

Analysis of the Needs for Developing Interactive Learning Media for Elementary School Students

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ARTICLE HISTORY

Received: 22nd April 2026

Revised: 18th May 2026

Accepted: 31st May 2026

Published: 8th June 2026

KEYWORDS

Analysis needs

Learning media interactive

Students school basic

Game-based learning

SDG 4 Quality Education

ABSTRACT - The rapid advancement of digital technology has significantly transformed educational practices, yet elementary school mathematics learning remains dominated by conventional lecture methods and passive media, resulting in low student engagement and limited conceptual understanding. This study aims to analyze the needs for developing interactive learning media based on educational games for fourth-grade elementary school students, particularly in mathematics learning on the topic of plane geometry. A qualitative descriptive approach was employed, with data collected through direct classroom observation and semi-structured interviews with fourth-grade teachers at a public elementary school in Tasikmalaya City. Data were analyzed using thematic analysis following the Miles and Huberman model, encompassing data reduction, data presentation, and conclusion drawing. The findings reveal a substantial gap between the demands of 21st-century learning and actual classroom practices. Teachers acknowledge the limitations of current media and express a strong need for interactive, practical, and easily operable learning tools that can sustain student motivation without adding instructional burden. Students demonstrated noticeably higher enthusiasm and engagement when game elements and visual stimulation were incorporated into learning activities. The needs analysis concludes that educational game-based interactive media represents a contextually relevant and pedagogically sound solution, capable of integrating challenge, visualization, immediate feedback, and two-way interaction to simultaneously foster students' cognitive, affective, and social engagement. These findings provide a strong empirical foundation for subsequent development and effectiveness-testing research. This study also aligns with SDG 4 (Quality Education), supporting the creation of inclusive, equitable, and innovative learning environments that promote lifelong learning opportunities for all elementary school students.

INTRODUCTION

Digital technology has triggered major transformations in many dimensions of human life, particularly in the education sector. Today, technology is no longer considered merely a support but an essential component of the learning process. Ali et al. (2024) stated that incorporating technology into learning is believed to improve the quality of education by delivering more engaging, interactive, and contextually relevant content. At the elementary education level, the application of technology is increasingly crucial because elementary school children are in a phase of cognitive growth that requires authentic, visual, and hands-on learning experiences. The modern education era demands an approach that shifts from a teaching-focused model to one that places students at the center. The learning process is expected to emphasize not only content understanding but also critical thinking, creativity, collaboration, and interaction skills. However, the reality in schools shows that teaching methods at the elementary level are still largely dominated by lectures and conventional tools such as textbooks and worksheets. This situation results in less active student engagement and does not fully support the development of 21st-century competencies (Habibah et al., 2021).

Today's elementary school children are part of a generation raised in an environment familiar with the digital world. They are accustomed to interacting with handheld devices, applications, and various types of electronic media on a daily basis. Prensky (2001) refers to this group as digital natives, a generation with a different learning style than their predecessors. A mismatch between student characteristics and the teaching methods implemented in schools can result in low student motivation and participation in the learning process. One subject often considered challenging and unengaging by elementary school students is mathematics. This subject is abstract and requires logical thinking and a deep understanding of concepts. Sari & Afriansyah (2022) explain that obstacles to learning mathematics for elementary school students often stem from material delivery that lacks context and the limited use of tools to facilitate conceptual understanding. As a result, students tend to memorize formulas without truly understanding the essence of the concepts being learned.

Learning aids play a crucial role in explaining abstract material to students' understanding. Well-designed aids can help students visualize concepts, increase their enthusiasm for learning, and encourage active participation in the learning process. Amelia & Suryani (2023) state that interactive aids can create a more engaging learning environment and allow students to interact directly with the learning content. Thus, the implementation of interactive aids is an important approach to improving the quality of teaching in elementary schools. In line with technological advances, digital-based interactive aids are increasingly being created and implemented in the learning process. Digital tools enable the integration of various components such as text, images, sound, video, and animation into a single learning package. Furthermore, digital tools also facilitate reciprocal interaction between students and the material. Diana et al. (2022) stated that digital interactive aids can increase student participation because they offer a more dynamic and responsive learning experience than conventional tools.

The game-based learning approach is one type of interactive aid that has received considerable attention in education. Game-based learning utilizes game elements such as challenges, rules, responses, and imbalances to create a rewarding and meaningful learning experience. Prensky (2001) stated that educational games can increase student learning motivation because they provide fun and challenges that encourage students to continue engaging in the learning process. In elementary education, learning through games is considered suitable for students' tendencies to learn through play. Setiawati et al. (2024) stated that game-based learning can simultaneously increase students' cognitive, affective, and social engagement. Through games, students not only learn to understand the material but also develop collaboration, decision-making, and problem-solving skills.

In addition to supporting student participation, game-based interactive tools also have the potential to strengthen literacy and numeracy. Literacy and numeracy are not only seen as the ability to read, write, and calculate, but also as the ability to apply that knowledge in various life situations. Interactive tools enable students to connect learning concepts to real-life situations through simulations, visualizations, and problem-based activities. This aligns with the demands of contextual learning, which emphasizes the connection between material and students' daily lives. On the other hand, national education policy also encourages the use of digital technology in learning as part of education reform. Elementary schools are expected to integrate technology pedagogically to improve the quality of learning. However,

this policy often faces obstacles at the practical level. Teachers still need tools that are practical, easy to operate, and appropriate to classroom conditions for effective technology integration (Habibah et al., 2021).

Previous studies have focused on the development and effectiveness of specific interactive tools. These studies generally generate noise and question the impact of the tools on student learning outcomes. However, research specifically addressing the needs analysis for developing interactive tools in elementary schools remains quite limited. In fact, needs analysis is a crucial initial step in development research because it determines the relevance and success of the tools to be created (Branch, 2009). Without a thorough needs analysis, the tools developed have the potential to be incompatible with the actual needs of teachers and students. A technically advanced tool may not be effective if it does not consider user characteristics and the learning context. Therefore, needs analysis is the primary foundation for designing interactive tools that are contextual, applicable, and user-oriented.

Based on the explanation above, this research has a strategic position as a preliminary study aimed at analyzing the needs for developing interactive tools for elementary school students. This research focuses on identifying existing learning conditions, teacher needs for tools, and student needs in mathematics learning. The results of this needs analysis are expected to provide a foundation, conceptualization, and empirical basis for developing interactive educational game-based tools that are appropriate to the characteristics of elementary school students and the demands of 21st-century learning. Therefore, the purpose of this research is to analyze the needs for developing interactive tools for elementary school students as a basis for designing tools that are relevant, contextual, and oriented towards active learning. This research is expected to contribute to the advancement of educational science, particularly in the field of learning aids and mathematics learning in elementary schools, as well as being a reference for further research at the development and implementation stage of interactive aids.

METHODS AND MATERIALS

This study use a qualitative approach using descriptive methods specifically designed to gain a deep and detailed understanding of the current learning conditions and specific needs in developing interactive learning media suitable for elementary school students. A qualitative approach was chosen because the primary focus of this study was to explore personal experiences, subjective perceptions, and naturally occurring classroom learning practices, particularly those related to the use of learning media and the level of student engagement in the mathematics learning process. This approach provided the researcher with the opportunity to capture learning phenomena contextually, comprehensively, and in accordance with real-world conditions without excessive intervention (Creswell, 2014).

This was conducted in a public elementary school in Tasikmalaya City, selected based on specific criteria to represent general conditions. The study subjects included fourth-grade teachers and fourth-grade students directly involved in the mathematics learning process, specifically on the topic of abstract data structures. Subject selection was purposive, considering that classroom teachers play a primary and central role in the planning and implementation of daily learning, while students are the ultimate and primary users of the learning media that will be developed in the future. Thus, the collected data is expected to accurately represent the actual and real needs of the users of these learning media.

Data collection in this study was conducted through two main techniques: direct observation and in-depth interviews. Observations were conducted to directly and systematically observe the learning process occurring in the classroom, including the teaching methods employed by teachers, the types of learning media utilized in practice, and the level of student engagement and response during the learning sessions. Meanwhile, interviews were conducted with classroom teachers to gather further information about their teaching experiences, challenges encountered in using learning media, the utilization of available technology facilities in the school, and their needs and expectations for interactive learning media that suit the unique characteristics of elementary school students. The interview technique used was semi-structured, allowing researchers to obtain in-depth, flexible, yet directed and focused data on the stated research objectives.

The data obtained from these two techniques were then analyzed using thematic analysis techniques based on the Miles and Huberman (2014) model, which consists of three main stages: data reduction, data presentation, and conclusions. In the data reduction stage, researchers select and focus data relevant to the research objectives, particularly data closely related to current learning conditions and the need to develop effective interactive learning media. Next, the data is presented in a clear and structured descriptive narrative to facilitate the identification of patterns, main themes, and the interrelationships between the various findings that emerge. The final stage is drawing conclusions, which is carried out continuously by verifying the findings based on the collected observation and interview data, so that the results of the analysis truly reflect the real and contextual needs for the development of interactive learning media in elementary schools.

RESULTS AND DISCUSSION

The results of this study were obtained through in-depth observations of ongoing learning processes and intensive and detailed interviews with fourth-grade teachers at an elementary school. Data analysis revealed a significant discrepancy between the demands of 21st-century learning and actual classroom practices, particularly regarding the use of interactive and modern learning media. The discussion in this study focuses specifically on the current learning conditions, the perceived needs of teachers and students for more effective learning media, and the implementation of this needs analysis in the development of interactive learning media based on educational games. Based on systematic observations, the mathematics learning process in the classroom is still heavily dominated by traditional lecture methods and question-and-answer sessions, with the teacher being the center of all learning activities. The learning media used mostly consist of standard textbooks, simple whiteboards, and conventional student worksheets. Learning activities tend to be one-way, with the teacher delivering the material directly and students working on problems individually without much interaction. This situation results in relatively low levels of student active engagement in learning, especially when dealing with abstract mathematics material such as the concept of plane figures.

These observational findings align with the research of Habibah et al. (2021), which stated that learning in elementary schools still focuses heavily on verbal delivery and the use of conventional media, even though these schools have adequate and readily available technological facilities. Murwanto et al. (2025) also revealed that one of the main obstacles to integrating technology into learning lies not in the availability of physical facilities, but rather in the lack of practical, easily accessible learning media that best suits teachers' daily classroom needs. In the context of mathematics learning, particularly in plane geometry, the limited use of interactive learning media directly impacts students' low level of conceptual understanding. Plane geometry requires students to understand geometric shapes, their distinctive properties, and the relationships between them visually and conceptually. If learning is delivered solely through simple verbal explanations and written exercises, students tend to memorize concepts without truly understanding their meaning and essence. Marthani and Ratu (2022) emphasized that geometry learning in elementary schools requires support from engaging visual media and concrete activities to enable students to develop conceptual understanding optimally and effectively.

Interviews revealed that teachers are fully aware of the limitations of the learning methods and media they have used so far. Teachers reported that students often appear less enthusiastic, easily bored, and lose interest when lessons are monotonous and lack variation. This directly impacts student participation in class discussions and other learning activities. Teachers urgently need learning media that can create a more engaging, interactive, and enjoyable learning environment so that students can actively and enthusiastically engage throughout the learning process. Teachers' need for interactive learning media is also closely related to the demands of the national curriculum, which emphasizes active, student-centered learning as the primary subject. Interactive, measurable learning media can help teachers facilitate more varied, creative, and educationally meaningful learning. Amelia and Suryani (2023) stated that interactive learning media can significantly increase student engagement because it enables dynamic two-way interaction between students and learning materials. Furthermore, interactive media also helps teachers explain abstract concepts through clear visualizations and more concrete and applicable simulations.

Beyond prioritizing interactivity, teachers also emphasize the importance of learning media that is easy to use, does not require complex technical preparation, and can be operated quickly. Learning media that are too complex in design have the potential to add burden to teachers and are difficult to implement sustainably in daily routines. Therefore, learning media that is needed is practical to use, flexible in application, and can be used in a variety of learning situations. This strongly aligns with Branch's (2009) opinion, which states that the success of learning media is determined by its suitability to the specific needs and varying abilities of users. From a student perspective, observations indicate that students are more enthusiastic, active, and engaged when learning involves fun game elements and engaging visualizations. Students appear more confident in expressing their opinions, collaborating with classmates, and demonstrating a heightened sense of curiosity when learning is presented in a fun and entertaining way. These characteristics indicate that elementary school students have a natural inclination to learn through spontaneous play and hands-on, interactive experiences.

These findings align with constructivist learning theory, which emphasizes that knowledge is built through active and participatory learning experiences. Bruner's theory states that learning will be more meaningful and effective when students are directly involved in the process of discovering knowledge through in-depth exploration and intense interaction with the learning environment (Yuntawanti et al., 2021). Interactive game-based learning media provide students with opportunities to experience this learning process in a natural, contextual, and enjoyable way. In the specific context of mathematics learning, game-based learning media is considered capable of helping students understand abstract concepts in a more concrete and applicable way. Sari and Afriansyah (2022) revealed that elementary school students' mathematics learning difficulties can be minimized through the use of engaging, innovative learning media that are appropriate for their early cognitive development. Game-based media allows students to learn through hands-on practice, try various problem-solving strategies, and receive immediate feedback, allowing for a deeper and more sustainable understanding of concepts.

The needs analysis also indicated that interactive learning media is needed not only to passively deliver material but also as a means of integrated and comprehensive learning assessment. Teachers reported that the learning evaluation process is still dominated by conventional written tests, which do not fully reflect students' comprehensive and holistic understanding. Interactive game-based learning media has the potential to facilitate formative assessment through instant feedback received by students during the learning process in real time. These findings are supported by Diana et al. (2022), who stated that interactive learning media allows teachers to accurately display students' learning progress in real time. This direct and instant feedback helps students quickly identify their errors and improve their understanding independently without embarrassment. In addition, assessments packaged in the form of games can reduce students' anxiety regarding learning evaluations and significantly increase learning motivation.

Game-based learning is a highly relevant and appropriate approach to comprehensively address these needs. Prensky (2001) stated that game-based learning integrates elements of engaging challenges, clear rules, immediate feedback, and motivating rewards, encouraging sustained and intensive student engagement. Setiawati et al. (2024) also emphasized that game-based learning can simultaneously enhance students' cognitive, affective, and social engagement, resulting in more holistic and comprehensive learning. Previous studies have shown that game-based learning media have a significant positive impact on elementary school students' learning outcomes. Suciyanti et al. (2024) found that the use of educational games in mathematics learning significantly and sustainably improved students' conceptual understanding and engagement. Safitri and Nurmaidina (2025) also reported that game-based learning media has a high level of feasibility and can significantly increase students' learning interest in the long term.

However, these research findings emphasize that the development of game-based learning media cannot be undertaken directly without an in-depth and comprehensive needs analysis. Learning media must be designed to suit the unique characteristics of students, the specific needs of teachers, and the diverse learning conditions in schools. The media developed must also consider the desired user experience so that it can be consistently implemented in daily learning without any obstacles. Murwanto et al. (2025) stated that the desire to use digital learning media is strongly influenced by the level of practicality, ease of access, and willingness of teachers in the classroom context. Based on the results of a comprehensive needs analysis, it can be concluded that interactive learning media based on educational games is a relevant and effective solution for improving the quality of mathematics learning

in elementary schools. This media is expected to bridge the gap between the demands of 21st-century learning and actual classroom learning practices. By combining engaging game elements, dynamic interactions, and immediate feedback, interactive learning media can encourage more active, meaningful, and student-centered learning to the fullest.

Thus, the results of this study provide a strong and valid empirical foundation for the development of interactive learning media based on educational games in subsequent research stages. This needs analysis not only identifies existing learning problems, but also provides direction for the development of pedagogically relevant, contextual, and applicable learning media to be implemented in elementary schools with optimal results.

CONCLUSIONS

Based on the research results and discussion, it can be concluded that the learning process in elementary schools still requires innovative learning media that can increase student engagement and understanding, particularly in mathematics. Observations indicate that learning is still dominated by lecture methods and the use of conventional media, even though schools have adequate technological facilities. This situation creates a gap between the potential use of technology and the learning practices that occur in the classroom. The needs analysis revealed that teachers require learning media that are interactive, easy to use, and able to increase student motivation and engagement. Practical and contextual learning media are considered more feasible for sustainable implementation in the learning process. From the student perspective, learning media that incorporates elements of games and visualization are considered more engaging and able to help students understand abstract concepts more concretely. The characteristics of elementary school students who tend to learn through direct experience and play activities require a more innovative and participatory learning approach.

The findings of this media based on educational games is a relevant alternative to address learning needs in elementary schools. Game-based media can integrate elements of challenge, interaction, and feedback, which can simultaneously encourage students' cognitive, affective, and social engagement. Therefore, this needs analysis provides an important foundation for the development of interactive learning media that is not only technologically innovative but also aligned with pedagogical principles and the characteristics of elementary school students. The implication of this research is the need for further research in the form of developing and testing the effectiveness of interactive learning media based on educational games. Future research is expected to produce learning media that are feasible, practical, and effective in improving the quality of mathematics learning in elementary schools and supporting the optimal implementation of 21st-century learning.

ACKNOWLEDGEMENT

No funding. This study was not supported by any grants from funding bodies in the public, private, or not-for-profit sectors.

CONFLICT OF INTEREST

Authors declare no conflicts of interest.

AUTHORS CONTRIBUTION

Trinanda Zalsa: Conceptualization, Methodology, Software. **Ika Fitri Apriani:** Data curation, Writing-Original draft preparation. **Erwin Rahayu Saputra:** Investigation. **Bayu Pratama Rhamdhani:** Software, Visualization, Validation. **Renata Nur Aziizah:** Supervision. **Sheva Anela Tanu Praditha:** Writing- Reviewing and Editing.

AVAILABILITY OF DATA AND MATERIALS

Data available on request from the authors.

DECLARATION OF GENERATIVE AI

The authors declare that no generative AI was used in the writing of the manuscript.

ETHIC STATEMENTS

Not applicable

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