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DEVELOPMENT OF SNAKES AND LADDER GAME MEDIA TO IMPROVE STUDENTS' LITERACY AND NUMERACY SKILLS IN MATHEMATICS AT SD MUHAMMADIYAH BANYURADEN

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ABSTRACT

The low literacy and numeracy skills of elementary school students are one of the problems that need attention in the mathematics learning process. Learning that is still dominated by lecture methods and the minimal use of innovative learning media causes students to be less active and experience difficulties in understanding the material. This study aims to develop a valid, practical, and effective educational snakes and ladders game media to improve the literacy and numeracy skills of fourth-grade elementary school students. This study uses the Research and Development (R&D) method with the ADDIE model which includes the stages of analysis, design, development, implementation, and evaluation. The research subjects consisted of 30 fourth-grade students of Muhammadiyah Banyuraden Elementary School as the experimental class and 30 fourth-grade students of Banyuraden Elementary School as the control class. Data collection techniques included interviews, observations, questionnaires, documentation, and tests. The results showed that the educational snakes and ladders game media obtained a validation score of 60 from material experts and 59 from media experts with a very good category. The results of the practicality test showed a teacher response of 45 and a student response of 8.5 with a very good category. The effectiveness test results showed a significant difference between the control class and the experimental class in literacy (sig. = 0.041) and numeracy (sig. = 0.046) skills. The paired sample t-test results also showed a significant increase in literacy and numeracy skills after using the media. Thus, the educational snakes and ladders game media was declared valid, practical, and effective in improving the literacy and numeracy skills of elementary school students.

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INTRODUCTION

Education plays a strategic role in raising the quality of human resources while laying the primary foundation for accelerating national development. The success of this educational system is heavily influenced by the quality and depth of the learning process orchestrated in the classroom. As facilitators of learning, teachers are not only burdened with the absolute obligation to master pedagogical, social, personality, and professional competencies in an integrated manner, but are also required to construct learning designs that adapt to student characteristics. The regulatory framework of Law of the Republic of Indonesia Number 20 of 2003 concerning the National Education System outlines that education is a conscious and structured effort to create a learning atmosphere that stimulates students to aggressively exploit their inner potential in the areas of spirituality, self-control, intelligence, morality, and social skills.

The curriculum is positioned as the main anchor or heart of the educational ecosystem because it acts as a compass for the entire series of learning rhythms in schools (Arifin, 2018). The redefinition of the meaning of the curriculum has now mutated from what was initially viewed narrowly as a collection of subjects, to the conceptualization of a set of structured learning experiences oriented towards achieving educational targets. This premise is in accordance with the thesis proposed by Syaodih Sukmadinata (2017), who postulated that the curriculum does not simply confine teaching text material, but rather encapsulates the totality of empirical experiences absorbed by students in an academic environment. Referring back to the draft of the National Education System Law Number 20 of 2003, the curriculum is interpreted as an articulation of regulations regarding targets, substance, teaching materials, and tactical methodologies implemented as a guide for the operationalization of learning in each educational unit (Arifin, 2018).

One of the competency pillars that occupies a central position in the discourse of 21st-century education is literacy and numeracy skills. Numeracy literacy is defined as the cognitive capability in exploiting various numbers, formal symbols, and fundamental mathematical concepts to solve pragmatic problems in the reality of everyday life, analyze quantitative data, and formulate strategic decisions based on analytical conclusions (Kemdikbud in Mahmud & Pratiwi, 2019). The construction of this numeracy ability encompasses several main facets that include calculation skills, understanding of numerical relations, and arithmetic operation dexterity (Purpura, 2009).

However, empirical evidence in the field reveals a concerning fact: the level of literacy and numeracy skills among elementary school students remains low. This dilemma is justified by students' minimal absorption of the substance of the teaching material, low active participation index throughout class hours, and fragile concentration and focus in absorbing the transfer of knowledge. Conventional teaching patterns that still position the teacher as the sole center of information result in students trapped in passivity and lose the stimulation of intrinsic learning motivation. This reality triggers the urgency of carrying out radical reconstruction through learning innovations that can condition an attractive, interactive, and stimulating learning ecosystem full of joy so that students' cognitive barriers in digesting the material can be maximally reduced.

Optimizing the use of learning media acts as a tactical option to unravel the tangled threads of these problems. Learning media serves a mechanical function as a channel for disseminating educational messages that can simultaneously attract attention, arouse interest, and boost

students' learning motivation. Precise media application has been proven to concretize abstract material, reduce the culture of false verbalism, and multiply the effectiveness of learning outcomes. Teachers are required to have professional sensitivity in selecting and formulating teaching media that align with the psychological development of elementary school-aged children. The characteristics of media that are concrete in nature, have aesthetic visualizations, and adopt the essence of play activities are considered far more compatible for application in children's concrete operational phase because they can bind their active involvement deeply.

In mathematics teaching, the game of snakes and ladders has emerged as a form of media with significant potential for integration into the classroom curriculum. Askalin (2013) explains that snakes and ladders is a universal game involving the interaction of two or more individuals using a checkered board, dice, and position markers. The use of modified snakes and ladders in the knowledge transfer process has been proven to boost activity indicators, instill a spirit of learning, stimulate the courage to argue, and boost the accumulation of student learning outcomes. In line with this, Sunaengsih (2016) emphasized that learning media interventions transmit positive linear implications to the quality of teaching output. By amalgamating educational elements into the structure of the snakes and ladders game, students can be introduced to a play-based learning experience that makes mathematics enjoyable and meaningful. The compilation of empirical observations produced by previous researchers validates an undeniable scientific conclusion regarding the effectiveness of snakes and ladders media interventions in stimulating the acceleration of literacy and numeracy skills in students.

The findings published by Daffa et al. (2024) and Novianti et al. (2024) provide initial justification that this board-based game engineering is able to convert cognitive saturation into active participation that has a direct impact on the sharpness of children's numerical analysis abilities. This fundamental strengthening phenomenon is corroborated by research by Pangestu et al. (2024) and Sonia et al. (2024), whose analysis detected a significant surge in aspects of numeracy skills and basic arithmetic operations through competitive yet educational play simulations. Completing this constellation of evidence, a study led by Yulita et al. (2024) concluded that the amalgamation of traditional game elements into the mathematics curriculum has been proven to act as a driving stimulus that boosts critical thinking skills and mastery of quantitative information in elementary school-aged children on a massive scale.

Based on the accumulated problems and theoretical potential above, this research is orchestrated with the fundamental target of designing and developing an innovative snakes and ladders game media in the realm of mathematics learning in elementary schools, while simultaneously testing the degree of validity, practicality, and actual effectiveness of the product in boosting students' literacy and numeracy competencies. The output of this research is projected to be able to contribute practically in the form of fresh alternative instructional media options to spur the escalation of the quality and performance of mathematics learning at the elementary education level in Indonesia.

RESEARCH METHODS

The operationalization of this product development uses a research and development (R&D) methodology by adopting the ADDIE systematic framework constructed by Sugiyono (2011). The R&D paradigm was chosen as the main methodological foundation because it has two goals: to create innovative instructional products while conducting comprehensive verification of their feasibility before wide-scale diffusion. The ADDIE model was implemented as an operational compass because it has a highly structured and comprehensive workflow for developing learning tools. These circular stages include analysis, design, development, implementation, and evaluation. The analysis phase is oriented towards mapping the urgent pedagogical needs of educators and students for instructional media that has effective, efficient, and attractive characteristics. The design phase is focused on constructing a blueprint for the snakes and ladders game media and all its supporting components. The development phase is realized through the fabrication of a product prototype, intensive validation by experts, and an iterative revision process. The implementation phase is executed through field trials on students after the product has received approval from subject matter experts, media experts, and field practitioners. Finally, the evaluation phase is conducted to make fundamental product improvements based on input and empirical findings in the field.

The observation subjects in this research were classified into two distinct groups: the experimental group and the control group. The experimental group consisted of 30 fourth-grade students at Muhammadiyah Banyuraden Elementary School who were exposed to a learning intervention based on the educational snakes and ladders game, while the control group consisted of 30 fourth-grade students at Banyuraden Elementary School who continued with the conventional instructional pattern. The selection of these two school sites was based on the similarity of the students' demographic profiles, equivalence of academic achievement, and geographical proximity within the same jurisdiction. The information extraction strategy was carried out through interviews, participatory observation, documentation studies, cognitive tests, and questionnaire distribution. Interviews served as a medium for collecting primary data, observations were applied to capture the reality of the learning process, documentation was utilized as supplementary material, tests were used as a benchmark for the accumulation of learning outcomes, while questionnaires were delegated to experts, educators, and students to analyze the degree of validity, practicality, and affective responses to the developed media.

The research instrument set was compiled comprehensively, including a material validation sheet, a media validation sheet, a teacher and student perception questionnaire, a learning implementation observation sheet, and a pretest and posttest test instrument. Instrument validity was verified using Pearson Product Moment correlation, while reliability was verified using the Cronbach's Alpha coefficient with the help of SPSS computational software. Data processing was carried out through a combination of qualitative and quantitative analysis. Qualitative methods were applied to narrate observation findings, interview results, and a repository of expert advice. Quantitative analysis was used to process the validation scores, questionnaires, and tests through percentage conversions based on the Benchmark Reference Assessment (PAP). Testing the degree of media effectiveness was carried out through a series of statistical analyses, which began with normality and homogeneity tests as formal prerequisites before moving on to more in-depth comparative testing of student learning outcomes.

RESULTS AND DISCUSSION

Analysis Level

The analysis phase was initiated through a series of participatory observation activities, in-depth interviews, and the dissemination of needs questionnaires delegated to educators and fourth-grade students at the research sites of Muhammadiyah Banyuraden Elementary School and Banyuraden Elementary School. The construction of these activities was specifically oriented to map the anatomy of mathematics learning, detect the level of literacy and numeracy skills of students, and identify the urgency of the existence of innovative learning media. Recorded observation data uncovered the empirical reality that the governance of mathematics learning in the field is still trapped in the dominance of the use of conventional textbooks and Student Worksheets (LKS) as the main reference instruments. Educators showed a rigid tendency to adopt the lecture method, a one-way (teacher-centered) approach that directly implicated in the decline in the index of active student engagement in the classroom. As a result of this monotonous instructional pattern, the classroom is shrouded in cognitive saturation and the loss of students' enthusiastic attention in absorbing knowledge transfer, which is exacerbated by the absence of teacher initiatives in utilizing game-based learning media or interactive instructional tools.

Information extracted through in-depth interviews with fourth-grade teachers validated the premise that students' literacy and numeracy competencies were at a suboptimal level. The phenomenon of cognitive barriers was detected when students were confronted with story problems, where they experienced analysis paralysis in identifying known data variables and determining precise solution formulations. The majority of students tended to perform speculative arithmetic calculations without first developing a conceptual understanding of the substance of the problem presented. From the educators' perspective, limited operational time allocation and the pile of administrative burdens were recognized as the main restrictive factors that hampered their creativity in fabricating teaching media independently. Conversely, the results of the exploration of students' perceptions of the subject revealed the psychological fact that students place a very high preference and interest in learning formats that are commodified in the form of games because they are considered more attractive and enjoyable.

Design Stage (Planning)

The design phase was initiated through an in-depth analysis of the curriculum structure, which includes Learning Outcomes (CP), Learning Objectives (TP), and Learning Objective Flow (ATP) specifically on the substance of the material on addition and subtraction of whole numbers up to 1,000. This structural exploration was executed to ensure linear alignment between the constructed media product and the applicable macro curriculum regulations and the characteristics of instructional needs at the elementary school level. Alongside this process, codification and mapping of specific indicators of numeracy literacy abilities were also carried out, which were to be systematically intervened and stimulated through the game mechanics.

The architecture of this snakes and ladders media is projected in the form of a conventional physical game that integrates various tactile elements including a macro-dimensional game board, position marker pawns, movement dice, question instrument cards, operational instruction manuals, articulation of learning objectives, a summary of anchor material, and formative evaluation sheets. The aesthetic construction of this media is designed by considering the psychological preferences of elementary school-aged children who tend to be responsive to

the stimulation of play activities, the saturation of bright colors, and attractive visual representations. The series of questions injected into the game ecosystem are formulated in a tiered manner (scaffolding) based on the degree of mathematical complexity and linked to everyday contextual problems to stimulate the sharpness of students' numeracy literacy.

To strengthen the product's conceptual validity, a Focus Group Discussion (FGD) forum was also held involving class teachers and academic colleagues to gather critical input regarding the initial media design. The results of the forum's collective review recommended that the developed product must adopt simple game rules, have a high level of usability, and be deterministic in triggering an escalation of active student engagement throughout class hours. The accumulation of this constructive feedback then served as a fundamental foundation for researchers to refine the media design (blueprint) before moving on to the manufacturing phase of the development stage.

Development Stage

The development phase was orchestrated through the embodiment of the design blueprint into a physical product commodity in the form of educational snakes and ladders game media. This produced instructional device integrates numeracy literacy-based stimulus questions that are injected spatially in certain strategic plots, a mechanical engineering that forces students to not only engage in recreational activities but also be absorbed in the active learning process. To ensure operational ease for educators during implementation in the classroom, this media is fully equipped with a user manual, a summary of supporting anchor materials, and formative evaluation instruments.

The fully developed product prototype was then delegated to material and media experts to assess its structural feasibility through a series of formal validation tests. Testing by the material validators focused on comprehensive mapping, encompassing aspects of content substance feasibility, grammatical accuracy, and pedagogical presentation accuracy. Based on empirical data tabulation, the material validation test successfully achieved an overall accumulated score of 60, categorically classified as very good. This numerical output provides scientific legitimacy that the commodified material fully aligns with the learning outcome targets, adopts a communicative language structure, and presents content compatible with the psychological developmental stages of elementary school students.

Table 1. Results of Material Expert Validation

Aspect	Score	Category
Content Eligibility	25	Very good
Language Qualifications	15	Very good
Presentation Eligibility	20	Very good
Total Amount	60	Very good

Parallel to the substance evaluation, validation testing was also delegated to media experts to comprehensively dissect aspects of visual aesthetics, material integration, and linguistic accuracy. The results of parametric calculations showed that the developed media successfully scored an overall accumulated score of 59, a numerical achievement that positions this product in the classification of the predicate "very good". The test output provides scientific legitimacy that the constructed game instrument has met the standards of structural feasibility, both in terms of attractive visual display configuration, coherence of material content, and effectiveness

of language articulation, thus being declared valid and worthy of implementation into the real learning ecosystem.

Table 2. Media Expert Validation Results

Aspect	Score	Category
Appearance	36	Very good
Material	14	Very good
Language	9	Very good
Total Amount	59	Very good

The accumulated constructive feedback and critical annotations delegated by the validator board were then exploited as a fundamental basis for iterative reconstruction and revision of the product prototype. Several structural modifications executed included sharpening articulation to make game mechanics instructions more rigid and easy to understand, repositioning the typographic scale by enlarging the font size to ensure optimal readability, and making aesthetic improvements to the visual configuration of the media to boost the appeal and psychological stimulation of learners.

Implementation Stage

The implementation phase was executed through two tiered stages, namely the initial field trial (limited scale) and the final field trial (large scale) which took place in the fourth grade of Muhammadiyah Banyuraden Elementary School. This series of empirical tests was oriented to measure the practicality index (usability) and the degree of product acceptance based on psychological perceptions extracted from educators and students. The results of the data tabulation in the initial field trial phase recorded that teacher practitioners gave an accumulated score of 40 which is in the good predicate classification, while student subjects scored an average score of 6.75 which positions this media in the feasible category.

Entering the final field trial phase, a significant escalation in the media's quality and functionality was recorded. The teacher-perspective assessment jumped to 45, categorically very good, while the average student score soared to 8.5, solidifying the product's position in the very good category.

Table 3. Results of Teacher and Student Responses

Test Level	Teacher	Student	Category
Initial Trial	40	6,75	Good/Decent
Final Trial	45	8,5	Very Good/Very Decent

Observations of the learning process showed that all stages of the lesson were carried out very well. Teachers were able to implement media according to the planned learning steps, and students demonstrated active participation throughout the learning process.

Table 4. Results of Observations on Learning Implementation

Aspect	Percentage	Criteria
Introduction	100%	Very good
You	100%	Very good

Cover	100%	Very good
Total	100%	Very good

The output of this implementation phase also validated the existence of a significant escalation trajectory in the level of literacy and numeracy skills of students. Reviewing the literacy skills facet, the distribution of posttest scores in the experimental class cluster jumped sharply from the initial interval of 28–44 to the superior range of 43–55, while the achievement of the control class only recorded a moderate shift from the range of 18–34 to 33–45. In line with this performance, in the domain of numeracy skills, the posttest score of the experimental group climbed from the initial limit of 28–49 to 43–58, which in contrast outperformed the rate of growth of the control class which moved slowly from the distribution of 18–36 to the level of 33–47.

Evaluation Stage

The evaluation phase is orchestrated in a circular and continuous manner that is inherent in every joint of the development process stage. The execution of this evaluative action is based on a feedback repository and critical annotations extracted collaboratively from subject matter experts, media experts, educational practitioners, and students. The series of reconstruction and revision actions executed encompass several structural aspects, including simplifying the articulation of the user manual instructions, repositioning the size scale and typeface typography to ensure optimal readability, improving the aesthetics of the media's visual configuration, and recalibrating a number of questions to align with the stages of students' cognitive development. The crystallization of all the outputs of this evaluation stage provides scientific confirmation that the educational snakes and ladders game media product has absolutely met the tri-validation criteria, namely conceptually valid, operationally practical, and empirically effective, thus gaining full legitimacy to be applied as a mathematics learning instrument to boost students' literacy and numeracy skills at the elementary education level.

Data analysis

Table 5. Results of the Literacy and Numeracy Normality Test

Variables	Class		Mr. (a)	Condition	Information	
Literacy	Control	Pre Test	0.146	a > 0,05	H_0	Normal
		Post Test	0.504	a > 0,05	H_0	Normal
	Experiment	Pre Test	0.346	a > 0,05	H_0	Normal
		Post Test	0.188	a > 0,05	H_0	Normal
Numeration	Control	Pre Test	0.193	a > 0,05	H_0	Normal
		Post Test	0.069	a > 0,05	H_0	Normal
	Experiment	Pre Test	0.101	a > 0,05	H_0	Normal
		Post Test	0.499	a > 0,05	H_0	Normal

Based on the data presented in Table 5, it can be explained that the significance index for the pretest and posttest instruments in the control class literacy domain were 0.146 and 0.504, respectively. Considering that the probability obtained is above the critical threshold of 0.05, then statistically H0 is accepted and H1 is rejected, a fulfillment of the criteria confirming that the distribution of literacy data in the control class group follows a normal distribution pattern. In line with these results, testing on the experimental group recorded a significance figure for the pretest and posttest literacy of 0.346 and 0.188, respectively. The achievement of scores exceeding the 0.05 coefficient again conditions the acceptance of H0 while rejecting H1, which is valid evidence that the fluctuation of literacy data in the experimental class is inherent in the assumption of a normal distribution.

Furthermore, in the numeracy ability aspect, the calculation of the significance parameters for the pretest and posttest phases in the control group locked the figures at 0.193 and 0.069, respectively. Considering that the numerical magnitude was consistently above the 0.05 level, the legality of H0 was confirmed and H1 was rejected, thus giving rise to the theoretical conclusion that the variance of the numeracy data in the control class was normally distributed. For the experimental group, the significance values achieved in the comparison of the pretest and posttest of numeracy were perched at the level of 0.101 and 0.499, respectively. This probability assessment that was above the alpha of 0.05 confirmed that H0 was accepted and H1 was rejected, a formal justification that confirmed that the structure of the numeracy data in the experimental class had fulfilled the assumption of normality.

The methodological exploration then continued with executing a homogeneity test to detect the presence or absence of similarity in data variance between the two groups of subjects studied. The decision-making parameters were based on theoretical regulations where achieving a significance value above the 0.05 threshold would validate the data's status as homogeneous. All statistical data computation outputs processed using SPSS 24 software have been systematically coordinated in the appendix. The visualization of the homogeneity test results for reading comprehension data and responsibility variables, both in the control class cluster and the experimental group, is comprehensively mapped through the following table.

Table 6. Results of Homogeneity Test

Variables	**Class**		**Mr. (a)**	**Condition**	**Information**	
Literacy	Control	Pre Test	0.146	a > 0,05	H_0	Normal
		Post Test	0.504	a > 0,05	H_0	Normal
	Experiment	Pre Test	0.346	a > 0,05	H_0	Normal
		Post Test	0.188	a > 0,05	H_0	Normal
Numeration	Control	Pre Test	0.193	a > 0,05	H_0	Normal
		Post Test	0.069	a > 0,05	H_0	Normal
	Experiment	Pre Test	0.101	a > 0,05	H_0	Normal

		Post Test	0.499	a > 0,05	H_0	Normal

The effectiveness of the educational snakes and ladders game media was analyzed using an independent sample t-test to determine the differences in literacy and numeracy skills between the control and experimental classes. The test was conducted at a significance level of 0.05 with the criterion H_0 being rejected if the significance value is less than 0.05.

Table 7. Results of the Independent Sample t-test

Variables	**Pretest Sig.**	**Conclusion**	**Post test Say.**	**Conclusion**
Literacy	0,921	No different	0,041	Significantly different
Numeration	0,735	No different	0,046	Significantly different

Through empirical evidence recorded in Table 7, the output of the independent sample t-test analysis in the literacy competency domain revealed that the significance coefficient for the pretest phase reached 0.921, which is greater than the alpha of 0.05. This statistical reality provides a theoretical basis that there is no disparity or difference in the initial literacy capacity between the student base in the control group and the experimental group. Conversely, the observation results in the posttest phase recorded a significance figure of 0.041, which is below the 0.05 threshold, a fulfillment of the criteria that confirms the existence of a very significant difference in the achievement of the two subject groups after the treatment intervention was delegated in the classroom.

Meanwhile, in the numeracy skills facet, the significance parameter in the initial test or pretest was perched at 0.735, which is greater than 0.05, so that the level of fundamental numerical understanding of students in both groups can be validated in an equal or balanced condition. However, the significance value achieved on the posttest sheet locked the number at the level of 0.046, which is significantly less than 0.05, which validates the emergence of a significant difference between the performance of the control class and the experimental class after the operationalization of the learning was completed. The constellation of data outputs provides scientific justification that the use of educational snakes and ladders game media instruments transmits a real influence on the acceleration of students' literacy and numeracy skills.

In order to explore more deeply the magnitude of the jump in student competency in the time span before the material confrontation until after the instructional activity was carried out, this research methodology moves to the next analytical comparison stage by utilizing the paired sample t-test.

Table 8. Paired Sample t-test Results for Literacy and Numeracy

Variables	Group	Sig. (2-tailed)	Information
Literacy	Control Class (Pretest–Posttest)	0,000	There is a significant increase
Literacy	Experimental Class (Pretest–Posttest)	0,000	There is a significant increase
Numeration	Control Class (Pretest–Posttest)	0,000	There is a significant increase

Numeration	Experimental Class (Pretest–Posttest)	0,000	There is a significant increase

Based on Table 8, all groups achieved a significance value of 0.000 (<0.05). These results indicate that both the control and experimental classes experienced significant improvements in literacy and numeracy skills after the learning process. Although both groups experienced improvements, the independent sample t-test results on the posttest showed that the experimental class performed better than the control class. These findings indicate that the educational snakes and ladders game is effective in improving elementary school students' literacy and numeracy skills.

DISCUSSION

The Validity of Snakes and Ladders Game Media to Improve Students' Literacy and Numeracy Skills

Empirical exploration revealed that the educational snakes and ladders game instrument produced has met all required validity parameters based on the assessment results from material experts and media experts with a very good predicate. This legality proves that the device successfully integrates aspects of the suitability of the teaching substance, visual aesthetic configuration, optimal readability index, and suitability with the psychological characteristics of elementary school-aged children. The existence of instructional media with a high degree of validity plays a crucial role as a channel for the effective dissemination of pedagogical messages, which in turn reduces cognitive barriers and makes it easier for students to absorb the material completely.

These findings provide theoretical affirmation to the game-based learning paradigm, which postulates that structured modifications to educational games can boost students' active engagement in academic activities. The amalgamation of numeracy literacy material into the mechanical structure of the snakes and ladders game transforms the media's position beyond mere recreational use into a strategic learning instrument that accelerates the achievement of curriculum targets. This phenomenon reaffirms that operational validation acts as an absolute screening phase to ensure the functional suitability of a product before it is deployed into the real classroom ecosystem.

The Practicality of Snakes and Ladders Game Media to Improve Students' Literacy and Numeracy Abilities

The developed Snakes and Ladders game device achieved a very high level of practicality, as evidenced by the excellent performance of teacher and student response sheets. This product is considered highly usable, supported by a robust instruction manual, and can be operated in instructional activities without the hassle of complex bureaucratic procedures. This operational efficiency provides educators with the flexibility to orchestrate classroom management in a more measurable manner while simultaneously encouraging active student participation throughout the learning process.

The findings of this study reinforce the theoretical foundation of active learning, which places the learner as the central driving force behind learning. The amalgamation of play and learning through the snakes and ladders game provides a platform for students to engage in direct observation, argumentation, and collective conflict resolution. This recreationally-inspired modification of the learning climate leads students to meaningful learning opportunities, as they gain contextual, empirical experiences. The implications of this conducive environment are reflected in the escalation of intrinsic motivation, focus of attention, and depth of student engagement during the knowledge transfer process.

The Effectiveness of Snakes and Ladders Game Media in Improving Students' Literacy and Numeracy Skills

The results of the parameter testing convincingly prove that the educational snakes and ladders game media has superior effectiveness in stimulating the growth of students' literacy and numeracy skills. This indicator of success is read from the very significant performance disparity between the posttest achievements of the control group and the experimental group based on the independent sample t-test calculation, as well as the recorded real spike between the pretest and posttest scores through the paired sample t-test calculation. The accumulation of statistical output is a scientific justification that the introduction of the snakes and ladders media transmits a linear positive impact on students' academic performance.

The effectiveness of this snakes and ladders media can be analyzed through a game-based learning approach, where the learning rhythm is commodified into a game format that can activate intrinsic motivational motors in students. Students' physical and mental interactions with the grid board, dice, and stacks of numeracy literacy problem cards force children to optimize their thinking skills, read texts critically, analyze variables, and solve challenges independently. This circular activity successfully concretizes the representation of mathematical symbols, which were initially abstract and complex, into a more down-to-earth and easily digestible visual form.

Furthermore, the Snakes and Ladders game instrument works simultaneously by engaging the cognitive, affective, and psychomotor aspects of students in a unified whole. In the cognitive domain, students are constantly trained to analyze quantitative information, construct logical reasoning, and solve numerical problems. From an affective perspective, a pleasant classroom atmosphere has been proven effective in reducing math anxiety and fostering a positive perception of the subject. Meanwhile, from a psychomotor perspective, gross and fine motor activity during the game helps strengthen long-term memory retention and internalize material concepts. Thus, the educational Snakes and Ladders game media design successfully creates a

meaningful teaching climate while simultaneously escalating the numeracy literacy capacity of elementary school students.

CONCLUSION

The crystallization of the entire series of research provides a theoretical conclusion that the educational snakes and ladders game media developed has met the tri-validation criteria, namely conceptually valid, operationally practical, and empirically effective to be integrated into mathematics learning to boost elementary school students' literacy and numeracy skills. The validity dimension is proven through the legality of the assessment from material experts and media experts who locked the predicate very good, so that the product is declared valid for use. The practical aspect is reflected in the positive responses of educators and students who confirm that this media has high usability, attractive, and deterministic properties in conditioning an interactive classroom climate. Furthermore, the results of statistical computations provide confirmation that this media is effective in improving students' numeracy literacy achievements, as indicated by the trajectory of score escalation from the initial phase to the final phase and the existence of a real disparity in results between the experimental group and the control group.

Based on these crucial findings, this educational snakes and ladders game is worthy of being used as an alternative instructional media option to support literacy and numeracy improvement programs at the elementary school level. Educators are advised to shift to utilizing game-based learning media to stimulate student activity and motivation. School authorities are also expected to provide accommodating support for the fabrication and downstreaming of innovative teaching media to stimulate learning effectiveness. Finally, for future researchers, there is ample room to explore and develop this snakes and ladders media across a broader range of materials, different educational levels, and modifications to other media forms, including cross-fertilization with digital technology to produce more adaptive and innovative variations of instructional media.

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