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Strategies to Improve Numeracy Literacy and Student Learning Enthusiasm through Interactive Learning Media in Mathematics

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A B S T R A C T

Numeracy literacy is one of the fundamental competencies that students need to master in order to solve problems and make decisions in everyday life. However, various national and international assessment results indicate that Indonesian students' numeracy literacy achievement remains relatively low. In addition, students' learning enthusiasm toward mathematics is often limited due to perceptions that mathematics is difficult, abstract, and less engaging. Interactive learning media have emerged as one of the innovative strategies that can help address these challenges. This study aims to systematically analyze the effectiveness of interactive learning media in improving students' numeracy literacy and learning enthusiasm in mathematics learning. This research employed a descriptive qualitative approach using a library research method. Data were collected from scientific journal articles, books, research reports, and relevant educational documents published between 2015 and 2025. The collected data were analyzed using content analysis techniques through data reduction, data display, and conclusion drawing. The findings indicate that various forms of interactive learning media, including educational digital games, interactive quizzes, animated videos, and manipulative learning tools, contribute positively to students' numeracy literacy development and learning enthusiasm

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INTRODUCTION

Numeracy literacy is an individual's ability to use mathematical concepts, procedures, facts, and tools to solve various problems encountered in daily life. Numeracy literacy isn't just about being able to do calculations; it also includes the ability to interpret quantitative information, analyze data, make decisions based on numerical information, and communicate reasoning results logically. In the context of 21st-century education, numeracy literacy has become one of the essential skills that students need to have in order to face social, economic, and increasingly complex technological challenges (Kemendikbudristek, 2023).

The importance of mastering numeracy literacy is reflected in various national and international education policies. The Merdeka Curriculum places numeracy literacy as one of the basic competencies that need to be developed in an integrated way across all subjects. However, several evaluation results show that Indonesian students' numeracy skills still need serious attention. The 2022 Programme for International Student Assessment (PISA) results show that Indonesian students' math achievement is still below the average of Organisation for Economic Co-operation and Development (OECD) countries. These findings indicate that many students still struggle to apply math concepts to solve contextual problems that are close to their daily lives (OECD, 2023; Kemendikbudristek, 2023).

Low numeracy literacy is influenced not just by students' cognitive abilities but is also closely linked to affective aspects, like learning enthusiasm. Learning enthusiasm is a psychological state characterized by interest, attention, motivation, and active engagement in the learning process. Research shows that students with high learning enthusiasm tend to be more active in asking questions, discussing, trying out different problem-solving strategies, and showing greater persistence with math tasks. On the other hand, low learning enthusiasm can make students passive, quick to give up, and less confident when learning math concepts they find difficult (Pratiwi & Lestari, 2022).

One of the factors causing low enthusiasm for learning math is the use of teaching methods that are not very varied and are still teacher-centered. Lessons dominated by lectures and routine exercises often make students feel bored, so math is seen as an abstract and dull subject. This situation highlights the need for innovative teaching that can provide a more engaging, meaningful learning experience, and fits the characteristics of today's students who are familiar with digital technology (Sari & Wijaya, 2021).

Previous studies have extensively discussed the effectiveness of interactive media in improving both students' math learning outcomes and their learning motivation. However, most of these studies still focus on a specific type of media or only examine one aspect of learning outcomes. In addition, research that specifically integrates discussions on the contribution of interactive learning media to students' numeracy literacy and enthusiasm for learning math is still relatively limited. This situation indicates a research gap that needs to be further explored through a synthesis of the available research findings.

Based on the description, this study aims to systematically analyze the effectiveness of interactive learning media in improving students' numeracy literacy and enthusiasm for learning in mathematics. This study is expected to provide a theoretical contribution by enriching discussions on innovative mathematics teaching strategies, while also offering practical recommendations for teachers, schools, and curriculum developers to optimize the use of interactive learning media to enhance the quality of mathematics education in elementary schools.

LITERATURE RIVIEW

The development of information and communication technology has opened up a wide range of opportunities for teachers to create various interactive learning media. Interactive learning media are learning tools that allow active interaction between students and learning materials through many activities like educational games, simulations, digital quizzes, animated videos, or interactive teaching aids. Several studies have reported that using interactive media can boost student engagement during learning, strengthen concept understanding, and help students build a more enjoyable and meaningful learning experience (Hidayat & Nurcahyono, 2020; Nugraha & Fajriah, 2022).

METHODOLOGY

This study uses a descriptive qualitative approach with a library research method. The library research method was chosen because the study focuses on reviewing, analyzing, and synthesizing various relevant scientific sources regarding the use of interactive learning media to improve numeracy literacy and student enthusiasm for learning in mathematics. Through this approach, the researcher aims to gain a comprehensive understanding of previous research findings so as to provide a clearer picture of the effectiveness of interactive learning media in the context of mathematics education.

The research data sources consist of scientific documents, including national and international journal articles, academic books, research reports, proceedings, and official documents related to numeracy literacy, learning enthusiasm, interactive learning media, and mathematics learning. Literature searches were conducted through several academic databases and portals, such as Google Scholar, Garuda, SINTA, ERIC, and various scientific repositories that provide access to educational publications. Using multiple databases was intended to broaden the range of sources and increase the diversity of references used in the research.

The literature review process was carried out using the keywords “numeracy literacy,” “interactive learning media,” “learning enthusiasm,” “interactive learning media,” “numeracy literacy,” “student engagement,” and “mathematics learning.” These keywords were used separately or combined to find sources that are highly relevant to the research focus. All the documents found were then screened based on the established inclusion and exclusion criteria.

The inclusion criteria for this study include: (1) articles or documents discussing interactive learning media in math education; (2) studies examining numeracy literacy, learning motivation, learning engagement, or student enthusiasm for learning; (3) scientific publications published between 2015–2025; (4) sources available in both Indonesian and English; and (5) documents that are directly related to the research objectives. The exclusion criteria, on the other hand, include documents that do not have clear methodological information, articles that are not fully accessible, and publications that are not directly related to the research topic.

Based on the process of tracing and selecting literature, 30 documents were obtained that met the criteria for further analysis. These documents consist of 24 national and international scientific journal articles, 4 academic books discussing learning theory and numeracy literacy, and 2 official reports from educational institutions related to assessment and education policies. All selected documents were then analyzed in depth to identify patterns of findings, similarities, differences, and trends in research results relevant to the focus of the study.

The data collection technique was carried out through documentation. This technique was implemented by identifying, collecting, reading, taking notes, classifying, and reviewing various documents that met the research criteria. The information obtained from each source was then organized based on the main themes, which are the types of interactive learning media, their impact on numeracy literacy, their effect on learning enthusiasm, supporting factors for implementation, as well as challenges encountered in using interactive learning media.

Data analysis was done using content analysis techniques. The analysis started with the data reduction stage, which involved selecting and focusing on information relevant to the research objectives. The next stage was data presentation by grouping research results into certain themes and categories to make the interpretation process easier. The final stage was drawing conclusions based on patterns found from various sources analyzed. Through this process, a synthesis was obtained that illustrates the contribution of interactive learning media to improving numeracy literacy and student learning enthusiasm in mathematics lessons.

To improve the validity of the data, the research applied source triangulation. Triangulation was done by comparing information from different types of documents and various research results with different contexts. If there is agreement in findings from several different sources, then that information is considered to have a higher level of trust. In addition, the use of both national and international sources was done to enrich perspectives and reduce the possibility of bias in the data interpretation process.

The research flow starts with identifying the problem, reviewing the literature, selecting documents based on predetermined criteria, collecting data through documentation, conducting content analysis on the selected documents, compiling a synthesis of the research findings, and finally drawing conclusions and making recommendations. With this procedure, the research is expected to produce a systematic, objective, and relevant study in explaining the role of interactive learning media as a strategy to improve numerical literacy and student enthusiasm for learning in mathematics.

RESULT

Based on the review and analysis of 30 documents that met the research criteria, it was found that interactive learning media play an important role in supporting the improvement of numeracy literacy and students' enthusiasm for learning mathematics. Various studies examined show that using interactive media can create a more active, engaging, and student-centered learning process. These findings consistently appear across different levels of primary and secondary education, even with variations in the media characteristics and learning contexts.

The analysis results show that there are four types of interactive learning media most commonly used in math learning: digital educational games, interactive quizzes, animated learning videos, and interactive manipulatives. Each of these media has different characteristics and contributions to developing numeracy skills as well as increasing student engagement during the learning process.

To get a more systematic picture, the results of synthesizing various previous studies are presented in Table 1.

Table 1. Synthesis of Research Findings on Interactive Learning Media in Math Lessons

Types of Interactive Media	Number of Studies Reviewed (n)	Key Findings on Numeracy Literacy	Key Findings on Learning EnthusiasmKey Findings on Learning Enthusiasm
Digital educational game	9	Helping students understand numeracy concepts through solving contextual problems and challenge-based activities	Increasing active participation, curiosity, and motivation to learn
Interactive quizzes (Quizizz, Kahoot!, Wordwall)	8	Helping students practice solving numeracy problems repeatedly with immediate feedback	Increasing student engagement through a healthy competitive atmosphere

Learning animation video	7	Making it easier to understand abstract math concepts through visualization	Catching students' attention and boosting focus during learning
Alat peraga manipulatif interaktif	6	Helping students build concept understanding through concrete experiences	Increasing student engagement in group learning activities and hands-on practice

Source: Results from the synthesis of various studies that were analyzed (2025)

The data in Table 1 shows that digital educational games are the type of media most frequently reported in the reviewed studies. This media is used to help students understand numeracy concepts through game-like activities, making the learning process more natural and enjoyable. Various studies show that students find it easier to grasp number concepts, arithmetic operations, fractions, and problem-solving when these concepts are presented in the form of interactive educational games (Wulandari & Hartono, 2021).

Besides educational games, interactive quizzes are also one of the most commonly used media. Platforms like Quizizz, Kahoot!, and Wordwall allow teachers to present math questions in an engaging way with scoring, ranking, and immediate feedback features. Based on the analyzed research findings, using interactive quizzes gives students the chance to practice repeatedly without getting bored, thus contributing to strengthening numeracy skills (Nugraha & Fajriah, 2022).

Educational animation videos have become another popular medium for explaining abstract math concepts. Studies show that visualizing through animation helps students understand the relationships between math concepts more concretely. Using colors, illustrations, and engaging storylines also positively impacts students' attention and focus during learning (Lestari & Kurniawan, 2020).

Meanwhile, interactive manipulative teaching aids remain an important choice, especially at the elementary school level. Various studies show that using teaching aids like fraction blocks, number cards, geometry boards, and other concrete materials helps students build an understanding of math concepts through hands-on experience. These media are considered very suitable for the cognitive development characteristics of elementary school students, who are still at the concrete operational stage (Fadillah & Yulianti, 2018).

DISCUSSION

The Role of Interactive Learning Media in Improving Numeracy LiteracyHasil sintesis Various studies show that interactive learning media has a positive contribution to students' numeracy development. This finding aligns with the view that the math learning process will be more effective if students have the chance to interact directly with the material they are learning. Numeracy literacy is not just about being able to do calculations, but also includes the ability to understand quantitative information, interpret data, engage in mathematical reasoning, and apply math concepts in various everyday life situations.

From a constructivist perspective, knowledge can't be directly transferred from teacher to student; instead, it's built through active learning experiences. That's why interactive learning media becomes a tool that lets students develop an understanding of concepts through exploration, experimentation, and problem-solving. When students interact with educational games, simulations, or hands-on teaching aids, they aren't just receiving information—they're also engaging in thinking processes that help form concepts more deeply.

Digital educational games are one of the most reported mediums to have a positive impact on numeracy literacy. Various studies show that game-based activities can integrate math concepts with situations that are close to students' daily lives. In these games, students face various challenges that require them to use counting skills, identify patterns, compare values, and make decisions based on numerical information. Activities like these encourage students to use math contextually, so their numeracy literacy develops more optimally (Wulandari & Hartono, 2021).

Besides educational games, interactive quizzes also make a big contribution to improving numeracy skills. The instant feedback feature available on platforms like Quizizz and Kahoot! lets students see the mistakes they made right after answering a question. Quick feedback helps students reflect on their thinking process so that their understanding of concepts can be continuously improved. These findings align with cognitive learning theory, which emphasizes the importance of immediate reinforcement and correction in the learning process (Suryadi & Hasanah, 2019).

Educational animation videos also play an important role in helping students understand abstract mathematical concepts. Many mathematical concepts are hard to grasp just through verbal explanations or mathematical symbols. Through animation visualization, these concepts can be presented in a more concrete form, making it easier to understand. For example, the concept of fractions can be visualized by dividing real objects, while 3D shapes can be shown through moving three-dimensional representations. This way, students get a clearer picture of the relationships between different mathematical concepts (Lestari & Kurniawan, 2020).

Besides technology-based media, manipulative teaching aids still play an important role, especially in elementary school. According to Piaget's cognitive development theory, elementary school students are still in the concrete operational stage, which is when understanding concepts is easier through direct experience with real objects. Using fraction blocks, number cards, geometry

boards, and other concrete media helps students build conceptual understanding, which becomes the foundation for developing numeracy skills at the next stage (Fadillah & Yulianti, 2018).

The Role of Interactive Learning Media in Boosting Learning Enthusiasm

Besides contributing to the development of numeracy skills, interactive learning media also has a strong influence on increasing students' enthusiasm for learning. Learning enthusiasm is one of the affective aspects that greatly determines learning success because it is related to students' motivation, attention, interest, and involvement during the learning process.

Based on various studies analyzed, interactive learning media can create a more engaging learning atmosphere compared to conventional teaching methods. The presence of visual, audio, animation, challenges, and interaction elements makes students feel more interested in participating in the learning process. This is different from learning that only focuses on lectures and monotonous exercises, which often makes students feel bored and lose motivation to study.

Digital educational games contribute a lot to boosting learning enthusiasm because they include gamification elements. Gamification is the application of game elements in non-game contexts, including learning. Point systems, rewards, levels, challenges, and leaderboards can make the learning experience more fun. Various studies report that students show higher engagement when learning activities are packaged as games compared to conventional learning (Anggraini & Saputra, 2023).

Interactive quizzes also have a positive impact on learning enthusiasm because they create a healthy competitive atmosphere. When students can see their results and rankings directly, it encourages them to try harder next time. Plus, having music, animations, and appealing visuals helps students stay focused and excited to complete the tasks assigned by the teacher (Handayani & Ramadhan, 2021).

These findings show that interactive learning media not only serve as tools for delivering material, but also act as a way to create a fun learning experience. When students enjoy the learning process, they tend to be more engaged, making it easier to achieve learning goals.

The Relationship Between Numeracy Literacy and Learning Enthusiasm

One interesting finding from this study is the mutually reinforcing relationship between numeracy literacy and learning enthusiasm. Some studies show that students who are highly enthusiastic about learning tend to have better numeracy skills compared to students who are less engaged in learning.

Findings by Fitriani and Kurnia (2023) show a strong positive relationship between numeracy literacy and learning enthusiasm, with a correlation value of $r = 0.76$. This value indicates that the relationship between the two variables falls into the strong category. If calculated using the coefficient of determination (r^2), the value is about 0.58 or 58%. This means that around 58% of the variation in one variable can be explained by its relationship with the other variable, while the rest is influenced by other factors such as the learning environment, family support, teaching quality, and individual student characteristics.

The findings show that increasing enthusiasm for learning can potentially have a positive impact on students' numeracy skills. On the other hand, when students start to understand math concepts well, their confidence grows, which leads to higher motivation to keep learning. This way, a mutually reinforcing relationship develops between the cognitive and affective aspects of learning math.

Different Findings and Limitations of Previous Research

Although most studies show positive results, not all research reports the same level of effectiveness. Some studies found that using interactive media doesn't always lead to optimal improvement if not accompanied by good lesson planning. In some cases, students actually focus more on the game aspects rather than the learning goals they are supposed to achieve.

In addition, some studies report challenges such as limited technological infrastructure, low digital competence of teachers, and a lack of support in school facilities. These factors make it difficult to fully implement interactive media in every educational setting. This finding shows that the effectiveness of interactive learning media is not only determined by the quality of the media, but is also influenced by teacher readiness, student characteristics, and the conditions of the school where learning takes place.

This study also found that most previous research used short-term experimental designs focusing on a single type of media. This situation often makes it difficult to generalize the results to a broader context. Therefore, further research involving various types of media, different student characteristics, and longer implementation periods is needed to get a more comprehensive picture of the effectiveness of interactive learning media.

Implications for Teachers and Curriculum Developers

This study provides important implications for math teachers and curriculum developers. Teachers need to use interactive learning media more systematically as part of their teaching strategy, not just as an add-on activity. The choice of media should match the learning objectives, the characteristics of the material, and the students' needs.

For curriculum developers, the results of this research highlight the importance of strengthening teachers' competencies in designing and utilizing interactive learning media. Teacher training programs should pay more attention to developing digital media, learning gamification, and technology-based teaching strategies. In addition, support for educational infrastructure also needs to be continuously improved so that the use of interactive media can be more evenly implemented across schools.

CONCLUSIONS AND RECOMMENDATIONS

Based on the literature review conducted on various studies related to interactive learning media in mathematics education, it can be concluded that interactive learning media has a positive contribution to the development of numeracy literacy and the increase of students' enthusiasm for learning. Various types of media found in this review include digital educational games, interactive quizzes, animated learning videos, and interactive manipulative teaching aids.

The synthesis of the literature shows that interactive learning media can help students understand mathematical concepts more concretely, increase active engagement during the learning process, and create a more interesting and meaningful learning experience. Several studies reviewed also reported that the use of interactive media is associated with improvements in students' numeracy skills through exploration activities, problem-solving, and more varied exercises. Besides impacting cognitive aspects, interactive learning media are also reported to boost students' enthusiasm for learning. A more enjoyable learning atmosphere, immediate feedback, and opportunities to actively interact with learning materials are factors that drive increased motivation and engagement in math learning. This study also shows a positive reciprocal relationship between numeracy literacy and learning enthusiasm. Increased enthusiasm for learning can support the development of students' numeracy skills, while improved math understanding can strengthen students' confidence and learning motivation. One of the studies reviewed reported a strong relationship between these two aspects, with a correlation value of $r = 0.76$, indicating a close connection between the cognitive and affective dimensions in math learning.

Based on these findings, interactive learning media can be considered as one of the learning strategies that support the development of numeracy literacy and increase student engagement in math learning. Therefore, teachers need to systematically integrate the use of interactive media in accordance with students' characteristics and the learning objectives they aim to achieve. This study has limitations because it uses a literature review method that relies on previous research findings. Therefore, further research is recommended to conduct empirical studies through experimental designs, classroom action research, or other field studies to obtain more comprehensive evidence regarding the effectiveness of various types of interactive learning media in diverse educational contexts.

FURTHER STUDY

This research still has limitations, so further studies are needed on the topic of Strategies to Improve Numeracy Literacy and Student Learning Enthusiasm through Interactive Learning Media in Mathematics to refine this research and provide more insight for readers and the author.

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