



## **Transformation of Mathematics Learning in the Digital Age: Improving Student Understanding with Learning Videos and Educational Game Applications**

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### **Abstract:**

This research aims to explore the role of digital media, especially learning videos and educational game applications, in improving students' understanding of mathematical concepts at SD Negeri 101/II Bungo. The research method used is a qualitative approach with a case study design. Data was collected through in-depth interviews with teachers and students, as well as direct observation of learning activities involving digital media. Data analysis was carried out using reduction, display, and verification techniques to identify the main themes that emerged from interviews and observations. The results show that digital media, especially learning videos and game applications, can increase student engagement, make it easier for them to understand mathematical concepts, and increase learning motivation. Students who use this media are more active and have a deeper understanding compared to students who use conventional learning methods. The implications of this study show that the use of digital media in mathematics learning can be an effective solution to improve the quality of education, especially in areas with limited resources. The research also provides new insights into the role of technology in primary education, and encourages further development of the use of digital media for more holistic learning.

**Keywords:** *Digital Media, Learning Videos, Educational Game Applications*

### **INTRODUCTION**

Education in Indonesia is experiencing challenges that are not light in the face of rapid technological developments. One of the sectors affected is mathematics learning, which is known for its abstract and complex nature (Alabdulaziz, 2021; Akanbi et al., 2021; Szczygieł & Pieronkiewicz, 2022). However, with technological advancements, especially in the field of digital media, there is a great opportunity to overcome this problem (He et al., 2021; Dwivedi et al., 2022; Banafaa et al., 2023). Learning mathematics using digital media, such as learning videos and educational game applications, has been shown to improve student understanding and engagement (Moon & Ke, 2020; Lo & Hew, 2020; Hussein et al., 2022). This is very relevant considering the need to improve the quality of adequate education, in line with the growing digital era and the need for competencies in the 21st century (Nouri et al., 2020; Van Laar et al., 2020; Núñez-Canal et al., 2022). Research on the use of digital media in mathematics learning at the elementary level, especially in elementary school, has made a significant contribution to understanding how technology can change

the traditional learning paradigm towards more interactive and effective education.

The importance of this research lies in the fact that although many studies examine the use of digital media in learning, few focus on its application at the basic education level, especially in areas with limited resources. In many elementary schools in Indonesia, including SD Negeri 101/II Bungo, the application of technology in learning is still limited and not optimal. This shows that there is a gap between technological advances and their application in mathematics learning. Therefore, this study aims to examine how the use of learning videos and digital media applications can affect students' understanding of mathematical concepts at SD Negeri 101/II Bungo, as well as the challenges faced in its implementation. This research will be the basis for a more adaptive education policy to technology in the digital era.

The phenomenon that is the focus of this research is how the use of digital media in mathematics learning can improve students' understanding of mathematical concepts at SD Negeri 101/II Bungo. Although there are a number of studies that show that digital media can increase students' interest and motivation to learn, in the field there are still many obstacles that hinder the effective application of technology. The main problems identified include the lack of adequate technology facilities in some elementary schools, the limited skills of teachers in integrating technology in learning, and the low involvement of students in mathematics learning which is considered difficult. By understanding these factors, this study aims to provide a clearer picture of how technology, especially interactive digital media, can help in bridging the gap in mathematical understanding at the primary education level.

Previous research relevant to this topic has provided various findings regarding the influence of digital media in learning. One of them is a study by Radović et al. (2020), which examines the influence of the use of educational game applications on students' motivation and understanding of mathematics. They found that students who learned with educational game apps had a better understanding and were more motivated to learn. Another study by Wu et al. (2021) also shows that the use of learning videos improves problem-solving skills in lower grade students. However, their research was limited to the effects of learning videos in high grades and did not address their impact on students in elementary school. In addition, research by Quah & Ng, (2022) highlights the use of interactive digital media, but the research focuses more on language learning and has not discussed in depth its application in mathematics learning at the elementary level. The conclusion of this literature review is that although there is research showing the benefits of digital media, there are shortcomings in applications and case studies in elementary schools, particularly in mathematics subjects.

Based on the review of the existing literature, there is a significant gap in research on the use of digital media in mathematics learning at the basic education level, especially in areas with limited facilities. Many previous studies have focused on the use of digital media in high schools or universities, and more tests on other subjects besides mathematics. This study aims to fill this gap by examining the influence of learning videos and digital media applications on mathematics learning at SD Negeri 101/II Bungo, an elementary school in an area with limited facilities. This research will provide new insights into the application of technology in mathematics learning at the basic education level, which in turn

can contribute to the development of technology-based education policies in Indonesia.

The novelty in this study lies in the application of interactive digital media, especially learning videos and educational game applications, in the context of mathematics learning at SD Negeri 101/II Bungo. This research not only focuses on the influence of digital media on the understanding of mathematical concepts, but also explores the factors that affect its implementation in school environments with limited resources. Another novelty is the selection of SD Negeri 101/II Bungo as the location of the research, which provides a new perspective on the challenges and opportunities of implementing digital media in areas with limited educational infrastructure. Thus, this research will make a significant contribution to the development of a more innovative and adaptive mathematics learning methodology to technology.

The basic assumption in this study is that the use of digital media, such as learning videos and educational game applications, can improve students' understanding of mathematical concepts at SD Negeri 101/II Bungo. This is based on the theory of constructivism which states that students will more easily understand the material when they are actively involved in an interesting and interactive learning process. Based on previous findings, digital media has been proven to increase student motivation and engagement in learning, which in turn can facilitate a deeper understanding of concepts. Therefore, the hypothesis proposed is that students who use digital media in learning mathematics will have a better understanding compared to students who only rely on traditional learning methods. As a provisional answer, it is hoped that this study will show that despite the challenges in implementation, digital media has great potential to improve the quality of mathematics learning at the primary education level, especially in areas with limited facilities.

## **RESEARCH METHOD**

This research was conducted at SD Negeri 101/II Bungo, which is located in Bungo Regency, Jambi. The unit of analysis in this study is students and teachers who are involved in learning mathematics, especially those who use interactive digital media and learning videos. This study uses a qualitative research design with a case study approach. This approach was chosen because it allows researchers to deeply explore the experiences, perceptions, and interactions of students and teachers in the context of the use of digital media in mathematics learning (Deng et al., 2020; Attard & Holmes, 2022; Santagata et al., 2021). The case study allows researchers to examine specific phenomena in a real educational environment, so that the results of this study are expected to provide a more in-depth picture of the impact of the use of digital media on students' understanding of mathematical concepts.

The sources of information in this study involve two main groups of respondents, namely students and teachers at SD Negeri 101/II Bungo. Student respondents were selected based on the criteria of those who had participated in mathematics learning using interactive digital media and learning videos. Teacher respondents were selected based on their experience in implementing the use of digital media in the classroom, as well as their role in facilitating learning. Interviews with teachers and students were conducted to explore their perceptions of the use of digital media in mathematics learning. In addition, observations were made to record students' interactions with digital media

during learning activities. This source of information is expected to provide comprehensive data to analyze the impact of the use of digital media in mathematics learning.

The data in this study was collected through interview, observation, and documentation techniques. Interviews were conducted with students and teachers to obtain information about their experiences in using digital media to understand mathematical concepts. Observations were made to record students' interactions with digital media during learning activities and to see how the media affected their understanding. Documentation is used to collect learning materials used in the classroom, including learning videos and applied digital media applications. The collected data is then analyzed using qualitative data analysis techniques consisting of three main stages: data reduction, data display, and data verification. Data reduction is carried out by filtering relevant information, data display is used to compile data in an easy-to-understand form, and data verification is carried out to ensure the accuracy and consistency of the findings obtained.

## **RESULTS AND DISCUSSION**

### **Result**

#### **Student Experience in Using Interactive Digital Media to Understand Mathematical Concepts**

The findings of this study show that the use of interactive digital media provides a different experience for students in understanding mathematical concepts. Based on the observations made, it can be seen that applications that combine visual elements and games can increase student participation in learning activities. Students who use these apps show higher levels of engagement compared to those who use traditional learning methods. For example, when learning geometry concepts, students seem to understand three-dimensional shapes more easily through an application that displays animations of these objects from various perspectives. This allows them to relate abstract mathematical concepts to real, easier visualizations. These applications support experiential learning, which is important in the context of teaching mathematics.

In further observation, it was found that students who used interactive digital media felt more confident in overcoming mathematical challenges. Students who use the app to visualize concepts such as volume, area, and geometric shapes appear to master material faster that would be considered difficult in conventional approaches. This is also reflected in class discussions where students are seen more actively asking questions and providing explanations related to the material they are learning using the application. Some students also revealed that they felt more motivated and interested in continuing math lessons because the app provides instant feedback that helps them know the extent of their understanding of the material being taught.

Based on the observation results, it can be concluded that the use of interactive digital media has a positive impact on students' learning experience in understanding mathematical concepts. Digital apps provide a more immersive experience, allowing students to learn in a more active and visual way. With elements such as animation and interactivity, students can more easily understand abstract concepts such as geometry and be able to see more real representations. In addition, this application also encourages students to participate more in the learning process, both through class discussions and independent exploration. Interactive digital media seems to help students in

visualizing and applying mathematical concepts, which improves their understanding of materials that were previously considered difficult or confusing. The use of technology in learning gives students the opportunity to learn in a way that is more in line with the way they understand the world around them.

These findings are in line with constructivist theory which argues that students' understanding will be better when they are actively involved in the learning process, either through exploration or direct interaction with the material (Voon et al., 2020). With the help of interactive digital media, students can learn in a more visual and interactive way, which allows them to understand the relationships between mathematical concepts through hands-on experience. This is also in line with learning principles that focus on active and engaged learning experiences, which can deepen understanding and increase student motivation in learning.

### Students' Perception of Learning Videos in Explaining Fractions

The findings of this study show that learning videos have an important role in helping students understand the concept of fractions in mathematics. Based on interviews with teachers and students, the use of video as a learning aid allows students to see visual representations of fractional concepts that they previously struggled to understand. The teacher revealed that the video helped students understand the difference between different fractions, such as  $1/2$  and  $1/4$ , in a way that was easier to understand. Students also feel more interested and excited in following math lessons when using videos as part of their learning. In some cases, students even continue watching videos outside of class hours to deepen their understanding of the topic.

From the interviews conducted with students, most stated that the learning videos made it easier for them to understand the concept of fractions. One of the students revealed, "Through the video, I can see how the fraction works in everyday life, such as when sharing food or sharing items with friends" (S1, 2023). This shows that videos help students connect theory with practical applications in their lives. In addition, videos equipped with animations and dynamic graphics help clarify abstract concepts, such as the division of fractions or the merging of fractions into a single entity. Some students also mentioned that they felt more confident in explaining fractions to their friends after watching the learning videos. Further findings regarding students' perceptions of learning videos can be seen in Table 1, which summarizes the main themes that emerged from student interviews.

**Table 1. Thematic Analysis of Interviews**

Main Theme	Sub-Theme	Quotes from Students
Understanding the Concept of Fractions	Visual Representation	"Through videos, I can see how the fraction works in everyday life, such as when sharing food or sharing items with friends" (S1, 2023)
	Graphic Animation Elements	"The animation in the video helps me understand the division of fractions more easily." (S2, 2023)
Student Motivation and Confidence	Increased Motivation	"I became more enthusiastic about math lessons after watching the video." (S3, 2023)
	Independent Learning	"After the lesson is over, I continue to watch videos to understand better." (S4, 2023)
Ease of Access and Understanding	Easy Access to Materials	"I can repeat the video if there is a part that I don't understand." (S5, 2023)

Based on interviews with students, it can be concluded that learning videos provide convenience in understanding the concept of fractions, especially through the use of applied visual elements. The videos allow students to see real-life examples of the application of the concept of fractions in everyday life, which helps them connect theory with practice. The visual representation in the video also makes abstract math material easier to understand. Some students stated that the video provided a clearer picture of the relationship between parts and whole in fractions, which they had previously struggled to understand through verbal explanations alone. The use of these videos makes students feel more motivated and confident in learning math, and gives them the opportunity to learn independently outside of class time. Learning videos have helped them see math material in a more practical and real context, which enhances their learning experience.

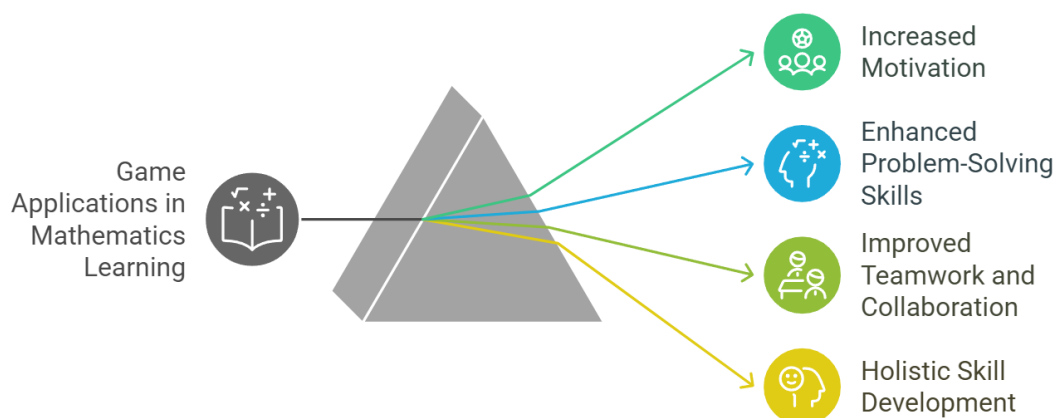
This finding is in line with the multimedia learning theory put forward by Golding & Verrier, (2021), who argues that the use of a combination of visual and text media can improve students' understanding and memory of the material being taught. By presenting material in the form of videos, which combine graphic, text, and animation elements, students can gain a better and deeper understanding of mathematical concepts. This shows that learning videos are not only an interesting tool, but also effective in conveying complex information in a way that is easier for students to understand. Videos also provide an opportunity for students to repeat the material independently, allowing them to deepen their understanding and overcome any difficulties they may face during the learning process.

### **The Role of Game Apps in Math Learning**

Based on interviews with students and teachers, the use of game apps in math learning provides a pleasant experience for students. Students who engage in learning with game apps stated that they feel more interested in learning math because of the interactive game elements. One teacher said, "Game apps help students not only understand math concepts but also make them more enthusiastic about learning" (G1, 2023). Most students also revealed that they found it easier to adapt to math material through game apps because of the difficult concepts presented in a more interesting and fun way. The games used in the classroom include a variety of math challenges that must be solved, and this invites students to think critically and work together in solving problems.

The interviews also revealed that students felt that the game app improved their skills in solving math problems independently. Some students stated that they became faster in solving problems after playing games, "After playing math games, I became faster in solving problems in exams" (S1, 2023). Furthermore, students reported that the in-game competition element provided additional motivation to continue learning. This is very useful, especially in learning mathematical concepts that are considered difficult. Some students also noted that games that require teamwork in completing challenges make them feel more connected to their peers, creating a more collaborative and fun learning atmosphere. With the elements of challenge and reward, students feel motivated to continue to try to understand the material more deeply. To make it easier to understand the findings above, it can be visualized in figure 1. Related to

exploring the impact of game applications in math learning.



**Figure 1. Exploring the Impact of Game Applications in Math Learning**

The results of the interview showed that game applications in mathematics learning help students learn in a more fun and interactive way. Games make math learning more engaging and challenging, with an element of competition that motivates students to keep trying. Additionally, the collaboration element in the game allows students to work together in teams, which not only improves their math skills, but also social and teamwork skills. Students feel more confident in solving math problems after practicing through games, and they experience an improvement in the speed and accuracy of solving problems. In this context, game applications not only serve as aids in mathematics learning, but also as a medium that encourages active student engagement, both individually and in groups.

These findings are in line with the theory of gamification in education which argues that the element of play can increase student motivation and engagement in learning (Sailer & Homner, 2020; Krath et al., 2021; Luo, 2022). By integrating games in learning, students not only gain mathematical knowledge, but also other important skills, such as problem-solving, teamwork, and critical thinking. Gaming apps provide a holistic learning experience, where students can develop their math skills in a more structured and fun way. Additionally, gaming apps allow students to learn in a way that better suits their learning style, improving their understanding of mathematical concepts that were previously considered difficult or confusing.

## CONCLUSION

This research provides important insights into the use of digital learning media, such as learning videos and game applications, in helping students understand mathematical concepts. The main findings of this study show that visual and interactive elements in digital media can improve students' understanding of mathematical concepts that were previously difficult to understand, such as fractions and geometry. Learning videos, with animations and dynamic graphics, help students connect theory with practice, while game apps provide a fun learning experience and strengthen their math skills through challenges and competitions. From a practical perspective, it emphasizes the

importance of applying technology in education to increase student motivation and engagement, as well as provide a way of learning that is more suitable for their learning style.

This research also makes a significant contribution to our understanding of how digital media can be used to support mathematics learning. By integrating the theory of multimedia learning and gamification, this research renews the perspective in the use of educational technology that is not only instructional, but also supports the active involvement and development of students' social skills. However, this research has limitations in terms of scope, such as only involving students from one location and a certain age, and relying on limited interview methods. Therefore, further research with a wider sample and a more varied approach is needed to obtain a more comprehensive picture. It is important to develop education policies that are more effective and relevant to the needs of students in various social and cultural contexts.

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