



NUMERACY DOMINO: DEVELOPING AN INNOVATIVE MATHEMATICS LEARNING MEDIA TO ENHANCE ELEMENTARY SCHOOL STUDENTS' COUNTING SKILLS

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Abstract. Low arithmetic skills and the lack of engaging mathematics learning media remain major challenges in elementary education. Conventional teaching methods often fail to stimulate students' interest and active participation, leading to difficulties in understanding basic mathematical concepts. Therefore, innovative and interactive learning media are needed to support meaningful learning and improve students' numeracy skills. This study aimed to develop an enjoyable, practical, and effective mathematics learning medium to improve the arithmetic skills of first-grade elementary school students. The study employed the ADDIE development model, which consists of five stages: analysis, design, development, implementation, and evaluation. The research was conducted at SDN 1 Pringga Jurang involving 21 first-grade students. The instruments used included validation sheets, response questionnaires, and students' mathematics daily test scores. The validation results showed that the material expert score was 49 and the media expert score was 47, both categorized as very good ($X > 41.88$), indicating that the developed media was valid and feasible for use. In terms of practicality, the teacher response score was 47 and the average student response score was 44.47, both also classified as very good, showing that the media was easy to use and well received by teachers and students. Furthermore, the percentage of students who achieved scores above the Minimum Mastery Criterion (KKM) increased by 33% after the product trial, demonstrating the effectiveness of the media in improving students' arithmetic skills. Therefore, it can be concluded that the Numeracy Domino mathematics learning media is valid, practical, and effective for use in elementary mathematics learning.

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INTRODUCTION

Twenty-first century learning requires a fundamental transformation in educational practices, particularly a shift from teacher-centered instruction to student-centered learning approaches. This paradigm shift aims to position students as active participants in the learning process who can construct their own knowledge through meaningful learning experiences. In this context, students are expected to possess essential 21st-century competencies, such as critical thinking, creativity, communication, and collaboration, which are crucial for addressing the increasingly complex global challenges (Rahayu et al., 2023). Therefore, learning is no longer focused solely on knowledge transfer but also on the development of higher-order thinking skills and problem-solving abilities.

However, the implementation of student-centered learning in practice is still not optimal, particularly in elementary school mathematics. Mathematics is often perceived by students as a difficult, abstract, and intimidating subject. This negative perception affects students' motivation and engagement in the learning process. As a result, students' learning outcomes in mathematics, especially in basic skills such as counting, remain relatively low.

Based on observations conducted at SDN 1 Pringga Jurang, it was found that students' numeracy skills are still low, as indicated by a large number of students who have not yet achieved the Minimum Mastery Criteria (KKM) in addition and subtraction topics. This condition is influenced by students' low learning interest and the limited use of innovative learning media in

classroom instruction. The supporting data for these findings are presented in [Table 1](#), which contains the presentation of mathematics daily test results on addition and subtraction material for first-grade students at SDN 1 Pringga Jurang.

Table 1. Presentation Data of Mathematics Daily Test Results on Addition and Subtraction Material for First Grade Students at SDN 1 Pringga Jurang

KKM	Name	Number of Students	Percentage
75	>KKM	12	57%
	< KKM	9	43%
	Total	21	100%

Based on preliminary observations conducted at SDN 1 Pringga Jurang, it was found that students' counting skills are still relatively low. This is indicated by the results of daily mathematics tests on addition and subtraction, where a significant number of students have not achieved the Minimum Mastery Criteria (KKM). Out of 21 students, only 12 students (57%) achieved scores above the KKM, while 9 students (43%) were below the required standard. This condition reflects the need for innovative learning strategies and media to improve students' understanding and performance in mathematics. The low achievement is primarily caused by students' lack of interest in learning mathematics, which is often perceived as difficult and uninteresting. In addition, the limited use of engaging learning media further reduces students' motivation to participate actively in the learning process. Therefore, there is an urgent need to develop learning media that are not only effective but also enjoyable and aligned with students' characteristics.

Counting skills are one of the fundamental competencies that must be mastered by students at the elementary level. These skills serve as the foundation for understanding more complex mathematical concepts in subsequent learning. Basic arithmetic operations, such as addition and subtraction, play an important role in developing logical and systematic thinking. If students fail to master counting skills properly, they will encounter difficulties in understanding more advanced mathematical materials, which may lead to a continuous learning gap.

The low level of students' counting ability is influenced by various factors, both internal and external. Internal factors include students' interest, motivation, and attitudes toward mathematics, while external factors include teaching methods, learning environments, and the availability of appropriate learning media. In practice, mathematics learning in elementary schools is still dominated by conventional methods such as lectures and textbook-based instruction. These approaches tend to be less engaging and emphasize memorization rather than conceptual understanding.

Furthermore, the limited use of varied and appropriate learning media also contributes to the low quality of learning. Learning media play an important role in helping students understand abstract concepts by making them more concrete and easier to comprehend. However, media that are not aligned with students' cognitive development may cause confusion and hinder the learning process ([Arsyad, 2017](#)). Therefore, it is necessary to develop learning media that are appropriate to the characteristics of elementary school students, namely media that are concrete, engaging, interactive, and capable of increasing students' active participation.

According to cognitive development theory, elementary school students are in the concrete operational stage, in which they understand concepts more easily through direct experiences and real objects. At this stage, students are not yet able to fully grasp abstract concepts without the support of concrete representations. Therefore, mathematics learning needs to be designed in a contextual and concrete manner so that it can be more easily understood by students ([Piaget & Inhelder, 1972](#); [Agustyaningrum et al., 2022](#)). The use of appropriate learning media can help bridge the gap between abstract concepts and students' real experiences.

One alternative solution that can be applied is the use of game-based learning media. This approach integrates elements of games into the learning process, thereby increasing students' motivation, engagement, and participation. Game-based learning provides enjoyable learning experiences, allowing students to learn without feeling burdened. In addition, games can also enhance critical thinking and problem-solving skills.



Domino card games are one type of simple game that can be modified into learning media. Domino has characteristics that are easy to use, attractive, and familiar to students. In the context of mathematics learning, domino cards can be modified by incorporating arithmetic problems, making them suitable for practicing students' numeracy skills (Asiya et al., 2024; Nurudin, 2023). Through this activity, students can learn while playing, making the learning process more interactive and meaningful.

Previous studies have demonstrated that game-based learning media can improve students' mathematics learning outcomes. Nurudin (2023) found that the use of domino card media combined with an active learning approach enhanced elementary students' numeracy literacy skills. Similarly, Laka et al. (2025) reported that mathematical domino card media integrated with the PMRI approach increased students' interest in learning mathematics. Mardiyati & Nugraheni (2025) revealed that domino card media combined with the Teams Games Tournament (TGT) model significantly improved students' mathematical problem-solving skills. In addition, Priatna et al. (2022) developed domino card media to enhance higher-order thinking skills in learning fractions and found that the media positively affected students' learning achievement. Kharimah et al. (2025) also developed fraction domino card media and concluded that the media was valid and practical for fourth-grade mathematics learning. Furthermore, Asiya et al. (2024) developed and utilized domino card media in thematic mathematics learning and found that the media effectively increased students' motivation and understanding. Sulaiman et al. (2025) showed that game-based learning assisted by Wordwall media improved elementary students' numeracy skills. In addition, Muliani & Muniksu (2020) emphasized the importance of developing problem-solving skills from an early age so that students are better prepared to face real-life challenges. These findings collectively indicate that game-based learning has strong potential not only to enhance students' mathematics learning outcomes but also to support the development of essential skills such as problem-solving and numeracy, thereby improving the overall quality of mathematics instruction.

However, several research gaps remain. First, most previous studies focused on improving students' learning outcomes, mathematical problem-solving abilities, higher-order thinking skills, or learning motivation, whereas studies specifically examining basic arithmetic skills among first-grade elementary school students are still limited. Second, many studies investigated digital-based or technology-assisted learning media, while the development of simple, low-cost, and contextually relevant media such as Numeracy Domino remains underexplored. Third, previous studies generally involved upper elementary students and mathematics topics such as fractions, multiplication, and problem-solving, whereas research targeting lower-grade students and basic counting skills is still scarce. Fourth, different development models, including Borg and Gall and 4D, have been employed in previous studies, but only a limited number of studies have systematically developed mathematics learning.

These findings are consistent with previous studies indicating that low numeracy skills among elementary school students are generally influenced by the lack of engaging and interactive learning media in mathematics instruction (Nurudin, 2023). In addition, most previous studies have focused more on digital-based learning media, while the development of simple, contextual, and easily implemented media such as card games remains relatively limited. Therefore, it is necessary to develop learning media that are not only engaging and appropriate to students' characteristics but also practical and applicable in various elementary school contexts (Rahayu et al., 2023).

Based on these gaps, this study aims to contribute by developing Numeracy Domino learning media specifically designed to improve first-grade students' counting skills. This study employs the ADDIE development model, which consists of analysis, design, development, implementation, and evaluation stages, to ensure that the developed media is valid, practical, and effective. The novelty of this study lies in several aspects. First, the Numeracy Domino media is specifically designed to improve basic arithmetic skills (addition and subtraction), which are fundamental in mathematics learning. Second, the media integrates visual representations with mathematical problems to support students' conceptual understanding in a concrete manner.

Third, this study applies the ADDIE model systematically to ensure the quality of the developed media. Fourth, the study provides empirical evidence of the effectiveness of the media in improving students' learning outcomes.

In response to these challenges, this study proposes the development of Numeracy Domino learning media as an alternative solution to improve students' counting skills. The media is expected to create a more engaging and interactive learning environment, where students can learn mathematics through play. By integrating cognitive, affective, and social aspects of learning, the Numeracy Domino media aims to enhance students' motivation, participation, and learning outcomes. Therefore, the objectives of this study are: (1) to develop Numeracy Domino learning media, (2) to determine the feasibility of the developed media based on expert validation, and (3) to examine the effectiveness of the media in improving first-grade students' counting skills.

RESEARCH METHODS

This study employed a Research and Development (R&D) method using the ADDIE development model, which consists of five stages: analysis, design, development, implementation, and evaluation (Sugiyono, 2019). This model was used to systematically and structurally develop a mathematics learning medium in the form of numeracy domino. In the analysis stage, the researcher conducted direct observations at the research site and interviews with the classroom teacher to identify problems faced by students. The research was conducted at SDN 1 Pringga Jurang, located in Indonesia, during the 2024/2025 academic year (odd semester). The results of the analysis showed that students' numeracy skills were still low, indicated by many students not achieving the Minimum Mastery Criteria (KKM). This condition was influenced by students' perception that mathematics is difficult and boring, as well as the limited use of innovative and engaging learning media in classroom instruction.

In the design stage, the researcher designed the numeracy domino learning media by modifying traditional domino cards into an instructional medium containing addition and subtraction problems. The design also integrated supporting images as concrete counting aids to help students understand mathematical concepts more easily and meaningfully. The ADDIE development model diagram used in this study is presented in Figure 1.

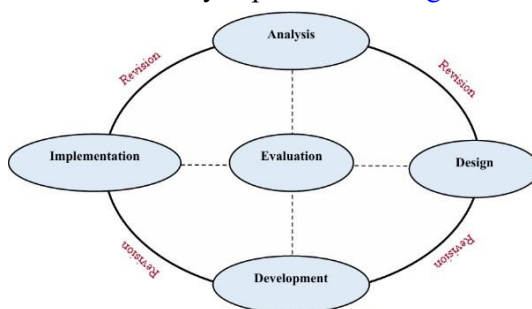


Figure 1. ADDIE Development Model

In the development stage, the researcher produced the numeracy domino learning media consisting of 28 cards. The development process included designing the media using the Canva application, preparing mathematics problem items, and selecting supporting images before printing the final product.

The developed product was then validated to determine its feasibility in terms of material and media aspects. The validity instrument used validation sheets covering content relevance, language clarity, accuracy of mathematical concepts, visual design, attractiveness, and suitability for first-grade students. The validation process involved two validators: (1) a material expert, namely a first-grade classroom teacher at SDN 1 Pringga Jurang who also serves as the homeroom teacher, and (2) a media expert, namely a lecturer from Universitas Hamzanwadi. The results of the validation, including suggestions, criticisms, and feedback, were used as the basis for revising and improving the product until it reached a valid and feasible level. Furthermore, the implementation stage was conducted by testing the validated numeracy domino media on 21 first-grade students at SDN 1 Pringga Jurang. The learning implementation was carried out over three

classroom meetings during the 2024/2025 academic year. The research subjects were determined using a purposive sampling technique, namely selecting participants based on specific considerations aligned with the research objectives. The subjects for practicality and effectiveness testing included the first-grade teacher and 21 first-grade students at SDN 1 Pringga Jurang.

Data collection techniques in this study included both qualitative and quantitative data. Qualitative data were obtained from interviews, observations, and suggestions from material and media experts. Quantitative data were collected through validation sheets, teacher and student response questionnaires, and learning outcome tests in the form of daily assessments. The instrument for validity consisted of expert validation sheets assessing content feasibility and media design feasibility. The instrument for practicality was measured through teacher and student response questionnaires regarding ease of use, attractiveness, and usefulness of the numeracy domino media in learning activities. Meanwhile, the instrument for effectiveness was measured through student learning outcomes tests to determine improvements in counting skills after using the media. The evaluation stage was conducted to assess the overall quality of the developed product based on validity, practicality, and effectiveness results. The evaluation outcomes were used to determine whether the numeracy domino learning media was suitable for improving students' numeracy skills in Grade I elementary school.

RESULTS AND DISCUSSION

Results

This study successfully produced an innovative learning product in the form of Numeracy Domino mathematics learning media, which was specifically designed and developed to improve the arithmetic skills of first-grade students at SDN 1 Pringga Jurang. The development of this instructional media was grounded in a systematic and structured approach using the ADDIE development model, which consists of five interconnected stages, namely analysis, design, development, implementation, and evaluation. Each stage was carried out carefully to ensure that the resulting product meets the criteria of validity, practicality, and effectiveness in supporting mathematics learning at the elementary school level.

At the analysis stage, a comprehensive needs assessment was conducted to identify the main problems encountered in the mathematics learning process. The findings revealed several significant issues, including the low arithmetic ability of students, minimal student engagement during classroom activities, and the lack of attractive and interactive learning media used by teachers. Most students perceived mathematics as a difficult and uninteresting subject, which negatively affected their motivation to learn. This condition was further supported by classroom observations and informal interviews with teachers, which indicated that learning activities were still predominantly teacher-centered and relied heavily on conventional methods such as lectures and textbook-based exercises. Consequently, students had limited opportunities to actively participate and explore mathematical concepts in a meaningful way.

The initial data on students' learning outcomes also reinforced the existence of this problem. Based on the results of the daily test conducted prior to the implementation of the developed media, it was found that out of 21 students, only 12 students (57%) were able to achieve scores above the minimum mastery criterion (KKM), while the remaining 9 students (43%) scored below the established KKM of 75. These results clearly indicate that more than one-third of the students had not yet mastered basic arithmetic skills, particularly in addition and subtraction. Therefore, there was an urgent need for an alternative learning approach that could make mathematics more engaging, interactive, and accessible for young learners.

Following the analysis stage, the design phase was carried out to conceptualize the structure and components of the Numeracy Domino media. The design process involved determining the learning objectives, selecting appropriate content, and creating visual layouts that are suitable for first-grade students. The domino cards were designed to include numbers, simple arithmetic operations, and colorful illustrations to attract students' attention and facilitate understanding. Special consideration was given to the cognitive development level of early-grade learners, ensuring that the media is simple, clear, and easy to use. In addition, the design emphasized the



integration of learning and play, allowing students to learn mathematical concepts through an enjoyable game-based activity.

The next stage was the development phase, during which the designed media was transformed into a tangible product. The Numeracy Domino cards were printed using safe and durable materials, with careful attention to aspects such as card size, readability, color contrast, and visual appeal. After the development process was completed, the product underwent a validation process to assess its quality and feasibility before being implemented in the classroom.

The developed learning media was validated by two experts, namely a material expert and a media expert, to ensure that it meets the required academic and technical standards. The validation process involved evaluating several aspects, including content accuracy, suitability with learning objectives, visual design, and usability. Based on the results of the validation, the material expert awarded a total score of 49, while the media expert gave a total score of 47. Both scores exceeded the predetermined interval criterion of $X > 41.88$, which categorizes the product as "very good."

More specifically, the material expert assessed the relevance of the content to the curriculum, the alignment with the learning objectives, the appropriateness of the material for first-grade students, and the clarity of the numerical representations and illustrations. The expert concluded that the content was highly suitable and effectively supports the development of students' arithmetic skills. On the other hand, the media expert evaluated the physical and visual aspects of the product, including the size and safety of the cards, the attractiveness of the design, the clarity of the fonts, and the consistency of visual elements. The results indicated that the media was well-designed, visually appealing, and safe for use by young learners. Therefore, the validation results confirm that the Numeracy Domino learning media is valid and feasible for use in elementary school mathematics learning.

The practicality of the Numeracy Domino media was assessed through questionnaires distributed to both teachers and students after the implementation stage. The purpose of this test was to determine the ease of use, attractiveness, and overall usability of the media in a real classroom setting. The results showed that the teacher's response score reached 47, which falls into the "very good" category. This score was derived from three main indicators: material suitability, visual appearance, and usability, which were further elaborated into ten statement items.

The teacher's responses indicated that the Numeracy Domino media is highly appropriate for first-grade students and effectively supports the teaching of arithmetic concepts. The media was considered easy to use, visually engaging, and capable of creating a more interactive and enjoyable learning environment. Furthermore, the teacher noted that the use of the domino cards encouraged active participation from students, as they were more enthusiastic and motivated to engage in learning activities. The game-based nature of the media also helped reduce students' anxiety towards mathematics and made the learning process more enjoyable.

In addition to the teacher's responses, students also showed positive reactions to the use of the media. They expressed interest and enjoyment in playing the domino game while learning mathematical concepts. This indicates that the media not only supports cognitive learning but also enhances students' emotional engagement, which is an important factor in effective learning.

The effectiveness of the Numeracy Domino media was evaluated by comparing students' learning outcomes before and after the implementation of the media over three learning sessions. The results of the quantitative analysis are presented in [Table 2](#).

Table 2. Students' Learning Outcomes Before and After Implementation

Category	Before Trial	After Trial
Mastery	12 students	19 students
Non-mastery	9 students	2 students
Mastery percentage	57%	90%
Non-mastery percentage	43%	10%

Based on the data presented in [Table 2](#), there was a significant improvement in students'



learning mastery after the use of the Numeracy Domino media. The percentage of students who achieved mastery increased from 57% before the trial to 90% after the trial, representing an improvement of 33%. At the same time, the number of students who did not achieve mastery decreased substantially from 9 students to only 2 students.

This improvement indicates that the Numeracy Domino media had a positive and meaningful impact on students' arithmetic learning outcomes. The interactive and engaging nature of the media helped students better understand basic mathematical concepts, particularly addition and subtraction. By learning through play, students were able to practice their skills repeatedly in a fun and stress-free environment, which contributed to their improved performance.

Furthermore, the use of visual aids and hands-on activities in the domino game supported students' conceptual understanding, making abstract mathematical ideas more concrete and easier to grasp. This aligns with the principles of constructivist learning theory, which emphasizes the importance of active participation and meaningful experiences in the learning process.

In conclusion, the results of this study demonstrate that the Numeracy Domino learning media is not only valid and practical but also effective in improving the arithmetic skills of first-grade students. The significant increase of 33% in learning mastery clearly indicates that the developed media successfully addresses the initial problems identified during the analysis stage. Therefore, the Numeracy Domino media can be recommended as an alternative instructional tool to enhance mathematics learning in elementary schools, particularly in fostering students' interest, participation, and understanding of basic arithmetic concepts.



Figure 2. Printed domino cards

Figure 2 illustrates the physical form of the Numeracy Domino learning media that has been printed and is ready to be used in classroom instruction. The domino cards are designed with an appropriate size that suits the characteristics of first-grade elementary school students, making them easy to hold, arrange, and play. Each card consists of two main sections separated by a center line, following the basic concept of traditional domino games.

On each side of the card, there are combinations of numbers, simple arithmetic operations (addition and subtraction), and attractive, colorful illustrations. The use of bright and contrasting colors is intended to capture students' attention and help them distinguish between different elements on the cards. In addition, the images presented are contextual and closely related to students' daily lives, which supports a more concrete understanding of numeracy concepts.

In terms of visual design, the font used is simple, clear, and large enough to be easily read by early-grade students who are still developing their reading skills. The layout of numbers, symbols, and images is arranged in a balanced manner to avoid confusion. Furthermore, the cards are printed on thick and safe materials, ensuring durability and comfort when used by students during learning activities.

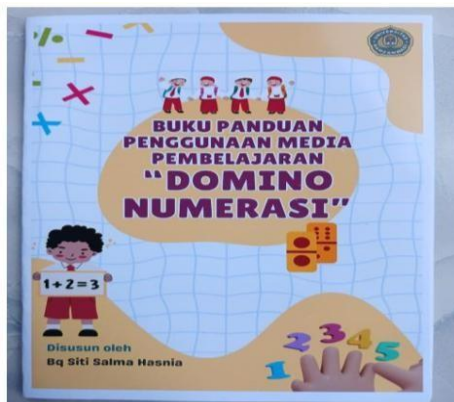


Figure 3. User Guide for the Use of Numeracy Domino Cards

Based on Figure 3 above, the Numeracy Domino learning media is also accompanied by a user guidebook that serves as a reference for teachers in implementing the media in classroom instruction. This guidebook contains systematic instructions, starting from learning objectives, step-by-step procedures for classroom activities, game rules, and learning evaluation that can be carried out after the use of the media. In addition, the guidebook also provides examples of learning scenarios and guidance on classroom management during the game to ensure that learning activities remain effective and conducive. With the existence of this guidebook, teachers are expected to more easily understand the implementation flow of the media, so that the Numeracy Domino can be implemented optimally and can enhance students' understanding of addition and subtraction concepts in an enjoyable way.



Figure 4. Implementation of Domino Cards in the Classroom

Figure 4 illustrates the use of the Numeracy Domino cards. In terms of usage, the Numeracy Domino cards are played by matching the result of an arithmetic operation on one card with the corresponding number on another card. For example, a card showing " $3 + 2$ " must be matched with a card containing the number "5." This activity is carried out in groups so that students take turns placing matching cards. Through this game-based learning process, students are actively engaged in repeated practice of addition and subtraction, which helps strengthen their understanding of basic numeracy concepts while also fostering interaction, cooperation, and an enjoyable classroom atmosphere.

Through this activity, students are indirectly trained to understand basic concepts of addition and subtraction through repeated practice. The game-based approach also encourages interaction among students, enhances their social skills, and creates an active and enjoyable learning environment.

Discussion

The results of this study indicate that the developed Numeracy Domino learning media has fulfilled the three main aspects of development research, namely validity, practicality, and effectiveness. These three aspects are essential indicators in determining the feasibility of a learning product before it is widely implemented in classroom instruction. The findings suggest

that the developed media is not only theoretically appropriate but also practically applicable in improving elementary school students' mathematics learning outcomes, particularly in basic arithmetic skills.

From the validity aspect, the scores obtained from the material expert (49) and the media expert (47) indicate that the Numeracy Domino media falls into the "very good" category. This shows that the content, visual design, and suitability of the media with the characteristics of first-grade elementary school students have met the required standards. The media is also aligned with the learning objectives, particularly in helping students understand addition and subtraction of whole numbers up to 10. This finding is consistent with previous research stating that valid learning media significantly contribute to improving the quality of learning because they ensure alignment between content, design, and student needs (Apriani et al., 2025; Astuti et al., 2025).

Theoretically, the use of game-based learning media such as Numeracy Domino is supported by various studies showing that this approach can increase student engagement in the learning process. Meitriani et al. (2023) state that game-based learning media can enhance students' attention and participation, especially at the elementary school level. This is further supported by Duangnate & Klaimongkol (2022), who found that game-based learning significantly improves students' cognitive engagement in mathematics learning. Therefore, the use of domino cards modified into numeracy learning media is highly appropriate for lower-grade elementary school students, who tend to prefer learning through play.

From the practicality aspect, the results of the questionnaires show that the teacher response score of 47 and the average student response score of 44.47 are categorized as "very good." This indicates that the media is easy to use, attractive, and effective in supporting the learning process. Teachers reported that the media helped create a more active and interactive classroom environment, while students felt more enthusiastic and enjoyed learning mathematics. These findings are in line with Paulina et al. (2023), who state that practical and easy-to-use learning media can enhance classroom interaction. Additionally, Astuti et al. (2025) emphasize that visually appealing media can increase students' interest in learning.

The effectiveness aspect represents the most significant finding of this study. The results show that the percentage of student learning mastery increased from 57% before the implementation of the media to 90% after its implementation, representing a 33% improvement. This increase indicates that the Numeracy Domino media is effective in improving students' arithmetic abilities, particularly in addition and subtraction. This finding is consistent with Septiana & Afnizar (2023), who found that game-based learning media can significantly improve students' numeracy skills. Furthermore, Tanudidjaja et al. (2025) reported that educational game media can enhance students' mathematical understanding and learning focus.

The findings of this study are further strengthened by previous research emphasizing the effectiveness of game-based learning in improving numeracy skills. Game-based multimedia has been proven to facilitate students' understanding of mathematical concepts through interactive and contextual learning experiences. According to Rohendi (2019), game-based multimedia for horizontal numeracy learning enables students to connect mathematical concepts with real-life situations, thereby enhancing their conceptual understanding and problem-solving abilities. This approach allows learners to actively construct knowledge through meaningful experiences, which aligns with the principles of student-centered learning.

Pedagogically, this improvement occurred because the Numeracy Domino media integrates learning and play, making the learning process more enjoyable and less monotonous. Rahayu et al. (2023) state that game-based learning can increase students' motivation and active participation. In the domino game, students are required to think, match, and solve problems in order to win, which indirectly trains their logical thinking and arithmetic skills.

These findings are also consistent with the game-based learning theory proposed by Prensky (2001), which states that games can enhance student engagement and motivation in the learning process. In addition, students' active involvement in learning is aligned with constructivist theory proposed by Bruner (1966) and Vygotsky (1978), which emphasizes that knowledge is constructed through active learning experiences and social interaction. Hwang &

Wu (2012) also found that interactive learning media can effectively support students' knowledge construction.

Furthermore, the use of Numeracy Domino media is appropriate to the cognitive developmental stage of elementary school students, who are generally in the concrete operational stage. According to Piaget & Inhelder (1972), students at this stage understand concepts more easily through concrete objects and direct experiences. This is supported by Agustyaningrum et al. (2022), who state that instructional media for elementary school students should involve real or visual objects. The use of images and cards in the Numeracy Domino media helps students understand mathematical concepts in a more concrete and realistic way. Agustyaningrum et al. (2022) also emphasize that the use of concrete media can improve students' understanding of abstract concepts.

Moreover, the use of attractive and interactive learning media has been proven to enhance students' understanding of instructional materials. Arsyad (2017) states that learning media can clarify the presentation of material and improve students' comprehension. This is reinforced by Apriani et al. (2025), who state that effective learning media can help students understand concepts more easily and deeply.

The findings of this study are also supported by international research showing that game-based learning has a positive impact on student learning outcomes. Plass et al. (2015) state that game-based learning can increase motivation and engagement. Wouters et al. (2013), through a meta-analysis, found that educational games are more effective than conventional methods in improving learning outcomes. Hamari et al. (2014) also reported that gamification in learning can significantly enhance student motivation and engagement.

In conclusion, the findings of this study indicate that the Numeracy Domino learning media is valid, practical, and effective in improving students' arithmetic skills. The media creates a more meaningful, enjoyable, and student-centered learning experience. Therefore, the Numeracy Domino media can be recommended as an innovative alternative for mathematics learning, particularly in lower elementary grades.

CONCLUSIONS AND SUGGESTIONS

Based on the results of the study, it can be concluded that the developed Numeracy Domino learning media has successfully met the criteria of validity, practicality, and effectiveness for use in mathematics learning in lower elementary grades. This is evidenced by the validation scores from the material expert (49) and media expert (47), both categorized as very good, as well as the positive responses from teachers and students, with a teacher response score of 47 and an average student response score of 44.47. In terms of effectiveness, the use of the media significantly improved students' learning mastery from 57% to 90%, representing an increase of 33%. These findings indicate that the Numeracy Domino media is capable of improving students' arithmetic skills, particularly in understanding addition and subtraction concepts, while also creating a more active, enjoyable, and meaningful learning process.

It is recommended that teachers, particularly those teaching lower elementary grades, use the Numeracy Domino media as an alternative learning medium to support mathematics instruction, especially in teaching basic arithmetic concepts. Future researchers are also encouraged to further develop this media by adapting it to other mathematics topics, larger sample sizes, or different grade levels in order to examine its broader effectiveness. In addition, schools are advised to support the use of innovative and game-based learning media to enhance students' motivation, participation, and numeracy skills in classroom learning.

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