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Development of Intermediate Media for Snakes and Ladders Multiplication and Division for Understanding Mathematics Class III State Primary School 1 Banjar Tengah

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Abstract
The facilities formulated regarding this analysis contain visual learning intermediaries which include game boards, question cards related to multiplication and division, material cards, dice, and pawns (students). This research aims to develop learning media and determine the feasibility, practicality and effectiveness of this method. The development method used in this research is the development model A D D I E, "Analysis, design, development, Implementation, and Evaluation". In this case, the data collection pattern of questionnaires and tests is used. There are two data analysis techniques in this research, namely quantitative analysis and qualitative descriptive. Intermediary media for multiplication and division should be used, this is explained because it has been proven by the validator. The agent of multiplication and division snakes and ladders explains that it is very efficient based on the results questionnaire student and teacher responses. The snakes and ladders medium of multiplication and division was also stated to be effective in students' understanding of mathematical concepts. This is proven by the average value of the pretest and posttest. So the results obtained were that the development of snake and ladder intermediate learning media for multiplication and division was declared feasible, practical and effective in supporting the understanding of mathematical concepts for class III students at SD Negeri 1 Banjar Tengah.
Keywords: Snake And Ladder, Concept Understanding, Multiplication and Division

INTRODUCTION

Education is one of humanity's obligations. Through education, humans gain knowledge about things they do not know and learn to become better individuals who can be beneficial for the future, both for themselves and others. Teachers, as the main pillars of education, play a significant role in shaping students who are mature and well-versed in learning. They also serve as role models of discipline, actively participate in the teaching and learning process, and provide effective education to students. Teachers are responsible for ensuring their students receive adequate learning intake, which requires them to possess high abilities and competencies. As a result, many people, especially parents, are becoming increasingly aware of the importance of education, particularly higher education. Consequently, a considerable number of parents strive to send their children to college.

Education itself is a process aimed at developing the abilities and character of individuals or students through teaching, training, and experience. This process involves the transfer of intelligence, skills, and values from one generation to the next. Education can take place formally in schools, colleges, and other educational institutions or informally through social interactions, family, and daily life experiences. The primary goal of education is to prepare individuals to contribute positively to society. Education has a significant impact on students, enabling them to socialize, adapt to their environment, and uphold moral and ethical values. According to Sujana (2019), education is a method used to support students both physically

and mentally over a long period, ensuring continuous benefits for their future while adhering to cultural values and Pancasila.

The character education process needs to be developed from an early age, as it greatly influences students' social lives. From basic to higher education, character development contributes to improving human resources. Character refers to a person's nature or disposition, which can be trained and developed optimally to produce a positive generation. In education, elementary school (SD) subjects include Indonesian Language, Religious and Character Education, Pancasila and Citizenship Education, and Social Sciences (Natural and Social Sciences), alongside Mathematics. Mathematics is a fundamental subject across various fields of science and is applied in everyday life. Therefore, teaching mathematics to elementary school students is crucial, as children at this stage should already understand basic calculations.

Teaching mathematics to elementary school students helps them develop critical, systematic, and structured reasoning skills, as well as logical thinking and collaboration abilities. According to the Ministry of National Education (2018), the goal of teaching mathematics to elementary school children is to ensure that students understand mathematical concepts, explain the relationships between these concepts, use reasoning to identify patterns and properties, perform mathematical manipulations for generalization, construct proofs, articulate mathematical statements, and solve mathematical problems. However, in many current learning environments, teachers remain the focal point of the classroom. As a result, learning models, methods, and strategies that encourage students to think critically are not fully utilized. Students are often presented with theoretical material without being exposed to real-life problems, leaving them unable to apply their knowledge effectively. Since mathematical concepts are interconnected, students must learn them sequentially to ensure comprehension. A structured learning approach makes it easier for students to grasp complex concepts, facilitating a deeper understanding of mathematics.

Initial research indicates that teaching and learning activities still rely on conventional methods, where teachers primarily use textbooks and worksheets as the main instructional tools. Additionally, teachers do not provide engaging teaching media that can capture students' interest, making them feel bored during lessons. As a result, there is a need for innovative teaching media that can help students better grasp learning materials and maintain their enthusiasm. This need is evident in the PTS (Progress Test) scores of third-grade students at SD Negeri 1 Banjar Tengah on multiplication and division material, where only 29% of students met the minimum competency criteria (KKM), while 71% did not. The fundamental concepts of mathematics include basic arithmetic operations such as multiplication, division, addition, and subtraction, applied to whole numbers, fractions, natural numbers, and integers (Oktavianingtyas, 2015). Learning arithmetic operations, particularly multiplication and division, requires logical interpretation and the ability to apply these concepts in problem-solving.

To address this issue, action-based learning is necessary. Students should not only focus on theory, memorization, or factual recall, as these approaches make it easier for them to forget concepts. Since mathematical concepts are highly interconnected, understanding one idea reinforces comprehension of others. Students should be encouraged to explore mathematical concepts progressively. Mathematical learning involves articulating plans, analyzing possibilities, and integrating various strategies into problem-solving. Mastery of concepts allows students to define, explain, and internalize learning materials in their own words. Given these challenges, introducing innovative learning media can help students understand and solve multiplication and division problems more effectively. Learning media serve as tools to facilitate the learning process, making lessons more engaging and meaningful. According to

Anggani (2013), "learning through play" allows children to manipulate, explore, practice, and discover various concepts and understandings on their own. This approach can be leveraged by teachers to create interactive and enjoyable learning experiences.

One effective teaching aid is the Snakes and Ladders game, which can serve as an engaging learning medium for students. Unlike traditional media that primarily rely on visual and auditory components, this game integrates gameplay into the learning process, enabling students to learn while playing. Well-designed learning media help students grasp educational content more effectively. In elementary school, learning media serve multiple functions, including acting as teaching aids and carriers of educational information. The development of the Snakes and Ladders game aligns with the playful characteristics of elementary school students, making it an effective tool for improving their mathematical skills. When students engage in this game, they experience learning in a pressure-free environment, reducing anxiety related to mathematical calculations. Without such stressors, students can better engage with the learning process, improving their agility and comprehension of mathematical concepts. The Snakes and Ladders board is designed with vibrant images and colors to attract students' interest. The goal of using this medium is to enhance students' enthusiasm, creativity, and engagement in learning. The benefits of this educational tool include making abstract concepts more tangible, overcoming spatial and temporal limitations, compensating for students' cognitive constraints, presenting learning materials interactively, and leaving a lasting impression on students.

The Snakes and Ladders game for mathematics has been carefully designed with problem-solving questions related to multiplication and division. This approach is expected to enhance students' understanding of mathematical concepts through interactive gameplay. However, before implementing this learning medium, it is essential to evaluate its quality, as the effectiveness of educational tools plays a crucial role in their successful integration into teaching. The rules of the Snakes and Ladders game, as stated by He (2021), involve two or more players using dice to move across a board featuring illustrated ladders and snakes. The board consists of 10 rows and 10 columns, numbered from 1 to 100, with ladders helping players advance and snakes causing setbacks. Within this learning medium, students actively participate in gameplay while developing their understanding of mathematical concepts. Thus, SD Negeri 1 Banjar Tengah has introduced mathematics learning media for multiplication and division using the Snakes and Ladders game. This initiative aims to improve students' comprehension and interest in learning mathematics. The significance of this research lies in its potential to guide schools in enhancing teacher competence in selecting effective teaching methods as alternative solutions for achieving educational objectives.

RESEARCH METHODS

The method used in this research is a development method with the ADDIE model development research type, which consists of the following steps: analysis, design, development, implementation, and evaluation. Analysis is the first step in gathering information that serves as the foundation for product development. Design is based on the interview process, which revealed that SD Negeri 1 Banjar Tengah predominantly uses textbooks and thematic learning in the learning process. Development is the stage where the product realization takes place, transforming the prepared concept into a tangible form. Implementation is the phase where the developed media has undergone expert validation and is ready to be applied in the classroom. Evaluation is where researchers assess all models and products that have been developed. The following is an illustration of the stages of the ADDIE model:

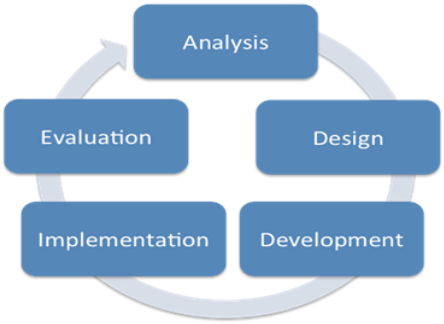

Figure 1. Stages of the ADDIE Model

This research design is the result of developmental research that aims to create a product as an intermediary medium for teaching and learning through the Snakes and Ladders game. By using the ADDIE development model—Analysis, Design, Development, Implementation, and Evaluation—each stage is structured as follows: Analysis is the initial phase where researchers gather information to be used as research data. Design is the phase where researchers plan the method or media to be used, typically conducted after the interview stage. Development is the stage where the product realization or method design takes place. Implementation is the application phase, where the developed media has been validated by experts and is ready to be implemented in the classroom. Evaluation is where researchers assess the method being developed. The Snakes and Ladders game is designed with an attractive layout. This game is also expected to enhance students' creativity in problem-solving and critical thinking. It was developed to improve students' understanding of mathematical concepts in class III at SD Negeri 1 Banjar Tengah. The design of this research includes: (1) Media board for the Snakes and Ladders game – The board consists of 100 boxes, some of which contain multiplication, division, and instruction-based questions. The board also includes various pictures to capture students' attention. (2) Dice and pawns – Used for rolling the dice, and students move according to the number of dots that appear. (3) Question cards – These cards contain questions that students must answer when landing on specific boxes, following the color-coded system. (4) Material cards – Before answering, students can take a material card to guide them in responding to the question. (5) Game rules – Provide explanations on what is allowed and prohibited during the game.

Research Procedures

Research requires structured procedures to address problems. As stated by Sugiyono (2016), research and development stages require solutions through specific product implementations. This research follows the guidelines of Sugiyono (2016), including: 1) Potential and Problems, consisting of: a) School Observation – The chosen research site, SD Negeri 1 Banjar Tengah, showed a lack of engaging learning media for class III students, particularly in multiplication and division topics. b) Testing Site Licensing – The research was conducted at SD Negeri 1 Banjar Tengah. c) Data Collection – The observations serve as the initial dataset. The lack of learning media in class III is used as a basis for product development to address challenges related to division and multiplication in understanding mathematical concepts at the class III level. The subjects in this research were students in class III of SD Negeri 1 Banjar Tengah, Kec. Country District, Jembrana. The data collection instrument involved conducting tests to assess improvements in students' understanding through the Snakes and Ladders learning media for division and multiplication. Purposive sampling was the technique used in this research, as it specifically targeted teachers and class III students at SD Negeri 1 Banjar Tengah.

Data Collection Techniques

Data collection techniques in this observational research include: a) Questionnaire – Used to determine the suitability of the learning media through a validation form completed by the class III homeroom teacher at SD Negeri 1 Banjar Tengah, as well as feedback from all class III students regarding their response to the Snakes and Ladders learning media. b) Test – Used to measure the effectiveness of the Snakes and Ladders media in teaching multiplication and division, aiming to enhance students' comprehension of the material through pre-test and post-test assessments.

Data Analysis Techniques

There are two types of data analysis techniques: quantitative analysis and qualitative descriptive analysis. Qualitative data consists of suggestions, opinions, and feedback from validators, which are used to refine the learning media to ensure its suitability for implementation in the learning process. Qualitative descriptive analysis follows these steps: Questionnaire Data Analysis – Includes expert and practitioner validation questionnaires, as well as student and teacher response questionnaires. Test Results – The pre-test and post-test results determine the effectiveness of the Snakes and Ladders media by measuring the improvement between students' performance before and after using the media.

RESEARCH RESULTS AND DISCUSSION

Based on the results of learning tests on the development of multiplication and division Snakes and Ladders intermediates conducted by researchers at the planning stage—derived from questionnaires and tests (pre-test and post-test)—the class teacher must be able to apply learning methods that are fun and engaging for students. This approach can increase students' motivation to learn, improve their focus, enhance their thinking skills, and strengthen their understanding of multiplication and division material. The research and development results have led to the creation of a product in the form of Snakes and Ladders Multiplication and Division learning media, along with question cards, material cards, game rules, dice, pawns, ice cream sticks, multi-purpose baskets, bags, and a guide bag to support the understanding of mathematical concepts in class III at Public Elementary School 1 Central Banjar. The research findings were tested by observing responses from class III students and teachers. After implementing the learning intermediate product design for teaching Snakes and Ladders Multiplication and Division, a learning intermediate product and its components were successfully developed, namely:

1. Snakes and Ladders Multiplication and Division Media. This includes media boards that have been created and printed on banners measuring 2x2 meters.

Figure 2. Snake And Ladder Media

2. Question Cards. The question cards on this media are printed using Bufalo paper with a size of 10 x 7 cm with total of 12 question cards by adjusting the number of question card boxes on the snake and ladder media.

Figure 3. Question Card Media

3. Game Rules. The rules are made on one sheet of paper which contains indicators of the understanding of the concepts that will be achieved and desired as well as containing the rules when playing the game.

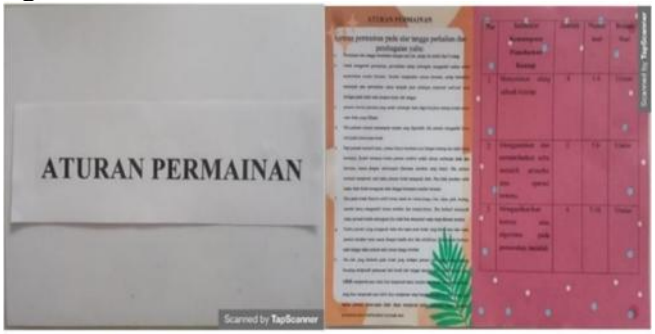

Figure 4. Regulatory Media

4. Dice. The dice that can be used in this media are dice that have the same shape as the snakes and ladders game in general, namely cubes. The dice used by researchers are dummy dice, which are useful for shaking and are later used to move the pawns (students).
5. Pawn. The pawns in the Snakes and ladders learning media are not the usual pawns, but the ones who are the pawns in this game are the students in class III of Central Banjar 1 Elementary School.
6. Ice Cream Stick. There are 24 ice cream sticks due to the number of class III students at SD Negeri 1 Banjar Tengah. Then, on the ice cream stick, write the student's name and how many answers the student can answer, both in the question box and the question card.
7. Multipurpose basket. This basket is used to store material cards, question cards, game rules and ice cream sticks.

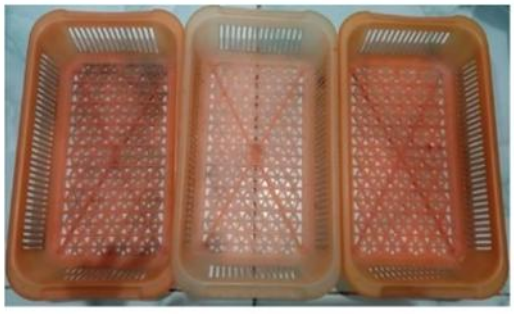

Figure 5. Multi-Purpose Basket

Before applying this learning method, several stages of analysis are carried out, namely:

1. Media Feasibility Data Analysis – Based on the results from the media validator and material validator, a percentage of 80% is obtained. When calculated using the feasibility table, it falls under the "feasible" category.
2. Media Practicality Data Analysis – This is based on a questionnaire test completed by teachers and students in the form of responses after using the learning media. According to the questionnaire responses, students achieved a percentage of 87% ("Very Practical"). The response from class III homeroom teachers received a percentage of 94% ("Very Practical").
3. Analysis of Media Effectiveness Data – This is obtained from pre-test and post-test results, measuring students' understanding before and after using the teaching and learning intermediaries.

	N	Range	Minimum	Maximum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
PreTest	24	57,50	22,50	80,00	51,7708	2,80107	13,72239	188,304
PostTest	24	45,00	55,00	100,00	84,7917	2,69156	13,18589	173,868
Valid N (listwise)	24							

Figure 6. Descriptive Analysis Results

With this, a gain index calculation was carried out aimed to find out more about the progress of students' understanding of the multiplication and division material before and after using the snake and ladder device. These results indicate that most class III students at SD Negeri 1 Banjar Tengah have a strong understanding of multiplication and division concepts when using the Snakes and Ladders learning media for multiplication and division. So the results obtained are that the learning method using division and multiplication as a medium of snakes and ladders is said to be feasible, practical and efficient in developing an understanding of mathematical concepts.

Discussion

Before being applied to students, this learning media must first be validated by a validator (lecturer). This validation process is carried out by two different validators. The results of the questionnaire assessment conducted by both validators are presented in percentages as follows: the media validator (Validator I) provided an assessment with a score of 80%, while the material validator (Validator II) also gave a score of 80%. After completing the validation, both Validator I and Validator II stated that the Snakes and Ladders learning tool for multiplication and division was highly suitable for use in elementary school learning. The average percentage provided by both validators was 80%. When converted using the feasibility table, this score falls into the "should" category. The results of this development align with research conducted by Rohmatan (2016), which found that validation by material experts resulted in a percentage score of 86.42% with highly useful criteria, while validation by design experts yielded a percentage of 79.17%, categorized as appropriate. The overall average score from both validations was 82.795%, indicating appropriate criteria. Similarly, research conducted by Agustini (2016) produced results consistent with this study. In Agustini's research, validation by material experts resulted in a score of 92% with highly appropriate criteria, while validation by media experts obtained a score of 76%, categorized as "should." The combined rating percentage from both experts was 84%, meeting the appropriate criteria. These findings support the validity and suitability of the material and intermediary media used in the Snakes and Ladders learning tool for teaching activities. Therefore, field trials can be conducted to further test the effectiveness of the Snakes and Ladders media for multiplication and division.

The advantage of this learning media is that students can actively participate in the learning process. Additionally, it enhances teaching and learning activities by capturing students' interest through engaging and interactive learning experiences. The questionnaire data in this study include responses from both students and teachers. Students reported that before using the Snakes and Ladders learning media, their overall average score was only 52%. However, after utilizing the Snakes and Ladders media for multiplication and division, their average score increased to 85%. Following the implementation of the Snakes and Ladders intermediary tool for division and multiplication in teaching and learning activities, the class III teacher at SD Negeri 1 Banjar Tengah conducted product testing. The purpose of this testing was to gather assessments, comments, and suggestions. Based on the trials conducted, an overall score of 47% was obtained, with an average of 4.7. The student response questionnaire regarding the Snakes and Ladders learning media for multiplication and division yielded a percentage of 87%, which falls under the "Very Satisfied" category. In addition to student feedback, the results from the class III teacher's questionnaire indicated that this learning tool for multiplication and division received a score of 94%, placing it in the "Very Practical" category. This finding demonstrates that the Snakes and Ladders media is effective and facilitates the teaching and learning process. The scoring guidelines for the three questionnaires used a Likert scale, which was then converted into percentages to determine the minimum validation limits and respondent scores.

Based on the research results, it can be explained that the gain index of students' understanding of the concept of multiplication and division before and after using the Snakes and Ladders technique in class III at SD N 1 Banjar Tengah shows that, among the 24 students, none (0%) experienced a decrease in concept understanding, and none (0%) maintained a stable understanding of the concept. Two students (8.3%) showed low concept understanding, eight students (33.3%) demonstrated moderate concept understanding, and fourteen students (58.3%) achieved a high level of concept understanding. These results indicate that the use of engaging and effective learning media, such as Snakes and Ladders, enhances students' enthusiasm for learning. The findings suggest that the majority of students develop a high level of concept understanding and remain engaged throughout the learning process. Additionally, this learning media proves to be practical, making it easier for teachers to deliver lessons effectively. The practicality of this media is supported by student and teacher questionnaire responses, which confirm that it is both easy to use and implement in classroom learning. The findings of this research are further supported by the study of Mardiah & Tahir (2021). Their research states that the results of the teacher response questionnaire achieved a 100% rating in the "Very Worth It" category. The Snakes and Ladders learning tool for multiplication and division was also rated as "Very Good," with a score of 98.61% based on test results from six students. Additionally, observations by Nastiti et al. (2022) show that the teacher response questionnaire received a score of 86%, while the student response questionnaire obtained a perfect score of 100%, placing it in the "Very Practical" category.

Thus, the Snakes and Ladders learning media for multiplication and division is highly suitable for use in elementary schools. The effectiveness test conducted in this research was based on pre-test and post-test scores. The data analysis in the effectiveness section aims to provide detailed research findings related to the total number of participants, highest and lowest scores, average scores, and standard deviation, as determined through descriptive analysis using SPSS. The table presented above (Image of Descriptive Analysis Results) illustrates the pre-test and post-test results of students. According to the table, the lowest score obtained by students in the pre-test was 22.5, while the highest score was 80. The average pre-test score was 51.77. After the post-test was conducted, the lowest score recorded was 55, while

the highest score reached 100. The average post-test score was 84.79. Before performing a paired t-test, a normality test was conducted to evaluate the distribution of pre-test and post-test scores. Using SPSS, the normality test for the pre-test, based on the Shapiro-Wilk test, yielded a significance value of 0.87, which is greater than 0.05, indicating that the pre-test scores were normally distributed. Similarly, the normality test for the post-test scores resulted in a significance value of 0.12, which is also greater than 0.05, confirming that the post-test scores were normally distributed.

Subsequently, hypothesis testing was conducted using a paired t-test, which produced a two-tailed significance value of 0.000, smaller than 0.005. Based on the hypothesis test results, it can be concluded that the Snakes and Ladders learning media for multiplication and division has a significant impact on students' understanding of mathematical concepts. Students' average scores increased from 51.7 in the pre-test to 84.7 in the post-test, reflecting a 60% improvement. These findings confirm that the Snakes and Ladders learning media is effective in enhancing students' understanding of mathematical concepts. The gain index test results for the 24 students in class III at SD N 1 Banjar Tengah indicate that none (0%) maintained a constant level of concept understanding, two students (8.3%) demonstrated low concept understanding, eight students (33.3%) achieved moderate concept understanding, and fourteen students (58.3%) showed a high understanding of mathematical concepts. The improvement in concept understanding before and after using the Snakes and Ladders learning media highlights its effectiveness.

These findings confirm that using the Snakes and Ladders technique for teaching multiplication and division significantly improves students' conceptual understanding. The results align with previous research conducted by Said (2021), which demonstrated that the Snakes and Ladders learning tool was both effective and beneficial for student learning. The study reported that before applying the learning tool, 55% of students scored above the Minimum Mastery Criteria (KKM). After using the learning media, 100% of students scored above the KKM, reflecting a 45% improvement in student performance. The successful application of this learning media in teaching activities has proven to facilitate students' understanding and enhance their motivation to learn. This study provides a solution for expanding the use of Snakes and Ladders as an intermediary learning tool for multiplication and division through the ADDIE development model. The results confirm that the Snakes and Ladders learning media is suitable, practical, and effective in improving mathematical concept comprehension among class III students at SD N 1 Banjar Tengah.

CONCLUSION

It can be concluded that the results of the research entitled "Development of Snakes and Ladders Intermediate Multiplication and Division towards Understanding Mathematical Concepts in Class III SD N 1 Banjar Tengah" show that the intermediate medium for division and multiplication is considered "proper." This is verified through validation by experts, with the first validator giving a score of 40 with a percentage of 80%, and the second validator also giving a score of 40 with a percentage of 80%. Thus, the average validation percentage obtained is 80%. However, there are several suggestions and inputs for product improvement to achieve even better results. Educators and third-grade students at SD N 1 Banjar Tengah completed a questionnaire, and the results indicate that this intermediary medium for division and multiplication is deemed "as practical as possible." After conducting trials with students, the percentage of media practicality reached 87%. This practicality assessment is further supported by the response from the third-grade teacher at SD Negeri 1 Banjar Tengah, who gave a score of 46, equivalent to a percentage of 94%. Practicality assessments conducted by both teachers and students in class III resulted in an average score of 90.5%. When converted,

this score falls into the "Very Practical" category. Therefore, the learning media for division and multiplication is highly practical for use and application in learning activities. The effectiveness of this learning media for division and multiplication has been proven to enhance students' conceptual understanding abilities. This is evidenced by an increase in student test scores from the pre-test to the post-test. Students' conceptual understanding improved from 51.7 to 84.7, reflecting a 60% increase. Based on the results of hypothesis testing conducted using a paired sample t-test, a highly significant two-tailed value of 0.000 was obtained, which is <0.005. The results of the gain index test showed that 2 students (8.3%) experienced changes in understanding at a low level, 8 students (33.3%) experienced moderate improvements in conceptual understanding, and 14 students (58.3%) experienced significant improvements in understanding at a higher level. Based on these findings, the researchers concluded that the learning media for division and multiplication, implemented in mathematics lessons at SD N 1 Banjar Tengah using class III students as subjects for developing learning materials, is effective.

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