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DESIGN AND IMPLEMENTATION OF FLASHCARD-BASED GAME LEARNING MEDIA FOR ELEMENTARY SCHOOL MATHEMATICS

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ABSTRACT
This study aims to design and implement Flashcard-based Game-Based Learning (GBL) media to improve elementary students' understanding of basic arithmetic operations. Using the ADDIE development model, the research focused on the stages of analysis, design, development, implementation, and evaluation. The feasibility of the media was assessed through expert validation, practicality testing, and effectiveness evaluation. The results indicate that the Flashcard-based GBL media is highly feasible, easy to use, and engaging for both teachers and students. Additionally, the effectiveness testing showed a significant improvement in students' learning outcomes, highlighting the media's impact in enhancing mathematical understanding, motivation, and learning engagement in a fun and interactive environment.

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INTRODUCTIONS

Education is essentially a consciously and systematically designed process to create learning experiences that enable students to develop their full potential. Through education, students are expected to grow into individuals with spiritual strength, mature personality, intellectual intelligence, noble character, and life skills that benefit themselves and their communities. This aligns with Law No. 20 of 2003 on the National Education System, which emphasizes that the ultimate goal of national education is to form Indonesian citizens who are faithful, pious, virtuous, knowledgeable, creative, independent, and socially responsible individuals. To realize these goals, the government continuously implements various policy innovations to improve education quality, one of which is the *Merdeka Curriculum*, which emphasizes contextual, flexible, and student-centered learning (Puskurjar, 2025).

The *Merdeka Curriculum* is grounded in Ki Hadjar Dewantara's philosophy that education must align with the nature of the child and their environment. Meaningful learning should provide enjoyable, reflective, and deep learning

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experiences. Therefore, teachers play a crucial role in designing learning activities that integrate cognitive, affective, and psychomotor aspects in a balanced manner while creating a participatory and creative classroom atmosphere.

In the context of elementary education, mathematics plays an essential role in developing logical, systematic, and analytical thinking skills. Mathematics also contributes to the cultivation of 21st-century competencies such as critical thinking, problem-solving, and logical reasoning (Ulya & Siswanto, 2024). However, in practice, mathematics learning in elementary schools still faces challenges, particularly in terms of low student engagement and motivation. Observations conducted at SD Negeri Sendangmulyo, Gunem District, Rembang Regency, revealed that more than 66% of second-grade students had not yet achieved mastery in basic arithmetic operations, with an average score of 58.33. This indicates that the learning methods employed remain insufficiently interactive and have yet to facilitate active student learning effectively.

One potential solution to this problem is to develop innovative learning media that can help teachers convey abstract concepts in a more concrete and engaging way. Learning media serve as an intermediary between teachers and students in the process of delivering educational messages (Munthe et al., 2023). According to Gagne, as cited in Balkis and Rakhmawati (2019), media constitute a component of the learning environment that can stimulate students to learn actively. The appropriate use of media can clarify learning messages, increase attention, foster motivation, and strengthen conceptual understanding.

One type of media suitable for teaching mathematics at the elementary level is the flashcard. Flashcards are illustrated cards containing symbols, numbers, or images that help students better understand and retain concepts. Balkis and Rakhmawati (2019) explain that flashcards are effective in introducing number symbols and arithmetic operations in a visual and enjoyable manner. Helena and Dwi, as cited in Nugroho and Budiyono (2023), add that flashcards assist students in associating numerical symbols with concrete objects, thereby facilitating cognitive processing in understanding mathematical concepts. Furthermore, flashcards are flexible, easy to use, and capable of enhancing memory retention and learning motivation (Indriana in Nugroho & Budiyono, 2023).

To make learning more engaging and aligned with the characteristics of elementary school students, flashcard media can be integrated with a Game-Based Learning (GBL) approach. According to Winatha and Setiawan (2020), GBL is a learning approach that employs game elements to achieve educational objectives. This approach fosters a competitive, interactive, and enjoyable learning environment, which increases students' motivation to learn. Sari and Ahmad (2022) state that through GBL, students learn via exploration, trial and error, and reflection, thereby developing critical thinking and problem-solving skills. Dewi and Listiowarno (2019) emphasize that play within an educational context serves creative and explorative functions that simultaneously develop social, cognitive, and affective abilities.

The integration of flashcards and GBL in elementary mathematics instruction is expected to create active, collaborative, and enjoyable learning experiences. This combination can help students understand abstract concepts concretely through meaningful play activities while enhancing motivation and learning outcomes. Komang et al. (2020) found that game-based media effectively improved learning outcomes and student engagement, as they correspond with the developmental characteristics of elementary school children, who naturally enjoy competitive and explorative activities.

To produce high-quality learning media that meet students' needs, this study employed a Research and Development (R&D) approach using the ADDIE model, which includes the stages of Analysis, Design, Development, Implementation, and Evaluation (Reiser & Mollenda in Waruwu, 2024). This model was selected because it is systematic, adaptive, and relevant to educational product development, particularly for instructional media. The analysis stage identified learner needs and characteristics, the design stage formulated the concept of the game-based flashcard media, the development stage involved product creation and validation, the implementation stage tested its classroom use, and the evaluation stage assessed its effectiveness in improving students' mathematics learning outcomes.

Learning outcomes reflect the level of student achievement after undergoing the learning process, encompassing cognitive, affective, and psychomotor domains. Factors influencing learning outcomes include

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motivation, interest, prior knowledge, learning media, and teaching methods. Therefore, the use of game-based flashcard media in mathematics learning is expected to enhance student engagement, reinforce conceptual understanding, and significantly improve learning achievement.

This study aims to: (1) Develop and produce flashcard-based learning media for the mathematics subject in elementary schools. (2) Assess the practicality of the media based on feedback from teachers and students. (3) Examine the effectiveness of the media in improving the mathematics learning outcomes of second-grade elementary school students.

METHOD

This study employed a Research and Development (R&D) approach, with the primary objective of designing and implementing flashcard-based learning media integrated with Game-Based Learning (GBL) for elementary school mathematics. This method was selected because it aligns with the research goal of developing an educational product that is valid, practical, and effective in improving students' learning outcomes (Sugiyono, 2019; Waruwu, 2024). The development model used in this study was the ADDIE model, which consists of five main stages: Analysis, Design, Development, Implementation, and Evaluation (Branch, 2016). This model was chosen for its systematic and adaptive characteristics, making it particularly suitable for technology-based instructional media development (Wibowo & Sutopo, 2023).

The research was conducted at SD Negeri Sendangmulyo, Gunem District, Rembang Regency, from July to September 2025. The participants included 30 second-grade students and two classroom teachers, who were involved in the needs analysis and implementation stages. The research site and participants were selected using purposive sampling, considering their relevance to the characteristics of the developed media students who were learning basic arithmetic operations.

The study adopted a one-group pretest–posttest design (Creswell & Guetterman, 2019), allowing the researcher to compare students' learning outcomes before and after using the flashcard-GBL media. The procedure consisted of three phases: administering a pretest to determine students' prior knowledge, implementing the media in the learning process, and conducting a posttest to measure learning improvement.

The research procedure followed the ADDIE model stages as follows: (1) Analysis. Identifying students' learning needs, challenges in mathematics learning, and the alignment of content with the curriculum. (2) Design. Creating the flashcard design using Canva, defining the game elements, and preparing the research instruments. The pretest and posttest instruments were designed with multiple-choice and short-answer questions focused on basic arithmetic operations (addition, subtraction, multiplication, and division). The questionnaires for validation included statements related to content, design, and usability. (3) Development. Producing the initial prototype, conducting expert validation by material and media experts, and revising the product based on expert feedback. (4) Implementation. Applying the media in the classroom learning process with second-grade students at SD Negeri Sendangmulyo. (5) Evaluation. Assessing the media's effectiveness, practicality, and appeal through learning outcomes and user responses.

The instruments used included observation sheets, validation questionnaires, learning achievement tests, and teacher and student response questionnaires. The observation sheets were used to identify instructional needs and classroom implementation, while the validation questionnaires consisted of items assessing content, design, and language suitability. The pretest and posttest measured media effectiveness through a set of 20 questions based on the arithmetic concepts taught. Sample pretest and posttest questions included: "What is the result of 12 + 7?" and "How many times does 5 go into 25?" The response questionnaires evaluated the practicality and user acceptance of the media (Riduwan & Akdon, 2018; Creswell & Guetterman, 2019).

Data collection techniques comprised observation, expert validation, learning achievement tests, and user response surveys. Data credibility was strengthened through triangulation methods, which combined multiple data sources and analytical techniques to enhance the accuracy of findings (Creswell & Guetterman, 2019).

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Data analysis was conducted using both quantitative and qualitative approaches. Qualitative analysis was applied to interpret observational results and open-ended responses from teachers and students, while quantitative analysis was used to calculate the validity, practicality, and effectiveness scores of the media. Quantitative data were analyzed using the percentage formula: $P=\sum x / N \times 100\%$.

The media was categorized as effective if it obtained a score of ≥ 76%, fairly effective for scores of 56–75%, less effective for 40–55%, and ineffective for < 40%. Improvement in learning outcomes was analyzed using the N-Gain test (Hake, 1998), categorized as high (≥ 0.70), moderate (0.30–0.69), and low (< 0.30). In addition, a paired sample t-test was conducted to determine the significance of differences between pretest and posttest results. If the p-value < 0.05, it indicated that the use of flashcard-based GBL media had a significant positive effect on students' mathematics learning outcomes.

RESULT AND DISCUSSION

Result

This study aimed to develop and examine the effectiveness of Flashcard-based learning media integrated with Game-Based Learning (GBL) to improve mathematics learning outcomes for second-grade students at SD Negeri Sendangmulyo in the 2025/2026 academic year. The development model used was ADDIE (Analysis, Design, Development, Implementation, Evaluation). The research findings include the stages of product development and field testing, covering aspects of validity**,** practicality, and effectiveness of the media.

Needs Analysis

The initial stage of the research began with a needs analysis to identify the actual learning conditions in the classroom. The researcher conducted observations and interviews with second-grade teachers at SD Negeri Sendangmulyo to explore the challenges faced by both students and teachers in learning mathematics. Based on the observations, it was found that students' learning outcomes were still relatively low, with an average daily test score of 58.33 and a mastery rate of only 33.33%. The teacher's instructional methods remained conventional, dominated by lectures and repetitive exercises, with minimal use of interactive media. As a result, students tended to be passive and easily bored during mathematics lessons. Teachers emphasized the need for innovative learning media that could enhance students' learning interest through enjoyable, easy-to-understand, and engaging activities that foster active participation. This analysis served as the foundation for designing flashcard-based educational games that are more attractive and interactive for young learners.

Table 1. Initial Student Needs Analysis Results

Aspect Analyzed	Observation Findings	Learning Implications
Average daily test score	58.33	Below the minimum mastery criterion (70)
Student mastery rate	33.33%	Requires innovative learning media
Teaching method	Conventional lectures and exercises	Limited student activity
Student response	Passive and easily bored	Needs engaging educational play activities
Media used	Fingers and simple concrete objects	Unattractive and less interactive

The interpretation of the analysis results indicates that the mathematics learning conditions in grade II at SD Negeri Sendangmulyo require innovation in media use. Conventional media have proven ineffective in stimulating student interest and active engagement. Therefore, the development of flashcard-based Game-Based Learning (GBL) media is considered an alternative solution that can create an active, enjoyable, and motivating learning atmosphere for students.

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Product Development

The next stage involved product development. At this stage, the researcher designed and created interactive flashcards tailored to the cognitive and psychological characteristics of early elementary school students. The cards were designed attractively with bright colors, simple illustrations, and large fonts for readability. Each flashcard contained a combination of numbers, arithmetic operations, and simple word problems. Additionally, the media was integrated with an educational board game titled *"Ular Tangga Petualangan Angka Ajaib"* (The Magic Number Adventure Snakes and Ladders), serving as an interactive platform for learning mathematics. The game was designed to promote healthy competition while engaging students in activities such as counting, recognizing number patterns, and solving simple problems through play.

Table 2. Specifications of Flashcard-Based Game-Based Learning Media

Component	Description
Type of media	Interactive flashcards + educational board game
Material	Arithmetic operations with whole numbers (addition and subtraction)
Card design	Created using Canva, 7.5 × 10.5 cm, colorful and illustrated
Game application	*The Magic Number Adventure Snakes and Ladders*
Learning function	Trains number recognition, arithmetic operations, and word problem-solving
Advantages	Interactive, engaging, easy to use, and durable

The developed product serves not only as a visual aid but also as an interactive learning medium that enables students to learn while playing. With an appealing design and integrated educational game components, students can learn mathematics in a fun and competitive atmosphere. This approach also assists teachers in creating active learning environments aligned with the *Merdeka Belajar* (Independent Learning) principles, where students are positioned as the central focus of the learning process.

Product Validation

After the product development phase, validation was conducted to assess the feasibility of the media before classroom implementation. Two expert validators were involved one media expert and one subject matter expert. The assessment covered four aspects: content feasibility, language, presentation, and media appearance.

Table 3. Results of Media and Material Expert Validation

Assessment Aspect	Average Score	Category
Content feasibility	3.85	Very Feasible
Language	3.90	Very Feasible
Presentation	3.80	Feasible
Media appearance	4.00	Very Feasible
Overall Average	**3.89**	**Very Feasible**

The validation results indicated that the flashcard-based GBL media met the feasibility standards for educational use. Minor revisions were made only to font size and color contrast to enhance visual comfort for students. Overall, the validators concluded that the media aligned well with mathematics learning objectives and was ready for field implementation.

Media Practicality

The practicality of the media was measured through classroom observations and response questionnaires completed by teachers and students. The trial was conducted in a second-grade classroom at SD Negeri Sendangmulyo with direct teacher involvement. One teacher mentioned, "The media is very easy to use. The students were excited to participate and learned better through the game. It's a refreshing change from the usual methods." Another teacher stated, "The flashcards helped in simplifying the arithmetic problems,

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making it easier for the students to grasp the concepts." Students also provided positive feedback, with one saying, "I like the game! It's fun to play and I feel like I understand the math better.".

Table 4. Results of Media Practicality Test

Respondent	Assessment Aspect	Average Score	Category
Teacher	Alignment with objectives, ease of use, instructional effectiveness	4.00	Very Practical
Student	Interest, active participation, ease of understanding	3.95	Very Practical
Learning Observation	Implementation of GBL syntax and student participation	3.90	Very Good

These findings indicate that the flashcard-based GBL media is highly practical for use in classroom learning. Students demonstrated high enthusiasm, active engagement, and improved comprehension of mathematical concepts. Teachers also found the media helpful for managing the class and maintaining student focus throughout the learning process.

Media Effectiveness

The effectiveness test aimed to determine the extent to which the use of flashcard-based Game-Based Learning media influenced students' improvement in arithmetic learning outcomes. The experiment used a pretest–posttest design involving 30 second-grade students at SD Negeri Sendangmulyo. Before the implementation, students took a pretest to assess their initial understanding. After several learning sessions using the flashcard-based GBL media, a posttest was administered to measure learning improvement.

During the learning sessions, the teacher acted as a facilitator, guiding students to learn while playing using the flashcards and the board game "The Magic Number Adventure Snakes and Ladders." The classroom atmosphere became more dynamic as students participated in answering flashcard questions to advance on the board. One student shared, "I loved the game. I wanted to win, so I really paid attention to the math problems." Each group competed in a friendly manner to reach the finish line, fostering intrinsic motivation and curiosity. This interactive and enjoyable learning process made the experience more meaningful for the students.

Table 5. Results of Media Effectiveness Test

Test Type	Average Score	Difference	Category
Pretest	49.63	–	–
Posttest	78.83	+29.20	Effective
N-Gain	0.60	–	Moderate–High
t-test (Sig. 2-tailed)	0.000	< 0.05	Significant

Data analysis revealed a significant improvement in students' learning outcomes after using the developed media. The average score increased by 29.20 points, from 49.63 (pretest) to 78.83 (posttest). The N-Gain value of 0.60 fell into the moderate-to-high category, indicating that the media was fairly effective in enhancing students' understanding of arithmetic operations. Moreover, the paired sample t-test result (Sig. 2-tailed = 0.000 < 0.05) confirmed a statistically significant difference between pretest and posttest scores.

This improvement not only reflects better cognitive achievement but also indicates positive changes in student attitudes and motivation. Students appeared more focused, confident, and enthusiastic when solving problems. These findings align with the principles of Game-Based Learning, which suggest that integrating gameplay elements into instruction can enhance students' emotional and cognitive engagement. Therefore, the implementation of flashcard-based GBL media is considered effective in reinforcing elementary students' understanding of basic mathematical concepts, particularly in addition and subtraction of whole numbers.

Discussion

The results of this study indicate that the development of Flashcard media based on Game-Based Learning (GBL) has proven to be valid, practical, and effective in improving elementary school students' mathematics learning

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outcomes. This media was designed not only as a visual aid but also as an educational game that fosters students' motivation and active participation. The success of this media implementation can be analyzed through three main aspects: product validity, practicality of use, and the effectiveness of the media in improving learning outcomes. Furthermore, the findings are discussed in relation to their relevance to 21st-century learning principles and the Kurikulum Merdeka (Independent Curriculum), which emphasizes active, student-centered learning.

The validation results show that the Flashcard-based GBL media obtained an average score of 3.89, categorized as very feasible. This finding confirms that the developed product meets the quality criteria of content, language, design, and pedagogical relevance. The media integrates appealing visual elements with educational gaming activities to reinforce students' understanding of basic mathematical concepts, particularly number operations.

This high validity aligns with Branch's (2016) view that the quality of instructional products depends on the harmony among content, design, and learner needs. Using the ADDIE model, the development process was conducted systematically and iteratively, allowing for continuous refinement at each stage based on validation results and user feedback (Wibowo & Sutopo, 2023). The reason GBL-Flashcards are effective is that they blend visual, kinesthetic, and cognitive learning modalities, offering multiple pathways to understand mathematical concepts. This is crucial for elementary students, whose cognitive and attention spans are still developing, as it helps reduce cognitive overload by breaking down learning into manageable chunks. In addition, by incorporating movement (such as physically advancing on the game board), GBL-Flashcards reduce cognitive load, facilitating better memory retention. This finding supports Nugroho and Budiyono's (2023) study, which revealed that visual media such as Flashcards enhance students' cognitive abilities in recognizing symbols, numbers, and basic number concepts. Bruner's (1966) theory on enactive, iconic, and symbolic representations also supports this approach, suggesting that students of this age learn more effectively through engaging with concrete visuals and hands-on activities.

The practicality test results show that the GBL-based Flashcard media achieved a score of 3.95–4.00 from teachers and students, which falls under the very practical category. Teachers found the media easy to use, easily integrated into the Kurikulum Merdeka lesson flow, and supportive of active, project-based, and play-oriented learning. Meanwhile, students perceived the learning process as more enjoyable, competitive, and less monotonous due to its game-like structure. These findings confirm Munthe et al. (2023), who stated that effective instructional media must facilitate interaction rather than merely deliver information. This is where the psychological principles of intrinsic motivation come into play. The gamification of learning increases intrinsic motivation by offering students rewards through achievement within the game, which fosters a sense of competence, autonomy, and relatedness, key components in Deci and Ryan's Self-Determination Theory (1985). The integration of Flashcards with Game-Based Learning principles allows students to learn through play (learning by playing), which has been proven to enhance engagement and knowledge retention (Sari & Ahmad, 2022). The game format creates a low-pressure environment that encourages risk-taking and learning from mistakes, which is crucial for fostering confidence in mathematics.

Practically, this media assists teachers in creating collaborative, participatory, and non-monotonous learning environments. The process becomes more flexible, as teachers can adjust game rules to match students' proficiency levels. This finding aligns with Winatha and Setiawan's (2020) study, which found that GBL application in elementary learning increases student activeness, cooperation, and communication. From a cognitive perspective, the game-based approach promotes deeper engagement by prompting students to think critically about problem-solving strategies during play. This aligns with the cognitive load theory (Sweller, 1988), which suggests that learning is most effective when instructional material reduces unnecessary cognitive load, allowing students to focus on higher-order tasks.

Thus, the practicality of Flashcard-based GBL lies in its ability to shift the teacher's role into that of a learning facilitator, while students become active subjects who learn through exploration, healthy competition, and reflection on their learning experiences. This approach is highly aligned with the constructivist paradigm underpinning the Kurikulum Merdeka (Yusuf et al., 2024).

The effectiveness test results demonstrate a significant improvement in students' mathematics learning outcomes. The average pretest score of 49.63 increased to 78.83 in the posttest, with an N-Gain of 0.60 (moderate–high category). The t-test results show a p-value = 0.000 < 0.05, indicating a statistically significant difference between

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the pretest and posttest results after implementing the Flashcard-based GBL media. This improvement suggests that students gained a deeper conceptual understanding after using this interactive learning medium. The reason behind this improvement can be attributed to the active learning strategies embedded within the GBL framework, which promote sustained attention, cognitive processing, and deeper understanding through play-based activities. Students not only memorized calculation procedures but also understood the meaning and relationships among numbers through enjoyable game-based activities. According to Mayer's (2005) cognitive theory of multimedia learning, the integration of visual and verbal materials, as seen in GBL-Flashcards, enhances the likelihood of dual-channel processing, leading to better learning outcomes.

This finding supports Hake's (1998) assertion that learning emphasizing active student engagement yields greater improvement compared to conventional methods. Moreover, this study aligns with Oktafyani et al. (2022), who found that number card media could enhance elementary students' motivation and arithmetic ability. Indriani et al. (2022) also reported that visual-based games could increase learning mastery up to 95%. Therefore, it can be concluded that GBL-based Flashcard media is not only cognitively effective but also positively influences students' motivation, focus, and emotional engagement in learning mathematics. This is because GBL-Flashcards activate both intrinsic and extrinsic motivation factors, which are crucial for sustained academic engagement.

From a theoretical perspective, the media's effectiveness can be explained using Gagne's concept in Balkis & Rakhmawati (2019), which states that effective learning involves visual stimuli, physical activity, and social interaction. The combination of these three elements in GBL-based Flashcards enables students to engage with the material in a holistic way, appealing to their cognitive, emotional, and social development. GBL-based Flashcards accommodate all three components by combining concrete visualization, group-based gameplay, and educational dialogue among students. Thus, this media serves as a bridge between traditional abstract learning and modern, experience-oriented learning approaches that are active and enjoyable.

The Kurikulum Merdeka and 21st-century learning emphasize the development of critical thinking, collaboration, communication, and creativity (4C). The application of Flashcard-based GBL directly supports these four competencies. Through educational game activities, students practice decision-making, teamwork, and creative problem-solving strategies. According to Sari et al. (2019), 21st-century learning must integrate active, collaborative, and meaningful experiences. This is reflected in the implementation of GBL, where students unconsciously develop Higher Order Thinking Skills (HOTS) as they solve problems and challenges during gameplay. Furthermore, Dewi and Listiowarno (2019) argue that Game-Based Learning fosters a low-pressure, experience-oriented learning atmosphere, which enhances students' intrinsic motivation, a key factor for long-term learning success. Therefore, integrating GBL-based Flashcard media not only focuses on improving mathematics learning outcomes but also contributes to shaping students' creative, collaborative, and independent learning character. This is essential in preparing students for the demands of the 21st century, where problem-solving, creativity, and collaboration are essential skills. Such a learning model is highly relevant for Indonesian primary education, as it aligns with the goals of the Kurikulum Merdeka to promote student-centered, contextual, and joyful learning experiences.

CONCLUSION

This study successfully designed and implemented a Flashcard-based learning media using the Game-Based Learning (GBL) approach, which proved to be valid, practical, and effective in improving elementary school students' mathematics learning outcomes, particularly in the topic of whole number operations. The media was developed using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), allowing for a systematic and learner-oriented development process. Based on the validation results from media and material experts, the GBL-based Flashcard media obtained an average score of 3.89, categorized as *very feasible*. This finding indicates that the content, visual design, and language aspects of the media were aligned with the characteristics of lower-grade students and supported contextual learning. In terms of practicality, both teachers and students gave average ratings between 3.95 and 4.00, signifying that the media was easy to use, engaging, and consistent with the active learning approach

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emphasized in the *Kurikulum Merdeka* (Independent Curriculum). The effectiveness test results revealed a significant improvement in students' learning outcomes, with the mean score increasing from 49.63 (pretest) to 78.83 (posttest) and an N-Gain of 0.60 (moderate–high category) with a *p*-value < 0.05. These findings demonstrate that learning through GBL-based Flashcards can enhance students' conceptual understanding, engagement, and learning motivation. Through a *learning-by-playing* approach, students do not merely memorize numbers and arithmetic operations but also develop a more meaningful and contextual understanding of mathematical concepts.

Theoretically, this study reinforces the view that combining visual media with educational gaming elements can enhance students' cognitive and affective engagement, as described in Bruner's and Gagne's theories on the importance of visual representation and active learning. Practically, the results provide a valuable contribution for elementary school teachers as an alternative innovative instructional strategy capable of fostering a fun, collaborative, and student-centered learning environment.

Future studies may extend this research by broadening the scope to different subject areas and educational levels, as well as integrating interactive digital technology elements to enhance the attractiveness and effectiveness of the learning media. Therefore, the development of Flashcard-based Game-Based Learning media can be regarded as a creative solution for realizing active, contextual, and engaging mathematics learning that aligns with the demands of 21st-century education.

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