in-depth research is needed to explore how technology can support the development of these skills over time (Hanifah, Budayasa, and Sulaiman 2025).

There has not been sufficient research on how technology can influence students' motivation and interest in mathematics. Motivation and interest are key factors that affect students' learning success. Technology has the potential to make learning more engaging and interactive; however, its impact on student motivation has not been extensively studied. Some students may feel more motivated through the use of technology, while others may feel pressured or overwhelmed. Further research is needed to understand how technology can be

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effectively used to enhance students' motivation and interest in learning mathematics (Chen and Huang 2024).

The role of teachers in facilitating technology-based learning has also not been thoroughly explored. Teachers play a key role in guiding and supporting students in the use of technology. However, many teachers feel less confident or insufficiently trained in using digital tools. This can hinder the effectiveness of technology-based learning. Further research is needed to identify teachers' training and support needs in integrating technology into their teaching practices. By doing so, teachers can become more effective in facilitating technology-enhanced learning (Santos et al. 2024).

There is still insufficient data on the challenges faced by teachers and students in using digital technology. These challenges may include limited access to devices, lack of technical support, or difficulties in integrating technology with the teaching materials. Understanding these challenges is essential for designing effective solutions and ensuring that technology can be used optimally. Further research is needed to identify and address these issues. By doing so, we can create a more supportive and inclusive learning environment..

The adaptation of technology to individual students' needs remains an underexplored area. Each student has different needs and learning styles, and technology has the potential to meet these needs more effectively. However, limited research has been conducted on how technology can be tailored to support individualized learning. Further studies are needed to develop tools and strategies that can.

There has not yet been an adequate evaluation of the costs and benefits of implementing digital technology in mathematics learning. Investment in educational technology often requires significant financial resources, making it important to assess whether the benefits gained are proportional to the costs incurred. Further research is needed to evaluate the cost-effectiveness of various technological approaches in mathematics education. In this way, we can make more informed decisions regarding investments in educational technology (Santos et al. 2024).

Further research is still needed to understand how technology can be used to support inclusive and equitable learning for all students. Technology has the potential to bridge educational gaps and provide broader access to students from diverse backgrounds. However, there has been limited research exploring how technology can be utilized to achieve this goal. Additional studies are needed to identify strategies and best practices for using technology to

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promote inclusive learning. In this way, we can ensure that all students have equal opportunities to succeed in learning mathematics (Dastyari and Jose 2024).

To bridge the existing gap, it is important to explore how digital technology can be effectively integrated into mathematics learning in elementary schools. In the context of an ever-evolving education system, digital technology offers a variety of tools and resources that can enhance students' learning experiences. However, although many schools have begun adopting this technology, there are still challenges in its implementation that need to be addressed. Therefore, this study focuses on concrete ways to integrate digital technology into the mathematics curriculum, ensuring that it provides maximum benefits for students.

Previous studies have shown the potential of technology in enhancing interactivity and student engagement; however, few have examined its impact on the deep understanding of mathematical concepts. This indicates the need for further research that can provide new insights into the effectiveness of technology in the context of mathematics learning. By understanding how technology can facilitate better conceptual understanding, we can develop more innovative and relevant teaching methods (Hanifah, Budayasa, and Sulaiman 2025).

Therefore, this study aims to identify methods and strategies that can maximize the use of technology in mathematics learning. By conducting an in-depth analysis of various approaches that have been implemented, this research will provide a clearer picture of best practices in technology use. Furthermore, it will also explore how technology can be adapted to meet individual students' needs, thereby supporting more personalized learning (Oumelaid, Boukari, and Ghordaf 2024).

By understanding the factors that influence the effectiveness of technology, we can design more structured and evidence-based approaches. This is important to ensure that every student, regardless of their background or ability, can utilize technology to enhance their understanding of mathematics. This study will also take into account various social and cultural contexts that may affect the acceptance and use of technology in the classroom.

Thus, the results of this study are expected to make a significant contribution to the development of more innovative and inclusive educational practices. In addition, this research aims to provide recommendations for educators and policymakers in designing curricula that are more responsive to technological advancements. Through these efforts, it is hoped that elementary students' understanding of mathematics will improve significantly, better preparing them to face future challenges.

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## RESEARCH METHODOLOGY

This study employs a quantitative approach to evaluate the effectiveness of digital technology in mathematics learning at the elementary school level. The quantitative approach was chosen because it allows for the collection of measurable data that can be statistically analyzed. By using this method, researchers can obtain more objective information regarding the impact of digital technology on students' mathematical understanding. Moreover, this approach facilitates the generalization of research findings to a broader population (Korenova, Krpec, and Barot 2024).

The population in this study consists of elementary school students from several schools in the Jakarta area. The schools involved in this research were selected based on specific criteria, such as the use of digital technology in the learning process. Samples were randomly selected from classes that have implemented digital technology, ensuring that the study's results reflect actual conditions in the field. In this way, the research is expected to provide a representative picture of the impact of digital technology on students' understanding of mathematics.

The instruments used in this study include questionnaires, mathematics comprehension tests, and classroom observations. The questionnaires are designed to measure students' attitudes toward the use of technology in learning, as well as to collect data on the frequency and types of technology used. The mathematics comprehension tests are administered to assess students' understanding levels before and after the implementation of digital technology. Classroom observations are conducted to obtain qualitative data on students' interactions with technology during the learning process..

The data collection procedure is carried out in several stages. First, questionnaires are distributed to students to gather information about their attitudes and experiences in using digital technology. Next, mathematics comprehension tests are administered before and after the implementation of technology in the learning process. Classroom observations are then conducted directly to record the interactions between students and teachers during lessons that incorporate digital technology.

The collected data will be analyzed using descriptive and inferential statistics. Descriptive statistics will be used to describe the characteristics of the sample and the questionnaire results, while inferential statistics will be employed to test the hypotheses regarding the impact of digital technology on students' mathematical understanding. Through this analysis, researchers can determine whether there is a significant relationship

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between the use of digital technology and the improvement of students' understanding of mathematics.

The results of this study are expected to provide a clear picture of the impact of digital technology on improving mathematical understanding among elementary school students. These findings are anticipated to be beneficial not only for the development of teaching methods but also as a reference for better educational policymaking. Thus, this research contributes to efforts to enhance the quality of education in Indonesia through the effective use of digital technology (Korenova, Krpec, and Barot 2024).

## RESULTS AND DISCUSSION

This study shows that the use of digital technology in mathematics learning can enhance students' motivation to learn. This finding is consistent with Hwang and Chang (2011), who stated that technology can create a more engaging and interactive learning environment. When students are actively involved in the learning process, they tend to be more motivated to understand the material being taught. This indicates that digital technology is not merely a learning aid but can also serve as a driving force for students' learning motivation (Chen and Huang 2024).

Furthermore, several studies have found that students who learn using digital mathematics applications show significant improvements in conceptual understanding compared to those taught through traditional methods. Research by Zheng et al (2016) supports this finding, demonstrating that interactive applications can help students grasp complex mathematical concepts more easily. Thus, digital technology can serve as a solution to overcome the difficulties that students often face in understanding mathematical material (Hetmanenko 2024).

Digital technology, such as interactive learning software, has been proven to help students understand complex mathematical material in a more enjoyable way. Mayer (2014), in his book, stated that multimedia can enhance students' understanding by presenting information in diverse formats. This suggests that the use of technology not only improves comprehension but also makes the learning process more engaging for students (Pratiwi, Suharta, and Suparta 2024).

Research by Li and Ma (2010) showed that the integration of technology in learning can increase student engagement, which in turn leads to better learning outcomes. Student engagement is crucial in the learning process, as actively engaged students tend to understand

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and retain information more effectively. Thus, digital technology can serve as a tool to enhance student engagement in mathematics learning (Vigel and Mettini 2024).

The results of the study also show that the use of instructional videos and mathematical simulations can strengthen students' understanding of fundamental concepts. Khan (2012) emphasized the importance of using videos in education, as they can present information in a more visual and engaging way. Thus, digital technology can help students better grasp difficult concepts through a more intuitive learning experience (Laurensi br Kaban et al. 2023).

In addition, digital technology enables students to learn independently and access a variety of learning resources, which can enhance their understanding. Baker (2016) noted that access to diverse learning resources can enrich students' learning experiences. This indicates that digital technology not only provides information but also offers students the opportunity to explore the material more deeply (Sharma 2024).

Research by Al-Emran et al. (2016) showed that students who used online learning platforms achieved better results in mathematics exams compared to those who did not use technology. These findings indicate that the use of digital technology can provide a competitive advantage for students in understanding and applying mathematical concepts. Therefore, integrating technology into mathematics learning is crucial for improving students' academic performance (Fitrah et al. 2024).

The use of digital technology in learning can also help teachers identify students' learning difficulties more quickly and accurately. Hattie (2009) emphasized the importance of feedback in the learning process, and technology can provide faster and more precise feedback. This enables teachers to adjust their teaching methods according to students' needs, thereby enhancing the effectiveness of learning (Magnago and Nunes 2024).

## DISCUSSION

Although many benefits have been identified, some studies also indicate that the success of digital technology use heavily depends on adequate teacher training and infrastructure. Ertmer and Ottenbreit-Leftwich (2010) emphasized that without proper training, teachers may not be able to utilize technology optimally. Therefore, it is important for educational institutions to provide sufficient training for teachers so (Osmani and Tartari 2024).

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Furthermore, the results of this study indicate that although digital technology has great potential, challenges in its implementation still exist. For example, not all students have equal access to technology, which can create disparities in learning. This aligns with previous findings showing that access to technology can significantly affect students' learning outcomes. Therefore, efforts are needed to ensure that all students have equal access to technology.

In this context, it is important to consider contextual factors that can influence the effectiveness of using digital technology in learning. Research by Hattie (2009) shows that factors such as the learning environment, parental support, and student motivation also play a significant role in learning success. Therefore, a holistic approach is necessary to ensure that digital technology can be used effectively to enhance students' understanding of mathematics (Abdelfattah et al. 2024).

Overall, the results of this study indicate that digital technology has great potential to enhance elementary students' understanding of mathematics. However, to achieve optimal outcomes, greater attention must be given to teacher training, technology access, and other contextual factors. With the right approach, digital technology can serve as an effective tool for improving the quality of education and students' mathematical understanding.

## CONSLUSION

This study aims to explore the role of digital technology as a learning tool and a driver of educational innovation in enhancing elementary students' understanding of mathematics. The results indicate that the use of digital technology, such as interactive learning applications, instructional videos, and online platforms, can significantly increase students' motivation and understanding of complex mathematical concepts. Thus, digital technology functions not only as a supporting tool but also as a driving force capable of creating a more engaging and interactive learning environment for students.

Based on the research findings, it can be concluded that students engaged in technology-based learning show significant improvements in their understanding of mathematical material. This aligns with previous studies indicating that active student involvement in the learning process can enhance their academic outcomes. By utilizing digital technology, students can learn in a more enjoyable and effective manner, which increases their motivation to understand and apply mathematical concepts.

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The contribution of this study is highly significant in the educational context, particularly in efforts to improve the quality of mathematics learning in elementary schools. This research provides new insights into how digital technology can be integrated into the curriculum to enhance students' understanding. Additionally, it highlights the importance of teacher training in the effective use of technology, enabling educators to maximize the potential of technology in the learning process.

However, despite the many benefits shown by the research findings, challenges in implementing digital technology still exist. Unequal access to technology among students can create disparities in learning. Therefore, it is important for educational institutions and the government to ensure that all students have equal access to technology, so that no student is left behind in the learning process.

Furthermore, this study also shows that the success of using digital technology heavily depends on support from the learning environment, including parental and community support. Therefore, collaboration between schools, parents, and the community is crucial to create an environment that supports the use of technology in learning. With strong support, students will be more motivated to learn and better understand mathematical material..

Moving forward, further research is needed to explore various aspects of digital technology use in education, including its impact on different groups of students with diverse backgrounds. This research can also serve as a foundation for developing more innovative and effective learning strategies that can be adapted to meet the needs of students in various educational contexts.

Overall, this study confirms that digital technology has great potential to enhance elementary students' understanding of mathematics. With the right approach and adequate support, digital technology can serve as an effective tool for improving the quality of education and helping students achieve better learning outcomes. Therefore, it is important for all stakeholders in education to collaborate in integrating digital technology into the learning process, so that students can fully benefit from the opportunities that technology offers in their education.

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