

Development of numbers adventure gamification in mathematics subjects for elementary schools

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Abstract: In elementary school mathematics, students often struggle to distinguish, name, and identify numbers. Simple gamification tools, such as the "Snakes and Ladders" game, serve as learning media that support the development of fundamental cognitive skills, including number recognition and problem-solving. This study aimed to develop and test the feasibility of the "Numbers Adventure" gamification model through a series of assessments regarding validity, practicality, and effectiveness. A Research and Development (R&D) approach was employed, following the Define, Design, Develop, Implement, and Evaluate & Revise stages. The study involved 51 students and three classroom teachers. Data collection instruments included media and instrument validation sheets, student and teacher response questionnaires, and learning outcome tests. The findings indicate that developing the "Numbers Adventure" gamification model was necessary to bridge the gap between students' learning characteristics, educators' needs, and elementary school curriculum requirements. Assessments by subject matter experts (96%) and media experts (95%) confirmed that the content, design, and learning structure met pedagogical standards and aligned with the elementary school curriculum. The practicality of the "Numbers Adventure" gamification proved to be very high, based on ratings from both students (95.11%) and educators (94%). The model demonstrated high effectiveness in improving mathematics learning outcomes, evidenced by N-Gain scores ranging from 0.83 to 0.88 (categorized as high). The "Numbers Adventure" gamification model successfully optimized numeracy concept understanding for students with varying levels of prior knowledge across all trial locations.

Keywords: Gamification, learning media, mathematics learning, numeracy

Abstrak: Dalam pembelajaran matematika di sekolah dasar, siswa sering kali mengalami kesulitan untuk membedakan, menyebutkan, dan mengidentifikasi angka. Alat gamifikasi sederhana, seperti permainan "Ular Tangga", berfungsi sebagai media pembelajaran yang mendukung pengembangan keterampilan kognitif dasar, termasuk pengenalan angka dan pemecahan masalah. Penelitian ini bertujuan untuk mengembangkan dan menguji kelayakan model gamifikasi "Numbers Adventure" melalui serangkaian penilaian terkait validitas, kepraktisan, dan efektivitas. Pendekatan Penelitian dan Pengembangan (R&D) digunakan dengan mengikuti tahapan *Define, Design, Develop, Implement*, serta *Evaluate & Revise*. Penelitian ini melibatkan 51 siswa dan tiga orang guru kelas. Instrumen pengumpulan data meliputi lembar validasi media dan instrumen, kuesioner respons siswa dan guru, serta tes hasil belajar. Hasil penelitian menunjukkan bahwa pengembangan model gamifikasi "Numbers Adventure" diperlukan untuk menjembatani kesenjangan antara karakteristik belajar siswa, kebutuhan pendidik, dan tuntutan kurikulum sekolah dasar. Penilaian oleh ahli materi (96%) dan ahli media (95%) mengonfirmasi bahwa konten, desain, dan struktur pembelajaran telah memenuhi standar pedagogis serta selaras dengan kurikulum sekolah dasar. Tingkat kepraktisan gamifikasi "Numbers Adventure" terbukti sangat tinggi, berdasarkan penilaian dari siswa (95,11%) maupun pendidik (94%). Model ini menunjukkan efektivitas yang tinggi dalam meningkatkan hasil belajar matematika, yang dibuktikan dengan perolehan skor N-Gain berkisar antara 0,83 hingga 0,88 (dikategorikan tinggi). Model gamifikasi "Numbers Adventure" berhasil mengoptimalkan pemahaman konsep numerasi bagi siswa dengan beragam tingkat pengetahuan awal di seluruh lokasi uji coba.

Kata kunci: Gamifikasi, media pembelajaran, pembelajaran matematika, numerasi

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INTRODUCTION

Mathematics plays a crucial role in education. The primary goal of mathematics learning is to equip students with problem-solving skills, a strategic competency that must be mastered (Malik et al., 2018). Given its importance as a fundamental science, mathematics instruction at all levels of formal education requires serious attention (Hajir & Arismunandar, 2024). Many students, particularly in mathematics, consider it the most difficult, boring, and uninteresting subject. This perception arises because, in the learning process, students are often positioned merely as listeners to teachers' lectures, without consideration of their readiness. As a result, students are less able to actively engage in the teaching and learning process (Amir et al., 2025; Kalifah et al., 2025; Yahya & Arismunandar, 2024). This condition is further exacerbated by the low motivation to learn among many elementary school students (Nasir et al., 2023). Low interest and motivation in learning among students are fundamental problems that directly affect learning outcomes (Kurniawan et al., 2021; Yurida et al., 2021).

Based on the e-Report Card (e-Report) at the Elementary School Unit (UPT) of Rumbia 25 Public Elementary School, available on the Merdeka Mengajar platform, the correction feature directly provides recommendations indicating that several students' numeracy achievement remains low. These weaknesses in numeracy skills indicate gaps in students' basic understanding of concepts such as number recognition, basic arithmetic operations, and number patterns. This gap also highlights the need for specific interventions to help students overcome obstacles to numeracy. One of the identified issues was the lack of engaging learning media and the limited use of teaching aids by teachers. Interviews with teachers revealed several challenges, including that approximately 70% of students struggled to correctly name number symbols for counting, match numbers with their symbols, and correctly sequence number symbols from 1 to 20.

Observations at the UPT of Rumbia 25 Public Elementary School revealed that, in developing numeracy skills, most students still struggled to differentiate between numbers and to name and show them. Based on observations, teachers at the school also use only media such as whiteboards, picture books, and other materials. Students are monotonous and struggle to recognize numbers. Furthermore, in first grade, students are still transitioning from kindergarten to elementary school. As teachers, we must provide a variety of teaching and learning activities so students can adapt to the new environment.

One of the rapidly growing trends in modern education is game-based learning, which focuses not only on academic achievement but also integrates cognitive and affective aspects into the learning process (Upreti et al., 2024). This approach aims to create a more enjoyable, interactive, and meaningful learning experience for students, and is able to foster their motivation to learn from within (Ahmad et al., 2026; Handaryani et al., 2026; Sucipto et al., 2026). The notion of gamification evolved from this setting. Gamification is the process of incorporating game elements into educational sessions to promote active participation and enhance learning outcomes. There is more to gamification than just games. It's a way of teaching that combines game design with learning goals to make learning more fun and challenging (Luo, 2022).

In elementary school, a game of Snakes and Ladders is a great example of gamification since it is both easy to use and has a lot of potential. The versatility of this classic game as a means of teaching fundamental cognitive abilities like number identification and problem-

solving has long been acknowledged (Asmila & Bumbungan, 2025; Hanun & Nugraheni, 2025; Ramdani et al., 2025; Sorkin, 2023). Susanti and Muktadir (2024) say that the engaging board design and different challenges help students learn to count steps, make decisions, and come up with plans to reach their goals. Additionally, Snakes and Ladders games can help students learn math better, get them more excited about learning, get them more involved, and help them make friends while they are studying. Based on these findings, it seems that snakes and ladders games have the potential to serve as an efficient, straightforward, and interesting learning medium for teaching mathematics to elementary school students (Fadila et al., 2025).

The application of Snakes and Ladders as a learning tool significantly improves children's numeracy skills. Research by Susetyawati et al. (2024) shows that participating in a Snakes and Ladders game improves children's numeracy skills and creates a more enjoyable learning environment, and fosters social interaction, as children help each other answer questions. A study by Sakdah et al. (2022) found that using the Snakes and Ladders Math game significantly improved students' multiple intelligences. This game proved effective at creating a fun, interactive learning environment, encouraging students to participate more actively in the learning process. Research by Rivai et al. (2022) found that implementing a Snakes and Ladders game using number cards in mathematics learning increased student activity and learning outcomes. Their findings indicate that using snakes and ladders can increase student engagement and learning outcomes in addition to subtraction.

The purpose of this study was to develop and test the feasibility of the Numbers Adventure gamification model through a series of validity, practicality, and effectiveness tests. This research is expected to produce a learning model that is appropriate to the characteristics of early grade students, relevant to curriculum demands, and effective in improving basic mathematics skills.

METHOD

The type of research used is Research and Development. The development stages include Define, Design, Develop, Implement, and Evaluate & Revise. The subjects in this study were first-grade students at three elementary schools in Jeneponto Regency, namely UPT SDN 7 Rumbia, UPT SDN 22 Rumbia, and UPT SDN 25 Rumbia in the 2025/2026 academic year. The number of students involved in this study was 51 students, with the support of three class teachers.

Steps in designing Numbers Adventure game components and mechanics:

- Determination of Player Structure

Design a snakes and ladders board with 16 pieces. Determine the location of the ladder and slide. Ensure the pieces contain math problems that align with the first grade curriculum.

- Learning Content Design

1. Number Recognition: Pieces containing number recognition problems (e.g., "Name the number that comes after 5").
2. Simple Addition and Subtraction: Pieces containing simple addition and subtraction problems (e.g., "Count 3 + 2").

3. Geometric Shape Recognition: Pieces requiring students to identify or draw basic geometric shapes.
 4. Problem Solving: Pieces with story problems that require simple problem solving (e.g., "If there are 5 apples and you give 2 to your friend, how many apples are left?").
- Visual and Material Design
1. Game Board: Design an engaging and educational visual design, using bright colors and relevant illustrations.
 2. Game Pieces and Dice: Design game pieces and dice that are safe and engaging for students.
 3. Game Instructions: Clear and easy-to-understand instructions to help students play without difficulty.
- Evaluation Tool Design
1. Question Cards: Cards with questions that correspond to the material in the game box.
 2. Observation Sheet: A sheet for teachers to record student performance and participation during the game.
 3. Reflection Questionnaire: A simple questionnaire for students to express their experiences after playing.

The instruments used in this study were media and instrument validation sheets, student response questionnaires, teacher response questionnaires, and learning outcome tests. Quantitative descriptive data analysis was used to analyze data in the form of scores or numbers from the results of the media/design expert validation questionnaire, student response questionnaires, teacher response questionnaires, and learning outcome tests. There were three quantitative descriptive analyses: validity analysis, practicality analysis, and effectiveness analysis.

$$s - \max = \frac{v - ah}{Tse} \times 100\% \quad (1)$$

Information:

s - max = expected score

v - ah = expert validation score

Tse = total empirical score generated

Table 1. Validity criteria for the numbers adventure game (Adhaningrum et al., 2021)

Criteria	Validity Level
80.01% - 100%	Very valid
60.01% - 80.00%	Valid
40.01% - 60.00%	Less valid
20.01% - 40.00%	Invalid
00.00% - 20.00%	Very invalid

The practicality analysis of Numbers Adventure was obtained from the results of student and teacher activity observations, as well as filling out student and teacher response questionnaires. The observation activities of teacher and student activities began with a

small trial and ended with the end of the learning process. The questionnaires were administered to students and teachers at the final meeting. The data from the student and teacher response questionnaires were analyzed to illustrate the practicality of Numbers Adventure in learning. The analysis of this data activity used the following formula:

$$v - pg = \frac{Tse}{Tsh} \times 100\% \tag{2}$$

- Information:
- $v - pg$ = practicality for users
- Tse = total empirical score generated
- Tsh = expected total score

Table 2. Practicality criteria for the numbers adventure game (Adhaningrum et al., 2021)

Percentage	Practicality Level
81% - 100%	Very practical
61% - 80%	Practical
41% - 60%	Quite practical
21% - 40%	Less practical
0% - 20%	Not practical

The effectiveness of Numbers Adventure is expressed through the interpretation of student learning outcome tests. The analysis used to assess effectiveness is the N-Gain (Normalized Gain) test, which aims to measure the relative increase in student understanding before and after the learning process. This approach allows teachers to gain a clearer picture of how successfully a curriculum or learning method is implemented. Through the results of the N-Gain analysis, student mastery of the material can be quantitatively assessed.

Table 3. N-gain score criteria (Sukarelawan et al., 2024)

Achievement Criteria Value	Ideal Level
$0.71 \leq g \leq 1,00$	High
$0.31 \leq g \leq 0,70$	Medium
$0.1 \leq g \leq 0,30$	Low
$g=0$	No increase
$-1.00 \leq g \leq 0$	Decrease

RESULTS AND DISCUSSION

Data collection on the needs of the Numbers Adventure gamification model was conducted to ensure that the development of this learning media was based on real-world needs. Analysis of student and teacher needs, as well as a review of learning outcomes and objectives served as essential foundations for determining the relevance, feasibility, and direction of the model's design. This ensured that the developed model was truly contextual, supported the learning process, and met the curriculum demands of elementary school mathematics instruction.

Analysis of learning outcomes and objectives for mathematics in elementary schools, particularly in first grade, shows that students in the early stages of education require concrete, engaging, and developmentally appropriate learning experiences to understand basic number concepts and simple operations. The curriculum formulates learning outcomes that emphasize students' abilities to recognize, compare, and represent numbers through meaningful and contextual activities. However, classroom learning practices are often abstract, resulting in suboptimal student motivation and engagement. Monotonous learning leads to decreased student motivation (Damopolii, 2025; Harso et al., 2021). This situation provides an important basis for developing the Numbers Adventure gamification, a learning medium that integrates game elements to facilitate the achievement of learning objectives in a more enjoyable, interactive, and meaningful way, while also supporting the development of early numeracy skills.

The characteristics of students who tend to be visual, kinesthetic, and contextual emphasize that a gamification approach not only meets their needs but also has the potential to enhance engagement, motivation, and a more meaningful mathematics learning experience. Overall, these learning needs indicate that students require a dynamic, hands-on learning environment, complemented by physical activities and concrete media. Student needs need to be assessed to ensure that products are developed that align with their characteristics (Ahliana et al., 2025; Rumbruren et al., 2022). Students have learning characteristics that still lean toward direct experience, but with varying levels of intensity. They have a strong interest in varied learning approaches, but the intensity of their preferences is not as homogeneous as in other schools. Therefore, the learning process at this school requires strategies that can accommodate these varying preferences to maintain optimal student engagement. Students require activities that provide real-world experiences, but the intensity of these needs is not too extreme, so the learning design must offer a balance between movement activities and conceptual explanations.

The Numbers Adventure gamification model for elementary school mathematics learning is essential due to the structural gap between the developmental characteristics of students, the conditions of learning in the field, and the curriculum demands related to learning outcomes and learning objectives. The secondary school students are in the concrete operational stage, which necessitates learning experiences that are grounded in real contexts, concrete visualizations, and enjoyable activities. In order to satisfy these requirements, the Numbers Adventure gamification model was created. The model provides cognitively and affectively pertinent learning experiences and incorporates local cultural and environmental elements (contextual). The material's proximity to students' daily lives is enhanced by the contextual environments incorporated into the game design, including illustrations and challenge scenarios.

The Numbers Adventure gamification model with contextual environments is desperately needed by elementary school teachers. It is believed that this model has the potential to address a variety of learning challenges, including the limitation of contextualized environments as learning resources, the absence of engaging media, and poor conceptual understanding. By employing a gamification approach, this model is designed to be straightforward, contextual, and non-technical. It has the potential to enhance the efficacy of mathematics education and assist educators in developing more

meaningful learning experiences that align with the characteristics of elementary school students.

Theoretically, gamification has been recognized as an effective approach for improving educational material. Hellín et al. (2023) contend that gamification may enhance student enthusiasm and involvement, especially when used in a learning context that emphasizes active participation. According to Kim et al. (2018), the engagement of active students is positively connected with a thorough grasp of the content being presented in the classroom. It is consistent with this opinion that this idea is. Different levels of difficulty, points, and prizes are all part of the game. They are not only fun, but they are also good for teaching math concepts. This is how Numbers Adventure works. Additionally, Mislia et al. (2025) showed that this kind of game structure can create teaching experiences that are not only fun and interesting, but also have deep value.

When making the product, the traits of the students, the educational goals, and an analysis of their needs are all taken into account. The design is used as a standard for professional testing and verification. The main focus of the item, which is still in the test stage, is on the medium's structure, usefulness, and usage path. The Number Adventure gamification is a way to learn that looks like a game of Snakes and Ladders but includes basic math tasks. These games teach kids how to recognize forms, add and subtract, and use the numbers 1 through 10. Game features, environmental images, and organized learning activities were incorporated into the media to improve student motivation, engagement, and conceptual understanding. This was accomplished via the development of the media. This first product format includes all the visual components, resources, and usage instructions necessary to make the learning process easier.

Snakes and Ladders Board		
Information	Visual (Layout and Illustration)	Text and Specifications
Board Design		Layout: Snakes and Ladders pattern (4x4 grid or circular path) with 16 squares. Elements: Cultural icons are displayed in specific squares. Snakes are replaced by slides (down) and ladders (up).
Plot 01 "START"		Label Text: "START - Angngaru" Visual: images/illustrations from Angngaru Red

Fig. 1. Storyboard Numbers Adventure model gamification

The Numbers Adventure learning medium storyboard (Figure 1) demonstrates the systematic development of the gamification design, integrating elements of Jeneponto's local culture and environment as the learning context. This is evident in the selection of

icons, illustrations, and game plot names, all of which refer to cultural objects, the natural environment, and local wisdom, such as Angngaru, Padduppa Dance, Rice Fields, Garassikang Beach Waves, and Bossolo Waterfall (Figure 2). Not only does the integration of these local components improve contextualization, but it also aims to cultivate a psychological affinity for mathematical ideas among students via the use of play experiences that are relevant to everyday life. The arrangement of the game board is achieved using a grid pattern of sixteen squares, with each square displaying a distinct image, color, and identifier. The purpose of this graphical improvement is to improve the game's appeal while also making it easier for students to navigate around the game. The presence of ascending and descending mechanisms via stairs and slides demonstrates that this media adopts the basic principles of educational board games, where game dynamics can encourage students' intrinsic motivation. These mechanisms also function as gamification elements that provide surprises, challenges, and encouragement to continue playing.



Fig. 2. Numbers adventure gamification model

The Numbers Adventure media components are intended to serve as a complementary gamification system that facilitates the mathematics learning process in

elementary education. The game board is the primary structure that actively engages students in the exploration of mathematical concepts by regulating the flow of learning activities through the mechanism of moving squares. The dynamics of the game are further bolstered by the presence of pawns, dice, and winner cards, which encourage student motivation and engagement during the activity by means of direct interaction, random elements, and symbolic rewards.

The aim of the problem cards is to promote the methodical development of mathematical skills during the gameplay. On one side of the card is the number, and on the other is the case. This style makes it easier for students to focus on the subject by removing visual distractions. There are answer keys in the handbook that help teachers accurately grade the work that their students have done. For example, this shows that using media not only gets students more interested, but it also helps teachers do their job of evaluating in game-based learning.

The guidebook is used as a tactical execution tool to make sure that the media is used in line with the publication and its rules. The guide has information about the media, how to use it, what games can and can't do, and how to evaluate them. This shows that the design of the product puts the ease of use of teachers first. In addition to providing a fun and active learning experience, the Numbers Adventure system also helps students develop a structured and meaningful way to learn math that is tailored to their needs as elementary school students.

We used the gaming method in The Numbers Adventure to meet the needs of teaching math in elementary school, which needs a framework that is relevant, interesting, and real. This framework integrates gaming principles into an educational approach that is methodical, theoretical, and pertinent to the learning context in which children are learning. Thus, this model acts as a conduit connecting the need of basic numeracy instruction with learning methodologies that have mostly been theoretical and lacking in experiential application.

Theoretically, the design of Numbers Adventure is rooted in the principles of gamification, which have been widely used in education to increase student motivation and engagement. Ratinho et al. (2026) stated that gamification includes elements such as points, badges, leaderboards, and challenges designed to provide structure to the game. These elements are organized into game boards, problem cards, and challenge mechanisms in Numbers Adventure. Gamification increases both intrinsic and extrinsic motivation through instant feedback, recognition of achievement, and competition and collaboration (Pustikayasa et al., 2026), making it highly suitable for supporting Mathematics learning that requires active engagement. In fact, Algburi et al. (2026) emphasized that the point system in gamification provides immediate feedback and increases student engagement—a mechanism integrated into this model through rewards and game progress on the board.

The game structure in Numbers Adventure also incorporates elements of challenge, as emphasized by Hellberg and Moll (2023) who stated that challenges enhance students' sense of achievement and cognitive engagement. Badges or visual reinforcement are also used as a form of achievement recognition, in line with Dyer et al.'s (2023) argument that badges provide motivation and a sense of accomplishment for students. Therefore, the model design not only presents a game but also provides a complete gamification system to facilitate learning motivation. The 150 × 150 cm game board is meant to offer a variety of

experiences that make learning through physical exercise easier. This design fits with the idea of embodied cognition, which says that having physical experiences can help your brain work better with math. As stated by Pustikayasa et al. (2026), the principles of gamification, which stress the process of achievement and set clear goals, are in line with how each tile on the board increases the difficulty. Deterding et al. (2011) found that the slide and ladder parts may make people more competitive by giving them quick feedback like a real scoreboard. As a result, the design of the game board serves as both a structured learning tool and an esthetic element.

Question cards serve as a cognitive component in the model. The cards are designed based on Bloom's taxonomy at the remembering (C1), understanding (C2), and applying (C3) levels, and are integrated with contextual activities. Research by Mursalin et al. (2024) shows that game-based learning can improve mastery of basic mathematical concepts, so the use of question cards in game activities is believed to strengthen number understanding. In addition, Chen et al. (2020) found that game elements encourage students to think creatively and deeply, characteristics facilitated through story problems and counting activities in Numbers Adventure cards. Furthermore, the finding by Susetyawati et al. (2024) that the snakes and ladders game significantly improves children's numeracy skills strengthens the empirical basis for using game formats such as Numbers Adventure in basic numeracy materials.

The integration of contextual elements in the model design is based on the principles of locally-based learning and ecopedagogy. In Numbers Adventure, illustrations of the Turatea environment, such as rice fields, beaches, traditional houses, and gardens, are used as context for the questions. This is also in line with Kuncoro (2024), who emphasized that students' interactions with environmental elements in games broaden their ecological insights. Handaryani et al. (2026) even emphasized that locally-based gamification can make learning materials more relevant and build students' cultural and social understanding. Thus, the visual and narrative design in Numbers Adventure is not merely decorative, but has pedagogical and cultural functions.

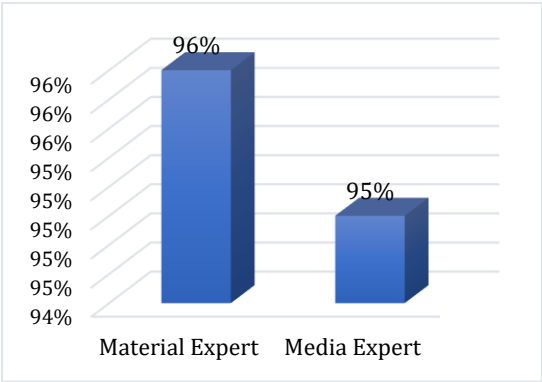


Fig. 3. Product validation by experts

Validation test data by subject matter experts on the quality of the Numbers Adventure gamification model for mathematics subjects showed a very high level of feasibility (Figure 3). Quantitatively, the accumulated assessment of 17 statement items resulted in a total score of 65 out of an ideal maximum score of 68. Through percentage

analysis, this achievement represents a validity level of 96%. Referring to the interpretation criteria for the feasibility of the development product, this figure places this gamification model in the "Very Valid" category. This indicates that the resulting product meets the established criteria for the feasibility of developmental products. According to Damopolii et al. (2022) and Dita et al. (2023), the validity of an instructional medium is assessed based on the extent to which the material enhances student performance in a given subject. The *Numbers Adventure* gamification model fosters active student engagement and facilitates deep, meaningful learning. Expert validators have confirmed the developed product's quality based on these standards. The *Numbers Adventure* gamification model offers students a learning experience that integrates mathematics principles into a game-based context. The validity of Numbers Adventure has met the criteria established by subject matter experts. In the realm of mathematics, this adventure-based gamification paradigm demonstrates a very high level of practicality. Quantitative evaluation yielded a score of 96%, placing it in the "Highly Valid" category. Figure 4 shows how the product was revised following assessment by the validator.



Fig. 4. Product before and after validation

Experts in media and design made an evaluation and found that the Numbers Adventure gamification model produced very good results. The results show that the Numbers Adventure product got an overall score of 84 out of a possible 88. Based on the number, the media has a truth level of 95%, which puts it in the "Highly Valid" group. This picture shows that the created media meets the requirements for interactive learning materials from both a technical and a visual point of view. It is ready to be used without needing major changes. Ahmad et al. (2026) highlight that gaming goods must go through a strict evaluation process before they can be used to teach math. Furthermore, Handaryani et al.'s (2026) results about the effectiveness of gamification were confirmed by expert evaluation and showed that math learning outcomes improved.

The usefulness assessment of the Numbers Adventure gamification model was done to see how useful, effective, and simple the media are in a real learning environment. The evaluation data came from a response questionnaire that was sent to all the students in three trial educational units: UPT SDN 7 (School A), UPT SDN 22 (School B), and UPT SDN 25 Rumbia (School C). Teachers were also asked to confirm the questionnaires as end-users. All quantitative data collected from the respondents' assessment results were then analyzed descriptively to obtain percentage values, which were then converted into qualitative

categories referring to practicality criteria standards. The following presentation presents a tabulation of practicality test data results along with an in-depth interpretation of the operational feasibility of the media in each educational unit.

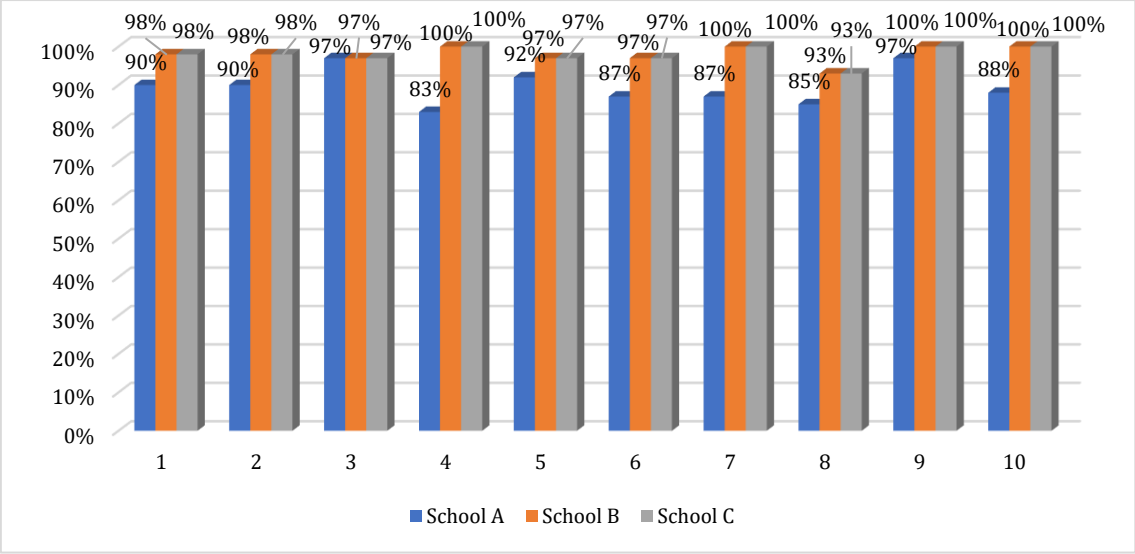


Fig. 5. Results of practicality tests on students

Figure 5 shows the results of the practicality test of the Numbers Adventure gamification model. All of the study subjects gave very good ratings, with an average accuracy of 95.11%. Based on these results, the Numbers Adventure media falls into the "Very Practical" category. This means that the media is highly acceptable and doesn't need anything major to be changed. When looking at the media from both an interface and a teaching point of view, the responses from students show how well it connects the cognitive and affective parts of learning. This is clear because it consistently gets the highest score (4) on important factors such as the desire to reuse the media ("reuse intention"), the ease of problem-solving, and the lack of technical issues during operation. Also, every student agreed that they liked using games to learn more than standard methods like reading books and that they didn't get bored while they were learning. These numbers show that adding game-like features to Numbers Adventure worked to make a fun and engaging learning setting that helped students at the school understand math subject on their own through fun activities.

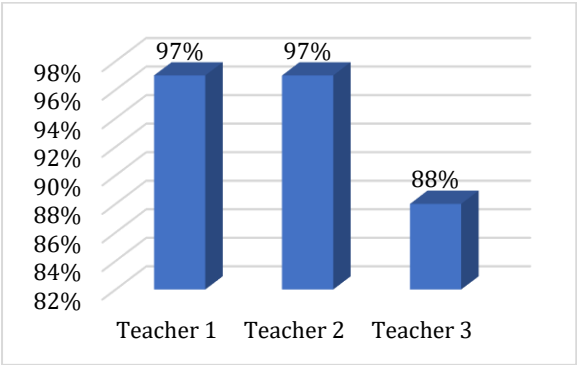


Fig. 6. Results of practicality tests for teachers

For the purpose of determining the extent to which the medium is applicable in actual classroom settings, an evaluation of the practicability of the Numbers Adventure gamification model (Figure 6) was carried out from the perspective of educational experts, namely teachers. An extraordinarily high level of acceptance was shown by the numerical data that was produced from the assessment tool, which was filled out by three instructors who responded to the survey. The average approval rate was 94%. It has been determined that the medium is classified as "Highly Practical" based on the results of the teacher assessment, which fall within the range of 81% to 100%, as determined by the criteria for practicality interpretation.

After conducting an in-depth analysis of the questionnaire's questions, it was discovered that educators often voiced favorable opinions on the educational effect and esthetic presentation of the media. All of the respondents gave the media the highest rating possible, which was four, because of its captivating and appropriate presentation for elementary school students, the clarity of the icons and symbols, and the belief that the media significantly improved student learning outcomes. Participants in G3 gave the content a grade of three, indicating that they had a slightly diverse opinion about whether or not it was suitable for their preferred method of learning. The majority of the teachers were in agreement that the layout, the ratio of text to graphics, and the ease of navigation were all performed well. Based on the results, it is clear that the Numbers Adventure model satisfies the operational feasibility requirements for its use as a powerful teaching tool to encourage interactive mathematics learning in elementary classrooms.

This success aligns with the advantages of gamification, which does not rely entirely on digital technology. As Handaryani et al. (2026) noted, offline gamification is often used in classrooms when digital technology is not readily available and can strengthen face-to-face interactions, increase intrinsic motivation, and create competitive or collaborative dynamics in real-time. The integration of contextual environmental aspects in Numbers Adventure makes this media remain relevant and practical to use even in conditions of limited facilities, so that it does not create infrastructure barriers for students.

Furthermore, the findings of Rivai et al. (2022) strengthen the evidence that practical game media can improve learning activities and outcomes. This same phenomenon is reflected in student responses in this study, where all indicators of enthusiasm, enjoyment of learning, and ease of solving problems received high scores. This means that the game elements in Numbers Adventure are not only easy to use but also have direct implications for students' cognitive and affective engagement. Susetyawati et al. (2024) emphasized that educational games make the mathematics learning atmosphere more enjoyable and interactive, thereby improving students' numeracy skills and enthusiasm. Student responses that gave perfect scores on the reuse intention and not feeling bored indicators prove that these characteristics are also achieved in Numbers Adventure.

The use of gamification in Numbers Adventure was assessed in three educational establishments, demonstrating a consistent and significant improvement in average academic achievement (Table 4). The use of gamification in Numbers Adventure significantly improved students' mathematical abilities. Descriptive analysis revealed a significant improvement in cognitive abilities, shown by the increase in the average score from pretest to posttest. The average Normalized Gain (N-Gain) score ranging from 0.83 to 0.88 evaluated the effectiveness of this model. The N-Gain measure indicates a high-

performance classification, confirming that the Numbers Adventure model enhances understanding of mathematical concepts.

Table 4. Mean and n-gain of learning outcomes

School	Data	N	Mean	n-gain
A	Pretest	18	2.78	0.88
	Posttest	18	9.17	
B	Pretest	19	3.79	0.83
	Posttest	19	9.26	
C	Pretest	14	3.57	0.88
	Posttest	14	9.28	

The gamification of Numbers Adventure has shown efficacy in improving mathematics educational results for elementary students in several testing sites. The findings from the pretest, posttest, and Normalized Gain (N-Gain) scores demonstrate a consistent improvement in numeracy abilities and comprehension of mathematical ideas. This discovery aligns with the conclusions of Susetyawati et al. (2024), who said that educational games have shown useful in enhancing students' numeracy abilities. Studies indicate that even basic games like Snakes and Ladders may enhance children's numerical abilities and their will to study, as students exhibit increased excitement while tackling arithmetic challenges. Similarly, Sakdah et al. (2022) discovered that gaming media fosters an enjoyable and engaging educational environment, while Raju et al. (2021) shown that the use of such games enhances participation and educational results.

Following participation in gamification-oriented education, students exhibited a significant improvement in their cognitive skills. This reinforces the assertion that game-oriented tasks may improve student involvement and concentration, alleviate math-related anxiety, and foster pleasurable learning experiences. Game components may augment involvement and elevate the pleasure of education, therefore yielding positive effects on learning results (Qudsi, 2024). Moreover, Hermaya et al. (2025) found that students participating in game-based learning activities shown significant improvements in their understanding of basic mathematical principles compared to traditional learning approaches. This claim illustrates that gamification serves as both a feasible medium and a potent educational approach for improving mathematical skills.

CONCLUSION

The outcome of this study highlights the need to develop the Numbers Adventure gamification model to reconcile the disparities between student learning characteristics, instructor needs, and curricular expectations in elementary education. The contents, layout, and educational framework are pedagogically valid and suitable for the elementary school curriculum, as evaluated by specialists in materials and media. The assessment conducted by students and educators revealed the very high practical use of the Numbers Adventure gamification model. This medium is user-friendly, entertaining, and free of technical impediments, which effectively facilitates student engagement and participation in mathematical instruction. The N-gain score, classified as high, indicates that integrating gamification into Numbers Adventure led to a considerable improvement in mathematics

learning outcomes. Students' knowledge of numerical concepts improves across all testing locations and at a variety of baseline skill levels, according to the approach.

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