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The Urgency of Implementing Interactive Multimedia to Meet Students' Needs in Mathematics Learning at Elementary Schools

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ABSTRACT

Mathematics is often considered a difficult and abstract subject for elementary school students. This can lead to a lack of understanding among students regarding the concepts being studied, which ultimately affects their learning outcomes negatively. To address this issue, the use of interactive multimedia in mathematics education has become an urgent necessity. The research was conducted in three different elementary schools with a total of 60 student subjects. In this study, activities were conducted to analyze and describe the needs of students regarding the use of interactive multimedia in elementary schools. The research method is qualitative descriptive, which describes phenomena based on the situation by conducting in-depth observation and data analysis of teachers and students. Based on the needs analysis questionnaire, it was found that the average percentage value is 75.5%. This indicates that more than half of the students require interactive multimedia. The research results show that interactive multimedia has the potential to change the way students learn, by combining interactive content and features that can help students understand abstract mathematical concepts more concretely and easily. The application of interactive multimedia in elementary school mathematics education helps to facilitate interaction between educators and students, making the learning activities more effective and efficient in improving the quality of education.

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1. INTRODUCTION

Along with the accelerated development of science and technology, education has become a necessity for humanity and a government priority, as it produces quality human resources for nation-building. Improving and developing human quality can be accomplished by providing mathematics learning in institutions, as it is one of the means of preparing clear, precise, and thorough thinking. Mathematics is one of the subjects taught at all levels of education, from elementary school, junior high school, senior high school, and college.

Learning mathematics in elementary school is crucial for students because the skills they acquire at this level have a significant impact on the next level (Amaliyah et al., 2022). Elementary school mathematics instruction will concentrate on concepts and basic mathematical resources to help kids with their higher-level math (Shabani, 2012). Consequently, the purpose of learning mathematics in school is to provide students with the pressure of structuring their reasoning in applying mathematics to daily life in the context of the society in which they exist.

Students learning will be meaningful if the teacher understands the object to be conveyed to them so that they can present it with full innovation during the learning process (Chusna, 2016). Creative thinking and ideas will emerge and develop if the mathematics learning process in the classroom uses appropriate learning media. Learning media are tools that can be used by teachers to convey information to students related to learning in an easily understandable manner (Komang et al., 2024).

In practice, however, conventional methods, such as lectures, are used the most in schools. This method is considered an interesting means of communication between teachers and students in teaching and learning activities. Nevertheless, in reality, the lecture method has some drawbacks, such as being monotonous if applied to subjects with lengthy meeting times; students becoming passive; it being difficult to assess student learning achievement; and learning is centered on the teacher as a provider of learning resources and material information students frequently struggle to comprehend arithmetic lessons, resulting in numerous errors and incorrect answers when solving problems. In geometry learning, teachers still use concrete media, such as props, to explain geometry's elements because they have difficulty using technological solutions (Kang & Chang, 2016; Khoo et al., 2011; Sung et al., 2017).

Teaching content is increasingly digitized and presented via multimedia, a computer-based presentation mode that combines words, images, audio, video, and animation (Gayeski, 2021). It enriches the content and makes it more engaging by encouraging students to acquire knowledge through multiple channels. In addition, researchers have attempted to incorporate interactive functions into educational multimedia content so that teachers can give students learning assignments, provide guidance, and receive feedback during interactive learning.

The use of multimedia to support pedagogy is effective, so teachers should develop multimedia applications as learning media (Babiker, 2015). Interactive multimedia in mathematics subjects raises students' attention (Kobayashi et al., 1996). Several studies have found that multimedia and interactive learning aids students in comprehending the material rather than simply memorizing it (Stirling & Birt, 2014; Takacs et al., 2015) found that the use of multimedia technology based on contextual learning models can enhance children's achievement and learning motivation, as well as student learning outcomes (Sung et al., 2019). Similarly, contextual learning with multimedia technology can effectively enhance both concept mastery and student character development (Dewi et al., 2015; Sugianto, 2016).

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According to the preceding explanation, optimal learning requires creative and innovative teachers. Teachers can innovate using the latest educational tools (Iksan & Saufian, 2012). Professional teachers have a significant responsibility in improving the quality of education. Teachers are one of the factors that influence learning objectives and the implementation of teaching in schools. A professional teacher is a competent teacher (Annisa & Ismail, 2024). Teachers need a learning device that supports the achievement of learning objectives, namely interactive media that can enhance students' conceptual understanding and motivation to learn in elementary school mathematics.

2. METHODS

2.1 Subject of The Research

The variable that is the focus of the research is an important component of the study. According to (Rosilia et al., 2020), the research subjects are the main component of the research variables. This analysis involves 60 fifth-grade students consisting of 48 girls and 52 boys from three elementary schools.

2.2 Research Data Collection Instruments and Research Procedure

This qualitative research utilized a descriptive approach. Descriptive research aims to systematically describe the facts and characterize the characteristics of the object of study precisely. In this research, activities were conducted to analyze and describe students' needs regarding the use of interactive multimedia in elementary schools. Data was collected from questionnaires needed by the students. The instrument used in this study is a questionnaire that will be filled out by students regarding the need for an interactive learning media, namely interactive multimedia. An instrument is a tool used to measure data that is practically inseparable from the data collection procedure (Rahmasari, 2025). This needs analysis will reveal the learning media required.

2.3 Data Analysis

A quantitative descriptive analysis will be performed on the collected data. The Guttman scale was used to examine the student needs analysis questionnaire. Students are required to respond to 10 questions on the instrument. The score for a "yes" response is "1," whereas the score for a "no" response is "0." By dividing the frequency of responses by the total number of responses and then multiplying the result by 100%, the score results were quantitatively examined as percentages. The category used to display the requirements analysis's percentage results was modified from Sejati (2021). **Table 1** below provides specifics about the classification.

Table 1. Classification of the Percentage Results from Completing the Student Needs Analysis Questionnaire

Rasio	Calssification
0-1,9%	Not required
2% - 25,9%	A small percentage need
26% - 49,9%	Fewer than half of them require
50%	Fifty percent of them require
50,1% - 75,9%	More than fifty percent require
76% - 99,9%	The majority require
100%	Everyone requires

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The quantitative data obtained from the needs analysis questionnaire will be interpreted based on **Table 1**. If the percentage is more than 50%, it indicates that more than half of the students require interactive multimedia. On the other hand, if the percentage is less than 50%, then most students do not require interactive multimedia in their learning.

3. RESULTS AND DISCUSSION

3.1. Result

According to student interviews, teachers have not utilized the most recent learning models when teaching geometry material. Only lectures, discussions, and question-and-answer sessions are used in the learning process, making learning teacher-centered. Moreover, when explaining geometry concepts, teachers typically employed concrete media. The teacher only used one-way learning media, which made students bored. As a result of using a teacher-centered learning method, students became less engaged.

Mathematics is difficult to acquire for students. It is due to the fact that students lack an understanding of math learning, particularly geometry material because they were only given lecture-based explanations and concrete media to explain the material. Traditional learning media employed in teaching and learning activities also demotivate students. Students prefer learning media in the form of interactive multimedia that combines videos, images, animations, assessments, and exercises that students can complete directly in the application. Despite this, teachers still utilize technology for learning infrequently due to technological limitations. A small percentage of students are familiar with interactive multimedia and have seen it. Students need multimedia presentations that include images, videos, and animations. The use of interactive multimedia facilitates students' comprehension of the material. In addition, this interactive multimedia incorporates a contextual learning model, which enables learners to make contextual connections between elements. Applying an interactive multimedia-assisted learning model can increase student motivation and make learning enjoyable.

Four elementary school teachers were interviewed to find out their needs regarding interactive multimedia-assisted contextual learning models. In the majority of cases, lecturing and concrete learning media are used for teaching mathematics, particularly geometry. Based on observations in five elementary schools, learning models and the media teachers frequently utilize in the classroom support books/textbooks, student worksheets, and concrete objects. This situation decreases student enthusiasm because the learning is teacher-centered, and students are not actively involved. Occasionally, students converse with their peers, ignore the teacher's explanation, and are preoccupied with their own world. In the end, these circumstances impede students' comprehension of related materials.

Analysis of the assessment of students and teachers' needs on contextual learning models supported by interactive multimedia obtained from lift filling, came from 51.7% of male students and 48.3% of female students. That is, the amount that gives an assessment and a statement of balanced needs. This can be seen in **Figure 1**. the percentage of primary school students who filled in the quantitative data with 60 Respondents.

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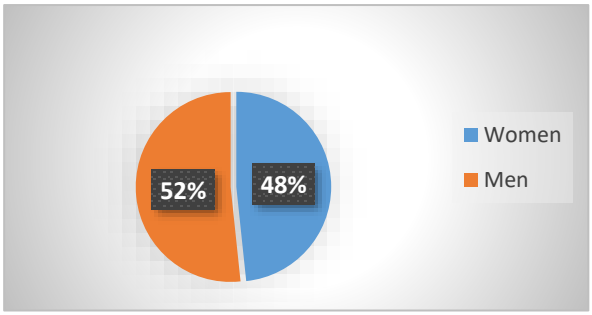


Figure 1. Percentage of Elementary School Students Filling Qualitative Data

The questionnaire results for the student needs assessment analysis are presented in **Table 2** below, while the results for the teacher needs analysis are presented as a word tree.

Table 2. Analysis of Students' Needs Assessment on Interactive Multimedia

No.	Statement	Yes	No	Average Percentage	Categories Results
1.	Learning mathematics is difficult to understand.	52%	48%		
2.	The mathematics explanation provided by the teacher is beyond my understanding.	58.3 %	41.7 %		
3.	Enjoy learning in groups.	92.9 %	7.1 %		
4.	Geometry learning must be connected to or relevant to real-world situations.	79%	21%		
5.	Learning by using textbooks, student books, and teacher books only.	56%	44 %	75.6%	More than fifty
6.	Learning by using student worksheet only.	71%	29 %		
7.	Have ever learned by using other media (visual, audio, and audio-visual)	88%	12 %		percent require
8.	Thrilled if geometry is taught in class using a variety of learning resources	87.5 %	12.5 %		
9.	Have ever witnessed learning mathematics with geometry material visualized/displayed by computer or animation	71 %	29%		
10.	Interested in learning through the utilization of media that can demonstrate how things function, such as pictures or real material.	100 %	0%		

Based on the needs analysis questionnaire, it was found that the average percentage value is 75.5%. When interpreted in **Table 1** with a range of 50.1% - 75.9%, which includes the majority category of students in need. This indicates that more than half of the students require interactive multimedia**.**

Table 2 reveals that 52% of students believe that learning mathematics, particularly geometry, is challenging due to the continued use of conventional teaching methods. Textbooks are still used by 56% of teachers. It consists of student books and teacher books in the learning process. As a result, students are less likely to comprehend the material when their teacher explains it. In fact, 79% of students prefer that geometry lessons be related to their real-world experiences so that they can construct their knowledge of geometry-related material. According to this table, students are highly content when they learn in groups (92.9%) and use student worksheets (71.1%). Therefore, students can work in groups on student worksheets. In addition, the material and exercise questions can be completed with the aid of interactive multimedia, which is an application that combines words, images, sound, video, and animation to encourage students to construct their knowledge and find

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discussion in the material actively. 87.5% of students are satisfied if geometry is taught in the classroom using various learning resources, particularly interactive multimedia. However, in teaching geometry, the teachers continued to use concrete media. In this case, 88% of students have learned to use other media (visual, audio, and audio-visual). However, only 71% of them experienced mathematics learning with geometry material visualized or shown through animation or computer when university students conducted research on interactive multimedia. However, teachers continued to employ conventional learning methods and media in the classroom. While 100% of students are interested in learning through the use of interactive media that can demonstrate how things work, images, or detailed or real material

Some students are interested in learning geometry because of its relationship to images, while others find it difficult to comprehend. Printed teaching materials, such as supporting books, student books, teacher books, and student worksheets, are utilized by teachers. Geometry's challenging material includes comprehending the concept of constructing geometry and solving problems relevant to students' daily lives. In this case, the context for learning geometry provided by the teacher is still conventional and employs models or approaches infrequently. Teachers believe that lectures and queries are the most effective methods for teaching and learning geometry. However, during the learning process, particularly during the formulation of the problem, students still struggle to understand this aspect. Learning content cannot be separated from the teaching and learning process, so it must be contextual. Thus, the learning content can correlate the subject matter to real-life situations. However, the teachers have never used a contextual model when presenting this material in the geometry learning process. Along with the instructional materials, teachers use concrete media to aid in learning geometry material. The characteristics of teaching material must be clear, intriguing, easy for students to comprehend, visually appealing, and functional. Therefore, learning is now technology-based. However, some teachers are less proficient with technology, such that they rarely or never use interactive multimedia in the learning process. Consequently, the current learning process tends to emphasize the teaching process, is text-based and abstract, and is still predominantly passive. Furthermore, one of the causes of failure in mathematics learning is that students do not understand mathematical concepts or students misunderstand mathematical concepts (Novitasari, 2016). The importance of conceptual understanding is a fundamental basis for achieving satisfactory learning outcomes that will be evaluated at the end. By learning concepts, students can understand and differentiate words, symbols, and signs in mathematics.

With the development of information technology and computing, the learning process became problem-based, contextual, and limitless. Students must be more active in this learning process by maximizing existing learning resources, such as interactive multimedia. According to its classification, multimedia is one of the forms of media that most actively engages students' senses. This is due to the fact that it uses a variety of media, including text, music, graphics, animation, and video, to convey information. Students' boredom from repetitive learning will be lessened with such a display, increasing their interest in comprehending the subject matter. This is in accordance with the cognitive theory of multimedia learning, where multimedia representations have the potential to produce deeper learning and understanding than presentations given in only one format. Here, “one format” refers to the delivery of information in the form of words or images only. Students are encouraged to engage with the computer through the use of multimedia. This implies that users have the ability to manage the multimedia application's components. In order to improve students' comprehension of mathematical concepts, teachers should be able to construct a contextual learning model supported by interactive multimedia.

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3.2 Discussion

Mathematics is one of the subjects that has an essential role in education (Eviyanti et al., 2017; Mawarni & Muhtadi, 2017). Mathematics plays a central role in school programs worldwide (Ramos Marroquin et al., 2021). Mathematics is a powerful tool for understanding the world because it teaches logical thinking and develops skills to solve real-life problems (Clements & Sarama, 2011; Watts et al., 2014). Mathematics is one of the subjects taught at all levels of education, from elementary school to college. In elementary school, students are required to study mathematics. Mathematics learning is a teaching and learning process designed by teachers to nurture students' thinking creativity, which can improve students' thinking skills and the capacity to construct new knowledge to improve students' mastery of mathematics material. Mathematics learning is basically abstract, and its concepts and principles are hierarchical.

According to Piaget's theory of cognitive development, students in school between the ages of seven and eight and twelve and thirteen are included in the concrete operational stage. Based on this cognitive development theory, elementary school students typically struggle to comprehend abstract mathematics. Due to its abstract nature, mathematics is generally difficult for elementary school students to comprehend. According to the findings, elementary school students find geometry content difficult to comprehend because it is still abstract; consequently, explanations provided by teachers make students less comprehensible. The lack of concept understanding ability in Indonesia is indicated by difficulties during the mathematics learning process (Mukrimatin et al., 2018) and (Fauzi et al., 2021) how students acquire knowledge influences their comprehension and application (van der Sanden et al., 2000). This finding indicates that teachers prefer lecturing and question-and-answer sessions, as students can comprehend and retain the material with these techniques. The teaching scheme is still teacher-centered, and students only receive learning material through teacher explanations; they are not supported by diverse sources that can activate students and focus on the student experience (Indriayu & Info, 2019).This situation causes students to be passive and unenthusiastic about learning. In fact, students are satisfied if learning utilizes various learning resources and is relevant to their lives.

In the learning process, teachers continue to rely on printed teaching materials. There are numerous varieties and qualities of teaching materials, one of which is a collection of materials that are systematically organized and displayed in accordance with the competencies that students have mastered (McLaren & Kenny, 2016). Material development is directed so students can locate concepts and procedures and implement them to solve given problems (Budiastra et al., 2020).

For student learning outcomes and achievements to improve or increase, learning about mathematics must become more creative, innovative, and enjoyable with the advancement of technology and information (Bulkani et al., 2022). The Internet, animation, and other forms of learning media are typically the most popular with students. Therefore, elementary school teachers must be innovative and creative in using technology to enhance student quality (Hanif, 2020; Sarioğlu & GIrgIn, 2020).The use of technology must be a reference for teachers to present a learning process that provides space for students to explore and facilitates interaction and collaboration between students and between students and teachers, especially for elementary school students learning mathematics. However, teachers never utilize technology-based learning media, such as interactive multimedia, in the classroom. It is due to the teacher's lack of technological understanding. Students have only witnessed and tried interactive multimedia due to the attendance of university students who came to conduct research and visualize learning materials through animation or computers.

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Moreover, the findings indicate that students are interested in learning through the use of media that can demonstrate how things function, such as pictures or real-world materials. Consequently, interactive multimedia is one alternative teachers can use to help students comprehend the material. Interactive multimedia combines images, video, animation, and sound in a single piece of software that enables direct user interaction. It is anticipated that multimedia technology incorporating multiple media will solve problems in the teaching and learning process, such as misunderstandings of mathematical concepts. Due to the combination of images, animations, and even intriguing sounds, interactive multimedia can provide concepts with an attractive appearance. With the display of interactive multimedia that contains concepts by connecting the concept of the material to students' real-world experiences, students can engage in direct practice during learning activities, creating an experience for them. Teachers can enhance students' understanding of mathematical concepts by developing contextual models as interactive multimedia, thereby influencing student learning outcomes.

4. CONCLUSION

With the advancement of technology, it can change the way of learning by incorporating it into an interactive multimedia. Based on the needs analysis questionnaire, it was found that the average percentage value is 75.5%. This indicates that more than half of the students require interactive multimedia Interactive multimedia has the potential to change the way students learn, by combining interactive content with features that can help students understand abstract mathematical concepts more concretely and easily. The application of interactive multimedia in elementary school mathematics education helps to facilitate interaction between educators and students, making the learning activities more effective and efficient in improving the quality of education.

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