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The Use of Snake and Ladders Game to Improve Mathematics Outcomes and Student Engagement in Primary Schools

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Abstract

The low ability of fifth-grade students in mathematics is evident in average report card scores that remain below the minimum passing grade. Students tend to lack confidence and approach learning mathematics passively. This study aims to describe the implementation of the Snake and Ladders game as a learning medium and to analyze improvements in learning outcomes and active student involvement. The research used a descriptive qualitative approach to describe the learning process in actual classroom conditions, with data collected through observation, interviews, and documentation. Data analysis used the Miles, Huberman, and Saldana model, which included data condensation, data presentation, and conclusion drawing. The results showed an increase in students' average mathematics report card scores from 67 to 83 after using game media, as observed in the graphs, and an increase in student engagement in discussions and group work. Interviews with teachers and students confirmed that the Snake and Ladders game, as an alternative medium for mathematics learning in elementary schools, helped students understand concepts and fostered more active, interactive learning.

Keywords: Learning Outcomes; Mathematics; Snake and Ladders Game; Student Engagement

Abstrak

Rendahnya kemampuan siswa kelas V dalam pembelajaran matematika terlihat dari rata-rata nilai rapor yang masih berada di bawah KKM. Siswa cenderung kurang percaya diri dan pasif terhadap pembelajaran matematika. Penelitian ini bertujuan mendeskripsikan implementasi permainan Snake and Ladders sebagai media pembelajaran serta menganalisis peningkatan hasil belajar dan keterlibatan aktif siswa. Penelitian menggunakan pendekatan kualitatif deskriptif yang berfokus pada penggambaran proses pembelajaran berdasarkan kondisi nyata kelas, dengan data yang dikumpulkan

melalui observasi, wawancara, dokumentasi. Analisis data menggunakan model Miles, Huberman, dan Saldana yang meliputi kondensasi data, penyajian data, dan penarikan kesimpulan. Hasil penelitian menunjukkan adanya peningkatan rata-rata nilai rapor matematika siswa dari 67 menjadi 83 setelah penggunaan media permainan, yang diperkuat oleh grafik pengamatan serta memperlihatkan kenaikan partisipasi aktif siswa dalam diskusi dan kerja sama kelompok. Wawancara dengan guru dan siswa mengonfirmasi bahwa permainan Ular Tangga sebagai alternatif media pembelajaran matematika di sekolah dasar membantu pemahaman konsep dan menciptakan pembelajaran yang lebih aktif dan interaktif.

Kata Kunci : *learning outcomes; mathematics; snake and ladders game; student engagement*

A. Introduction

Curriculum development and 21st-century educational needs require teachers to provide interactive, creative, and student-centered learning experiences. Student-centered learning methods are very important in education because they place students as active subjects in the learning process. Curriculum development and 21st-century educational needs require teachers to provide interactive, creative, and student-centered learning experiences. Student-centered learning methods are very important in education because they place students as active subjects in the learning process. Classroom learning, especially in mathematics, should focus on activities that engage students in discovering numerical concepts. This approach helps students understand mathematics as a meaningful process of thinking, not just calculations, so that the critical and creative competencies needed in the 21st century can develop optimally. However, various international studies and evaluations indicate that Indonesian students' mathematics achievement remains relatively low (Stelawati et al., 2023). This situation highlights the gap between the demands of 21st-century learning and classroom practices. Empirical evidence of low student achievement in mathematics is available from the following international studies.

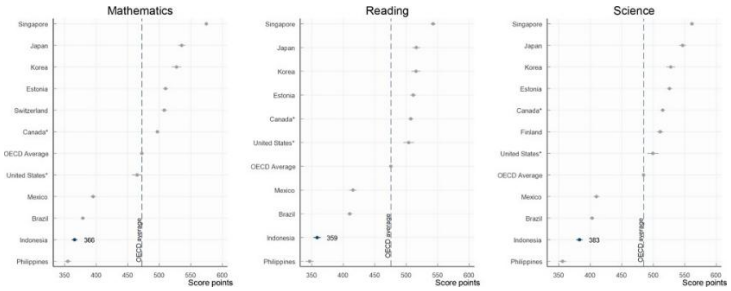

Figure 1. Graph of Average Scores for the Programme for International Student Assessment (PISA)

PISA data (2022) show that in Indonesia, the percentage of students who achieve at least Level 2 in mathematics is 18%, much lower than the OECD average of 69%. In other words, the minimum requirement for students is to interpret, without instruction, simple statements involving mathematical representations, such as comparing the total distance between two alternative routes or comparing prices in different currencies. More than 85% of students in Singapore, Macau (China), Japan, Hong Kong (China), Taiwan (China), and Estonia meet this criterion (in descending order). These findings indicate a serious gap in foundational mathematical understanding among Indonesian students. In the context of primary education, this condition suggests that many learners struggle with conceptual comprehension rather than procedural calculation alone. Therefore, innovative game-based media are considered a relevant approach to strengthening conceptual understanding and active participation in mathematics learning.

The interview in class V of SDN 2 Kauman Ponorogo during the mathematics learning process. Based on the interview results, it appears that the learning outcomes of class V students are in the low category. This can be seen in the average score of only 67, while the Minimum Passing Criteria (KKM) set is higher than that. This condition shows that most students have not mastered the material optimally. Many students still make mistakes in solving problems and only understand the basic parts of the material taught. The low average shows that their mastery of the concepts does not meet the expected basic competencies, so the students' learning outcomes are classified as low. The teachers at the school said that without the right media or teaching aids, students only memorize formulas without truly understanding their application in everyday life. The teacher's efforts indicate that providing learning media appropriate to children's learning styles, such as educational games, can make learning more meaningful. Moreover, the media has educational values because it encompasses aspects of entertainment, challenge, competition, and collaboration, which can motivate students to take an active role in learning. According to Nurramadani (2024), it is important in this context that instructional media and learning tools are used in mathematics lessons. Media will help students understand abstract ideas more concretely and visually, making them easier to learn (Damanik et al., 2025). Engaging media, such as games and gamification, can increase students' motivation, active participation, and problem-solving logical thinking skills (Friska et al., 2024). Media- based learning makes the process of learning mathematics more enjoyable, interactive, and effective, thereby encouraging active student participation and optimal learning outcomes (Laksana et al., 2024).

Low learning outcomes in mathematics often occur because the learning process relies solely on the lecture method (Kautsari Azizah & Findrayani., 2024), making it difficult for students to understand the meaning of concepts and they tend to just memorize formulas without knowing how to apply them (Pamungkas & Azmi, 2021). One example of a media that teachers can use in mathematics learning is the Snake and Ladders game. That Snake and Ladders game is integrated with the mathematics learning material for grade V (Fauziahnur & Baidullah, 2025). The use of game-based learning media such as Snake and Ladders can create a more active and enjoyable learning atmosphere for students. In game-based learning activities, students are given the opportunity to participate directly in the mathematics learning process. Interaction among students during play can help develop motivation to learn, cooperation, active engagement, and confidence in expressing opinions (Dwi Agustino et al., 2024). Through play- based learning, mathematics education focuses not only on the final results but also on the process of understanding important concepts (Facchino et al., 2025).

Thus, the main problem in this study is the low mathematics learning outcomes and active engagement of fifth-grade students of SDN 2 Kauman Ponorogo related to the limited use of interactive learning media. The novelty of this study lies in its focus on the implementation of the Snake and Ladders game media as an integrated strategy to simultaneously improve mathematics learning outcomes and student engagement. This study aims to provide contextual evidence and practical insights on how game-based learning media can be implemented effectively in elementary school mathematics learning.

B. Research Method

This research used a qualitative, descriptive approach through observation, interviews, and documentation. Interviews were conducted with two teachers and two students as primary informants. A descriptive qualitative approach was chosen because this study aimed to explore in depth the implementation of game-based learning in natural classroom situations and to understand participants' experiences, perceptions, and interactions during the learning process.

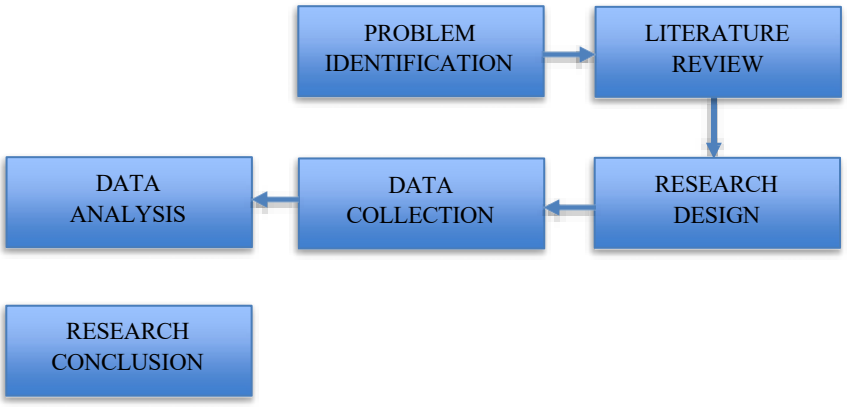

Figure 2. Research Flow

The research procedure was carried out through several systematic stages adapted from (Sugiyono, 2022) research framework and simplified according to the needs of this study. The first stage was problem identification, which aimed to assess classroom conditions and identify the main problems affecting learning outcomes and student engagement in mathematics. The second stage involved a literature study to build a theoretical foundation and review previous studies relevant to game-based learning. Next, the research design stage involved determining the data sources, research instruments, and research implementation procedures as guidelines for the research activities.

The next stage is data collection through observation, interviews, and documentation to obtain a comprehensive picture of the learning process and implementation of the Snake and Ladders game. The data obtained is then analyzed qualitatively by organizing, reducing, and interpreting it to identify patterns in student engagement and changes in learning outcomes. The final stage of the research is to draw conclusions and compile practical recommendations based on the research findings, to improve the quality of mathematics learning through game-based media.

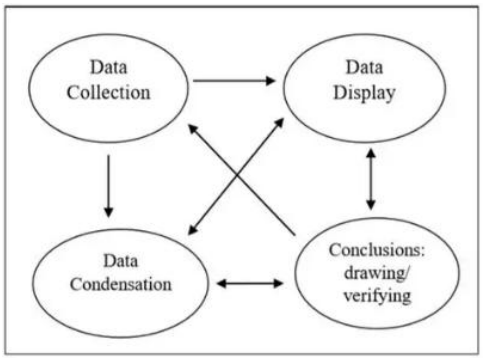

Figure 3. Data Analysis

Data analysis in this study used the interactive analysis model developed by Miles, Huberman, and Saldaña, which comprises four main stages: data collection, data condensation, data presentation, and conclusion drawing and verification. Data were collected through observation, interviews, and documentation during the learning process. The data obtained was then condensed through a process of selection, focusing, simplification, and organization to suit the research focus. This stage aimed to filter data relevant to implementing the Snake and Ladders game, student Engagement, and learning outcomes.

The data is presented in narrative descriptions and excerpts from findings to enable a systematic understanding of the relationships among the data. The final stage is drawing and verifying conclusions through interpretation and rechecking the data to ensure the consistency of findings. These four stages are interactive and iterative throughout the research. Therefore, all results presented in this study are the result of a systematic analysis process based on the Miles, Huberman, and Saldaña model (Miles et al., 2014).

C. Results and Discussion

The results of this research were obtained through observation, interview, and documentation techniques with research subjects, namely 2 mathematics teachers and 2 grade V students at SDN 2 Kauman, Ponorogo. From the preliminary observations, it was found that mathematics learning in the class was still centralized on passive students. Of the 14 students observed, only 5, or about 35%, were actively answering questions, while 9, or 65%, tended to remain silent and avoid interaction. This condition shows that students still fear mathematics, especially in solving problems step-by-step.

Table 1. Teacher Interview Results

Classification	Description
Teacher 1	Teacher 1 stated that most fifth- grade students show very low interest and motivation in learning mathematics. The students seem lacking in confidence and try to avoid math lessons. This slows their understanding, making it difficult for the teacher to teach effectively.
Teacher 2	Teacher 2 added that students can learn mathematics, but they quickly become anxious when faced with slightly complex problems. Without learning media that encourage movement and play, students tend to remain passive and wait for instructions.

Table 1 shows that most fifth-grade students do not yet have sufficient interest or motivation in mathematics and still feel insecure about their abilities. When working on difficult problems, students feel anxious and avoid active learning. This causes students to take longer to understand the lesson material and hinders teachers from carrying out the learning process in accordance with the established curriculum targets. Therefore, it is very important to use interactive and enjoyable learning media to encourage students to be more active, confident, and enthusiastic in learning mathematics.

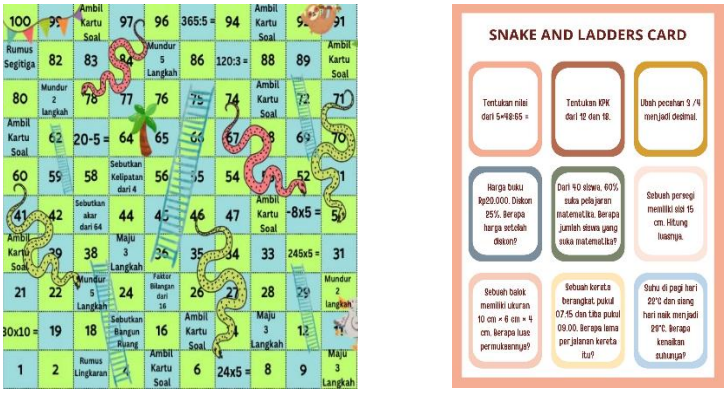

Figure 4. Snake and Ladders Game Design
Source: Researcher Documentary (2025)

The Snake and Ladders game is designed to use colorful, attractive images to capture students' interest from the very first time they encounter the media. The game's colorful, attractive presentation not only makes it interesting but also helps generate students' interest in learning. The Snake and Ladders game has also been developed with simple, participatory, and meaningful rules. In this manner, the students develop logical thinking, teamwork, and planning to comprehend mathematical concepts, thereby creating an active and interesting learning environment. Apart from providing an in-depth learning experience, this game enables students to participate in the learning process through engaging challenges that help them enjoy every step.

The picture indicates a creative version of a conventional Snakes and Ladders game board, which is used to facilitate mathematics learning. The squares in any game board represent each move in the game. The creative element here is that each square contains questions for participants to answer. The game is applicable to any learning point the students are covering. The teacher briefly explains to the class what each game board covers before allowing them to play. The children then form small groups to enable effective interactive participation as they learn. When the children roll the dice and land on a square marked with one of the numbers, they then attempt to solve the question at that square. If they get the correct answer, it means they can continue playing according to the rules. Conversely, if it is wrong, they can opt to discuss as a group to get the correct answer. This way, teachers can incorporate elements that allow them to directly assess students' knowledge through board games aligned with learning objectives. In setting up board games, these are not simply for pure entertainment but are considered learning strategies to promote student engagement cognitively and socially. Interactions within these groups promote student confidence.

Figure 5. Implementation of the Snake and Ladders Game

The math learning method uses the game of Snakes and Ladders. This method takes approximately 30-40 minutes. The game's application can serve as both a learning break and a planned learning approach. The method of incorporating content into the game allows students to gain knowledge through experience. The classroom discussions that emerge while working on the problems promote the exchange of ideas and enhance understanding. This game can serve as a casual evaluation of students' capabilities. In a relaxed yet focused learning environment, students can be more confident participating actively in learning mathematics.

Table 2. Results of Student Interviews

Classification	Description
Student 1	Student 1 stated that learning math using Snake and Ladders is fun because students can play while learning and answer questions as they progress in the game.
Student 2	Student 2 added that making mistakes motivates them to try again in order to advance further in the game.

Based on information provided by fifth-grade students, it is evident that the Snake and Ladders game not only has an interesting design but also helps students be brave in problem-solving situations. This helps students to be brave and not afraid of failure. Students acquire unlimited knowledge since knowledge acquisition is the outcome of collaboration. The use of the Snake and Ladders game helps to improve mathematics learning and active engagement among elementary school students. This is evident from increased motivation, activity, and understanding among students. By incorporating game characteristics, visual design, and problem-solving activities that align with students' characteristics, the Snake and Ladders game can serve as an alternative learning medium to improve the quality of mathematics learning.

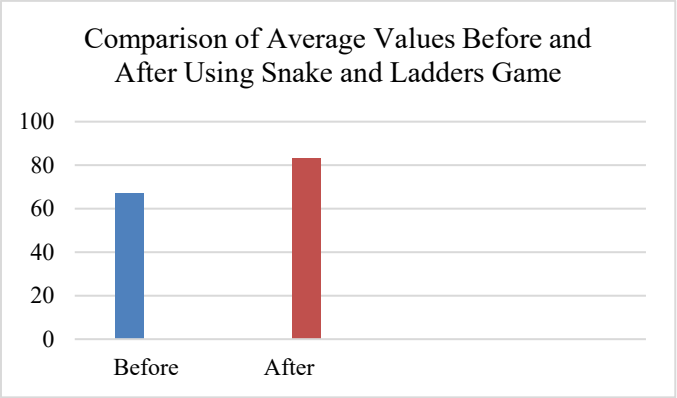

Figure 6. Comparison of Average Mathematics Scores Before and After Using the Snake and Ladders Game

Figure 6 compares students' math learning outcomes before and after the implementation of the Snake and Ladders game, using scores from students' math report cards. Based on the data presented in the graph, the overall average of the students' math scores was 67. Following the implementation of the Snake and Ladders game in the learning process, the average score increased to 83. As such, it is recognized that the Snake and Ladders game media added 16 to the overall scores. As such, the overall use of the Snake and Ladders game media contributed positively to students' development of their understanding of math. During the Snake and Ladders game media learning activity, students' overall scores improved and their participation increased, creating a more dynamic learning environment.

The Snake and Ladders game helps increase student participation in learning activities. Specifically for fifth graders, this game serves as a stimulant for children to actively participate in the learning activity through a play-based approach that requires student engagement. Students are braver about answering questions because of the supportive learning environment, which prevents them from getting frustrated or stressed out. Children also interact more because they gather in groups to decide what to do next while playing Snake and Ladders.

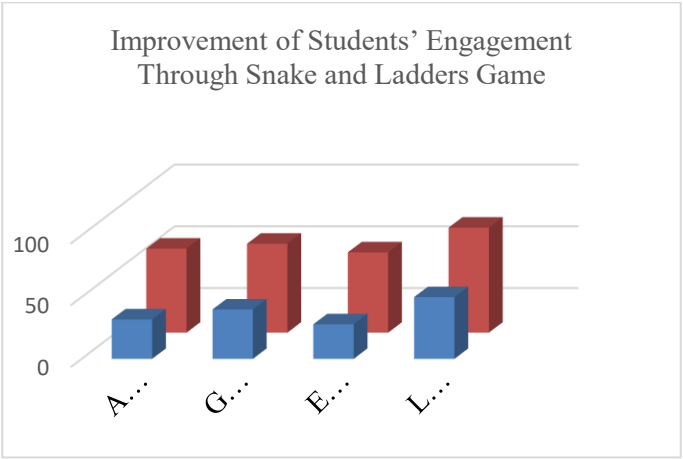

Figure 7. Students' Engagement Before and After Using the Snake and Ladders Game

The data presented in Figure 7 are derived from primary data collected through direct observations

conducted by the author during the research implementation. The findings in the figure indicate that students' active participation has increased across all aspects following treatment with the Snake and Ladders game. Participation by the students is measured by the increase in questions asked by the students, which increase to 68% from the original 32%, the number of students who answered the questions increases to 72% from 40%, group discussion rose to 80% from the original 45%, the number of students who expressed their opinions increases to 65% from the original 28%, while the enthusiasm of students to follow the learning process rose to 85% from 50%. The use of Snake and Ladders media has been effective in increasing students' active participation in the learning process. Communication among students and interaction with one another have also been carried out properly, with discussion and group work also applied. Apart from this, respect and sportsmanship are achieved during interaction, where students are able to accept the final result at the end of the game. All of these factors are helpful in developing an appropriate classroom environment that enables students to actively participate in the learning process. Such a condition suggests that the game's applicability can serve as an alternative measure for developing students' interest, confidence, and appropriate attitudes towards mathematics.

Discussion

The results of this study reinforce Jean Piaget's Theory (1972) which emphasizes that elementary school-aged children are at the concrete operational stage, meaning they learn best through tangible objects and direct experiences. Learning media is very important because it helps students build their own understanding. In the context of SDN 2 Kauman Ponorogo, the classroom teachers have implemented the game Ladders and Ladders to provide students with concrete learning experiences through play-based learning activities. This medium allows students to see, touch, and interact directly with the learning material, thereby helping them independently build conceptual understanding. This approach aligns with the view (Vitoria et al., 2020) which states that success in learning depends on the teaching methods and strategies applied appropriately by the teacher in the classroom.

The implementation of the Snake and Ladders game in mathematics learning at SDN 2 Kauman Ponorogo reflects the perspective (Indah Suciati, 2021) which emphasizes that the use of mathematical learning media is very important to help students build thinking skills, develop problem-solving abilities, and foster positive attitudes and feelings towards mathematics (Dwi Oktaviana et al., 2024). Through the game of Snake and Ladders, students not only practice counting and understanding mathematical concepts concretely but are also trained to think logically when making game moves and solving the given problems (Ukhti Hanifah Tiarawati & Sukartono, 2024). This reinforces the research findings (Anggoro et al., 2025), which emphasize the use of media in mathematics learning to improve students' learning outcomes, motivation, and active engagement, thereby enabling optimal achievement of learning objectives (Efendi & Fitri, 2025).

The use of the game Snake and Ladders allows teachers to present mathematical concepts in concrete, realistic terms, thereby enhancing students' understanding of abstract material (Wati, 2021). This is also in line with the philosophy of the Independent Curriculum promoted by the Ministry of Education, Culture, Research, and Technology of Indonesia (Kemendikbudristek) (2022), which emphasizes the importance of student-centered, meaningful, and contextual learning through hands-on learning experiences. The learning process should encourage student activity, strengthen critical thinking skills, and involve students in solving real-world problems (Putra & Setyawan, 2025). Thus, the use of the Snake and Ladders game not only helps students understand abstract mathematical concepts more concretely but also supports the implementation of active and meaningful learning in line with the direction of national education policy in elementary schools (Nurussofa & Astuti, 2023).

The implementation of the educational version of Snake and Ladders in this study is designed not only as a learning tool in the form of a game (Adrillian et al., 2024), but also carefully designed with

consideration for students' learning needs and the nature of the mathematical concepts being studied (Afrianti & Maryatun, 2025). The game of Snake and Ladders can be used as a tool for evaluation or reinforcement after lessons are conducted in class. This study was designed to develop math problems that align with the learning outcome criteria that students should meet upon reaching a certain level in this game (Anggoro et al., 2025).

The results of applying the Snake and Ladders game in mathematics learning at SDN 2 Kauman Ponorogo show positive changes in learning outcomes and in the active involvement of fifth-grade students, as evidenced by improvements in problem-solving skills, active participation in learning, higher learning motivation, and observations and interview findings. Students became more active in the learning process, were willing to try to solve problems, and showed increased understanding of the material studied (N.P.D. Apriyantini et al., 2024). This is reinforced by the view (Kusuma Ardi & Desstya, 2023) that learning activities packaged as games can reduce students' fear and anxiety towards mathematics, making them more focused and motivated during the learning process. This condition affects the gradual improvement in student learning outcomes, both in conceptual understanding and in the ability to solve math problems (Fulana & Kumala, 2024).

Overall, implementing the Snake and Ladders game in mathematics learning improves the quality of the learning process, learning outcomes, and the active participation of elementary school students. This media not only helps students understand mathematical concepts more concretely and enjoyably (Djamilah & Ulfah, 2025), but also encourages active participation, cooperation, and student confidence during the learning process through hands-on experiences that align with the principles of Merdeka Belajar. (Chayati et al., 2021). Learning through hands-on experiences and play can change students' perceptions of mathematics, making them more positive and meaningful (Putra & Fernandes, 2024). The use of the Snake and Ladders game is worth considering as an alternative, to enrich innovative and practical learning media, and to optimally support the achievement of mathematics learning objectives and improve the quality of learning in elementary schools.

D. Conclusion

Based on the results, it can be concluded that implementing the Snake and Ladders game as a game-based learning medium has a positive and significant impact on the mathematics learning of fifth-grade students at SDN 2 Kauman Ponorogo. Using this game can create a more active, interactive, and meaningful learning environment by integrating mathematical concepts into structured play. This game is used in the mathematics learning process for 30-40 minutes per session under the teacher's guidance, so that students not only play but also think, discuss, and solve mathematical problems. The research results show an improvement in students' learning outcomes, indicated by an increase in the average mathematics score from 67 before implementing the game to 83 after implementing Snake and Ladders, and an increase in the number of students meeting the Minimum Competency Criteria (KKM). In addition, student engagement in learning improved across all indicators, including actively asking and answering questions, participating in group discussions, expressing opinions confidently, and showing enthusiasm for attending lessons, as shown in the student engagement graph. This is further supported by interview results with teachers and students, which indicate a positive change in students' attitudes toward learning mathematics. The students became more confident and less afraid of making mistakes, and the game of Snake and Ladders helped them understand abstract mathematical concepts more concretely through hands-on learning. Therefore, the Snake and Ladders game can be used as an alternative to enrich mathematics learning media and improve the quality of education in elementary schools.

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