International Journal of Multicultural and Multireligious Understanding

http://ijmmu.com
editor@ijmmu.com
ISSN 2364-5369
Volume 13, Issue 2
February, 2026
Pages: 86-93

The Role of Snakes and Ladders Educational Game in Enhancing Learning Motivation and Basic Arithmetic Operation Skills: A Case Study of Grade 2 Ibnu Bajjah

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http://dx.doi.org/10.18415/ijmmu.v13i2.7280

Abstract

The purpose of this study is to describe the role of the Snakes and Ladders educational game in enhancing learning motivation and basic arithmetic operation skills among second-grade students of Class 2 Ibnu Bajjah at SD Muhammadiyah Sapen Yogyakarta, Indonesia. This research employed a qualitative descriptive case study design. The participants consisted of 34 students (15 boys and 19 girls) enrolled in the mathematics subject at the end of the first semester. Data were collected through participatory observation, semi-structured interviews, documentation, and field notes. Data analysis followed the stages of data reduction, coding, data display, and conclusion drawing, supported by source and methodological triangulation to ensure trustworthiness. The findings reveal that the Snakes and Ladders educational game effectively enhances students' learning motivation, as indicated by increased enthusiasm, active engagement, persistence in solving problems, and reduced fear of making mistakes. In addition, students' competency in arithmetic operations—particularly addition and subtraction within 100—improved through meaningful and repeated counting activities integrated into the game mechanics. The game also fostered a more collaborative and interactive classroom atmosphere, promoting positive peer interactions and cooperative problem-solving. These results suggest that the Snakes and Ladders educational game can serve as an effective instructional medium to improve the quality of mathematics learning in lower elementary grades. The study provides practical guidance for teachers to design meaningful and enjoyable game-based learning activities that support numeracy and motivation.

Keywords: *Educational Game; Snakes and Ladders; Learning Motivation; Arithmetic Operations; Mathematics Learning*

Introduction

Mathematics learning in primary school plays a crucial role in developing children's numeracy skills and logical thinking. However, classroom realities often show that mathematics—especially basic arithmetic operations—is perceived as difficult, monotonous, and less interesting by lower-grade students. This condition was also found in Class 2 Ibnu Bajjah at SD Muhammadiyah Sapen Yogyakarta, the setting of this study. The class consists of 34 students (15 boys and 19 girls). As a classroom teacher and

researcher, the author observed that towards the end of the first semester many students showed declining learning motivation, low enthusiasm for arithmetic exercises, and difficulty maintaining focus when the lesson was delivered through conventional, worksheet-based activities.

Initial classroom observations indicated that only about one-third of the students actively responded to questions, while the others tended to be passive and highly dependent on teacher direction. This situation reflects a gap between the ideal expectations and the actual learning conditions. Ideally, mathematics learning in the lower grades should be implemented through concrete, enjoyable, and interactive approaches that align with children's cognitive development, which is still in the concrete operational stage as described by Piaget. When instruction is dominated by procedural exercises and individual worksheets, students are not optimally engaged in constructing their understanding of arithmetic concepts.

The urgency of renewing instructional methods became more apparent when the teacher noticed that many students lacked confidence in their ability to perform basic calculations. Prior research has shown that low learning motivation directly influences numeracy development and understanding of number concepts. Other studies also indicate that lower-grade students require concrete, activity-based learning so that they can maintain attention and interest in mathematics. In this context, teachers are challenged to design learning experiences that are both pedagogically sound and emotionally engaging for young learners.

One promising alternative is the use of educational games as learning media. Games can create a joyful atmosphere, stimulate curiosity, and strengthen both intrinsic and extrinsic motivation. From a game-based learning perspective, well-designed games can promote social interaction, positive competition, and meaningful learning experiences through activities that involve movement, strategy, and problem-solving (Gee, 2020; Pratama & Anggraini, 2022). Snakes and Ladders is a traditional board game that can be easily adapted into mathematics learning media. For lower-grade primary students, this game offers concrete experiences in counting, moving along a number path, and understanding numerical relationships in an enjoyable way.

A growing body of empirical research has demonstrated the effectiveness of Snakes and Ladders–based media in improving learning outcomes in mathematics, such as numeracy skills and achievement in number-related topics (Azizah & Findrayani, 2024; Rivai et al., 2022; Stelawati, 2023; Widiastuti, 2024). Nevertheless, studies focusing on how the Snakes and Ladders educational game supports both motivation and basic arithmetic operations in a lower-grade classroom, particularly in an Islamic-based modern primary school context such as SD Muhammadiyah Sapen, are still relatively limited. Previous studies often concentrated on upper grades or emphasized test score improvement without sufficiently exploring the dynamics of classroom interaction, emotions, and student–teacher perceptions.

This study seeks to fill that gap by conducting an in-depth qualitative case study in a second-grade classroom. The research does not merely report learning outcomes; it also describes the process of implementing the Snakes and Ladders educational game, students' responses, classroom dynamics, emotional expressions, and the teacher's reflections on the use of the game. Theoretically, this study draws on self-determination theory of motivation (Deci & Ryan, 2020), constructivist perspectives on learning (Bruner, 1966), and cognitive developmental theory (Piaget, 1972). These perspectives collectively support the argument that educational games can serve as appropriate learning tools for lower-grade students to understand mathematical concepts concretely and meaningfully.

Based on this background, the study aims to answer the following main question: How does the Snakes and Ladders educational game contribute to enhancing learning motivation and basic arithmetic operation skills among second-grade students at SD Muhammadiyah Sapen Yogyakarta?

Methodology

Research Design

This study employed a qualitative descriptive design with a case study approach. The focus was to understand in depth the process of implementing the Snakes and Ladders educational game and its contribution to students' learning motivation and basic arithmetic operation skills in Class 2 Ibnu Bajjah at SD Muhammadiyah Sapen Yogyakarta. A case study design was chosen because it allows the researcher to explore a learning phenomenon in its natural classroom context in a detailed, holistic, and contextualized manner. The aim was not to test hypotheses or generalize statistically, but to provide rich descriptions and interpretations of the case under investigation.

Research Context and Participants

The study was conducted in Class 2 Ibnu Bajjah at SD Muhammadiyah Sapen Yogyakarta, an Islamic-based primary school in Indonesia. The research took place at the end of the first semester, when basic arithmetic operations (addition and subtraction within 100) were the main focus of mathematics instruction.

Participants were 34 students (15 boys and 19 girls) who were all involved in the implementation of the Snakes and Ladders educational game. A purposive sampling strategy was applied because this group directly experienced the instructional intervention. Students' identities were anonymized using pseudonyms to protect confidentiality. The classroom teacher served as a key informant and collaborator in the observation and reflection processes.

Role of the Researcher

The researcher also acted as the classroom teacher. This dual role involved planning and implementing mathematics lessons using the Snakes and Ladders educational game; observing students' behaviours, responses, interactions, and difficulties during the activities; keeping detailed field notes on classroom dynamics; conducting semi-structured interviews with selected students and the collaborating teacher; and collecting relevant documents such as lesson plans, students' worksheets, photographs, and video recordings. Reflexivity was maintained by regularly discussing observations with the collaborating teacher and cross-checking preliminary interpretations with participants where appropriate.

Research Procedures

The research procedures were organized into three major phases: pre-implementation, implementation, and post-implementation.

In the pre-implementation phase, the researcher identified problems related to students' low motivation and difficulties in arithmetic operations; designed a lesson plan that integrates the Snakes and Ladders educational game; prepared research instruments including observation sheets, interview guides, and documentation checklists; obtained formal permission from the school and informed consent from parents or guardians; and explained the rules of the game to students.

In the implementation phase, the game-based mathematics lessons were carried out over several meetings. Students were divided into small groups of 5–6 members. Each group received a Snakes and Ladders board that had been modified for arithmetic learning. Students took turns rolling the dice, moving their pawns, and solving the arithmetic problems indicated by the squares they landed on. Peers and the teacher helped check answers and provided feedback.

In the post-implementation phase, the researcher conducted semi-structured interviews with students and the classroom teacher; collected students' worksheets and documented their work; reflected with the collaborating teacher on the strengths and challenges of the game-based lessons; and organized and analysed the collected data thematically.

Data Collection Techniques

To ensure data richness and depth, three main techniques were used: observation, semi-structured interviews, and documentation. Classroom observations focused on students' learning motivation (attention, enthusiasm, persistence, and initiative), participation in the game, collaboration, and strategies used in solving arithmetic problems. Semi-structured interviews were conducted with ten students and the classroom teacher to explore their experiences and perceptions of the game-based lessons. Documentation included photographs, video clips, students' worksheets, and lesson plans, which were used to support and triangulate the observation and interview data.

Data Analysis

Data analysis followed the qualitative analytic procedures proposed by Miles, Huberman, and Saldaña (2014): data reduction, coding, data display, and conclusion drawing. Data reduction involved selecting and focusing on relevant information from field notes, observation sheets, interview transcripts, and documents. Coding was conducted through open coding, axial coding, and selective coding to identify patterns and themes. Data were displayed in narrative form with illustrative quotes and examples from classroom events, and conclusions were drawn and verified through triangulation and member checking.

Trustworthiness and Research Ethics

The trustworthiness of the study was enhanced through strategies of credibility, transferability, dependability, and confirmability. Credibility was addressed by triangulating data sources and data collection techniques and by conducting member checking with the collaborating teacher. Transferability was supported by providing thick descriptions of the research context, participants, and procedures. Dependability was strengthened by maintaining an audit trail of field notes, transcripts, coding schemes, and analytic memos. Confirmability was ensured by grounding interpretations in the data rather than in personal bias.

Ethical considerations included obtaining permission from the school and informed consent from parents, protecting students' anonymity by using pseudonyms, avoiding any form of harm or embarrassment during the activities, and using all collected data solely for academic purposes.

Findings

Enhanced Learning Motivation

At the beginning of the game-based lessons, most students showed high levels of curiosity and excitement. Students who usually appeared passive during traditional lessons became more engaged as they took turns rolling the dice and moving their pawns. Observation data indicated that 28 out of 34 students (about 82%) demonstrated clear positive behavioural indicators of motivation such as smiling, actively volunteering to play, and maintaining attention throughout the activity.

Interview data revealed that students perceived mathematics as more fun and less boring when it was integrated into the Snakes and Ladders game. Several students explicitly stated that they preferred learning mathematics through games rather than only through worksheets and textbook exercises. This shift in perception suggests that the game successfully changed students' emotional responses toward mathematics from anxiety and boredom to enjoyment and anticipation.

During the game, students were more willing to attempt solving arithmetic problems, even when they were unsure of the answers. Mistakes were treated as part of the game and were often corrected collaboratively by peers. The classroom atmosphere was supportive, and students did not appear embarrassed when their answers were wrong. This pattern reflects an increase in task persistence and a reduction in fear of failure.

Improvement in Basic Arithmetic Operation Skills

Worksheet analysis and observation during the game indicated that many students improved their accuracy and speed in performing addition and subtraction within 100. After several sessions, 25 students were able to solve two-step addition problems without teacher assistance, and 30 students showed faster response times in mental calculations during game turns compared with the first session.

The game naturally required students to perform repeated calculations each time their pawn moved. This repetition occurred in a meaningful and engaging context, as students needed correct answers to move forward or avoid sliding down a snake. Over time, this led to greater fluency; students became more confident and could explain their strategies when asked by peers or the teacher. However, not all students progressed at the same rate. Six students still experienced difficulties, such as slower calculation speed or confusion when combining dice values with board positions. Even among these students, gradual improvement was observed as the sessions progressed and they received peer support.

Classroom Interaction and Collaboration

The group-based nature of the Snakes and Ladders game promoted intensive peer interaction. Students frequently discussed how to solve arithmetic problems, checked each other's answers, and negotiated strategies for moving their pawns. Cooperative behaviours such as taking turns fairly, encouraging teammates, and resolving minor disputes were observed.

The classroom atmosphere became more dynamic yet remained manageable. Instead of a silent, teacher-centred classroom, the learning environment was characterized by lively but purposeful talk around mathematics problems. This indicates that the game supported not only cognitive engagement but also social and emotional engagement in learning.

Teacher's Perceptions

The classroom teacher perceived the Snakes and Ladders educational game as a practical and effective medium for lower-grade mathematics learning. In the teacher's view, the game helped to make abstract numerical concepts more concrete and visible, increase students' active participation and reduce boredom, differentiate instruction naturally as more capable students could support peers, and provide formative assessment opportunities, since the teacher could observe students' strategies and errors in real time.

The teacher also emphasized that the game was relatively low-cost, easy to prepare, and reusable for different topics by modifying the content of the squares.

Discussion

The findings of this study confirm that integrating the Snakes and Ladders educational game into mathematics lessons can positively influence both learning motivation and basic arithmetic operation skills among lower-grade primary students. From a motivational perspective, the increased enthusiasm, active participation, and reduced fear of mistakes observed in this study are consistent with self-determination theory, which posits that students' intrinsic motivation is enhanced when their needs for autonomy, competence, and relatedness are supported (Deci & Ryan, 2020). Game-based activities provide meaningful choices (autonomy), clear and achievable challenges (competence), and intense social interaction (relatedness), all of which were evident during the Snakes and Ladders sessions.

In terms of cognitive development, the game aligns with Bruner's enactive–iconic–symbolic representation sequence. Students physically moved pawns on the board (enactive), made sense of the board layout and number path (iconic), and then connected these experiences to symbolic representations of numbers and operations (symbolic). This multi-representational experience is particularly appropriate for children in Piaget's concrete operational stage, where learning is best supported by concrete and visual experiences (Piaget, 1972; Oktaviani, 2021).

The observed improvements in arithmetic fluency and conceptual understanding echo findings from previous research that board games with numerical content can strengthen number sense and calculation skills (Siegler & Ramani, 2018; Widiastuti, 2024). Repeated practice embedded in gameplay allows students to consolidate arithmetic skills without experiencing the monotony often associated with traditional drills.

The study also highlights the role of the Snakes and Ladders game in fostering collaborative learning. The frequent peer discussions, mutual help, and collective decision-making observed in this classroom resonate with Vygotskian perspectives that emphasize the importance of social interaction in cognitive development. Through interactions within their groups, students operated within their zones of proximal development, with more capable peers providing scaffolding to those who struggled.

Overall, this study contributes to the literature by showing how a simple, culturally familiar board game can be systematically integrated into mathematics instruction in a lower-grade classroom within an Islamic-based primary school context. It underscores that improving numeracy does not always require sophisticated digital tools; carefully designed low-cost games can also be powerful when used thoughtfully.

Conclusion and Practical Implications

Conclusion

This qualitative case study examined the role of the Snakes and Ladders educational game in enhancing learning motivation and basic arithmetic operation skills among second-grade students at SD Muhammadiyah Sapen Yogyakarta. The main conclusions are as follows: The Snakes and Ladders educational game effectively increased students' learning motivation; contributed to improvements in basic arithmetic operation skills, particularly addition and subtraction within 100; fostered a more collaborative and interactive classroom environment; and was perceived by the teacher as a practical, low-cost, and flexible learning medium.

Practical Implications

Based on the findings, several practical implications can be proposed. For teachers, it is recommended to intentionally integrate educational games such as Snakes and Ladders into mathematics lessons, especially when teaching number operations to lower-grade students. Games should be designed with clear learning goals, appropriate difficulty levels, and opportunities for reflection. For schools, educational games can be incorporated into school-wide numeracy programs, mathematics clubs, or extracurricular activities to reinforce basic arithmetic operations in a fun and engaging manner. For curriculum developers, the potential of traditional games could be further explored and documented in instructional guides, so that teachers can easily adapt them to various topics and skill levels. For future researchers, further studies could employ quasi-experimental designs with control groups or conduct longitudinal research to examine long-term effects on motivation and numeracy development, including comparisons between physical and digital versions of the game.

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