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Innovative Learning Media: A Multiplication Memorization Game for Better Math Mastery

Syahla Nurul Farhanah[1]*, Chrisnaji Banindra Yudha[2], Dyah Anugrat Herzamzam[3]
[1,2,3]Primary School Teacher Education Study Program, STKIP Kusuma Negara, Jakarta, Indonesia
*syahlanurul@stkipkusumanegarajakarta.ac.id

Abstract

The purpose of this study is to understand developing multiplication memorization game for math classes in grade IV SDN Pejagalan 01. Then, examine the effects of the multiplication memorization game on the math lessons taught in grade IV SDN Pejagalan 01. The type of research that is used is called research and development, and its goal is to develop and produce a product. The ADDIE (Analysis, Design, Development, Implementation, Evaluation) approach is used in this study of development. These research tools include observation, documentation, angket or validity, wawancara, and testing. The results of the study on the development of media for teaching multiplication memorization games in math classes are as follows: 90% of the material, 96% of the media, and 94% of the language. The results show that the didik's response in the small-scale uji coba kelas was 97.3%, while the didik's response in the large-scale uji coba was 97.3%. The results of the study on the use of multiplication memory games in math classes fall into the "Valid" category and can be used in the classroom.

Key word: Innovative Learning Media, Math Mastery, Research and Development

1 INTRODUCTION

The development of mathematics in various fields today drives the rapid advancement of technology. Awalia et al. (2019) stated that all students must be taught mathematics starting from elementary school so that they can learn to think logically and critically. Being logical and critical means that mathematics lessons should be explained from abstract concepts to concrete examples so that students can understand the real implementation of the material being studied. This way, mathematics can be more easily understood. Therefore, students need tools or learning media to make learning materials easier to comprehend. Expecting all elementary students to fully master mathematics is considered excessive. As educators, teachers must be able to improve their technological skills so they can deliver mathematics lessons that suit students' needs.

According to Awalia et al. (2019), learning media that aligns with learning activities will make the learning process more effective and efficient. Media serve as comprehensive learning tools consisting of various learning activities designed to help students achieve specific and well-defined learning objectives. In fact, learning can still take place without learning media; however, delivering material only through lectures is considered less effective, especially for elementary school students. Their concentration often shifts easily toward play, and with large class sizes, teachers need methods that can attract students' attention and interest.

Mathematics as a subject also requires appropriate learning media, particularly for multiplication materials, which many students find difficult. This aims to increase students' interest in mathematics. The media used should be tailored to students' needs to capture

their attention and make learning more enjoyable. As technology continues to advance, it should be utilized effectively - one way is through digital educational games such as the Multiplication Memorization Game. Kalaka et al. (2023) stated that mathematics learning becomes more engaging when taught using presentation concepts similar to those found in games. It has been proven that learning arithmetic through game-based media attracts children's interest more than conventional media such as paper and pencils. Game-based digital educational media are therefore considered more effective in helping students understand mathematics lessons, particularly in multiplication.

Multiplication material is often complained about by some students because it requires memorization of numbers, which can be monotonous. This makes students easily bored and eventually give up, as rote memorization alone fails to sustain their interest. However, this is not the case for all students, as some have faster comprehension abilities, making memorization less difficult for them. Nevertheless, at the elementary level, students still need learning that moves from abstract concepts to concrete understanding. Thus, multiplication should be understood not merely as memorization but as a concept that can be meaningfully grasped. To address this issue, learning through play should be implemented, allowing students to participate according to their abilities and needs. The type of play students are most familiar with is digital games, which are often used solely for entertainment. When used excessively, they can hinder thinking and creativity. However, combining learning and play is considered an appropriate approach, as it makes learning more enjoyable. Therefore, teachers are encouraged to utilize technology, which they can learn from various social media platforms or through training programs provided by the Ministry of Education and other institutions.

2 RESEARCH METHOD

Based on the research problems that have been formulated, the type of research used in this study is developmental research, which produces a product in the form of learning media. This study employs the Research and Development (R&D) method. Each product developed requires different research procedures. The product developed in this study is a Multiplication Memorization Game as a learning medium for the mathematics subject in Grade IV of SDN Pejagalan 01. The study uses the ADDIE development model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The following describes each stage of the development process in detail.

1. Analysis
   Analysis refers to the attitude or attention toward an object, fact, or phenomenon, allowing it to be brokendown into smaller parts and understanding how each part relates to the whole (Hidayat & Mukhlisin, 2020). The analysis stage is conducted to identify students' needs in developing the Multiplication Memorization Game learning media. There are two important steps in the analysis process, namely: field study and literature study (Rustandi & Rismayanti, 2021).
2. Design
   The design stage is the second step in the ADDIE development model. Design is a process of applying various principles and techniques to define a system or process in sufficient detail to allow its physical implementation (Dengen & Hatta, 2009). This stage involves planning the content or media to be developed, such as creating questions relevant to the material and aligning them with the type of game to be developed in the Multiplication Memorization Game. The process begins with creating a storyline, flowchart, storyboard, learning material, assessment instruments, and gathering supporting materials.
3. Development
   To simplify understanding, development can be defined as an effort to improve, enhance, or refine something that already exists (Diana et al., 2017). Development can also be seen as a process of improving something to have higher value. The

Multiplication Memorization Game learning media is developed by including practice questions, applying appropriate methods, and selecting suitable types of games. In this stage, the researcher creates the learning media based on the previously designed plan. The digital game-based media is developed using canva and includes learning materials and quizzes. After the media is completed, it is then validated by media experts, material experts, and language experts.

4. Implementation
   According to the Kamus Besar Bahasa Indonesia (KBBI), "implementation" means "execution" or "application." It is often associated with actions carried out to achieve specific goals (Yuliah, 2020). Once the planning stage is completed, implementation takes place. Implementation is the act of carrying out a well-prepared plan (Fatimah, 2021). In this stage, the game has been revised and refined based on suggestions from media, material, and language experts before being tested on students. There are two stages of testing: small-group testing and field testing. The trials involve evaluating factors such as learning motivation, ease of use, visual attractiveness, and the usefulness of the Multiplication Memorization Game learning media. Implementation or testing is conducted to determine how effective and efficient the media is when used as a teaching aid for both teachers and students in the classroom.
5. Evaluation
   Evaluation is a systematic process of determining the value of something—such as a policy, activity, decision, performance, process, person, or object—using specific criteria. Evaluation enables students to understand the extent of their success during the learning process. In this stage, the assessment results are analyzed and conclusions are drawn. Questionnaires collected from media experts, material experts, language experts, and students indicate that the desktop-based learning media developed for this topic is considered feasible and appropriate for classroom use (Mahirah & Alauddin, 2017).

3 RESULTS AND DISCUSSION

3.1. Results

The result of the research and development conducted by the researcher is a product in the form of a digital based Multiplication Memorization Game to improve students' multiplication memorization skills. The media development was carried out using the ADDIE development model, namely Analyze, Design, Development, Implementation, Evaluation. The following is a description of the ADDIE model stages in this study. The analysis stage, namely problem analysis and needs analysis. In the problem analysis stage, observations revealed that fourth-grade students at SDN Pejagalan 01 still had difficulty completing multiplication calculations because they had not yet memorized the basic multiplication tables for 1-10, resulting in low learning outcomes in mathematics for the multiplication material. In the needs analysis stage, it was found that teachers predominantly used tables as a medium for learning multiplication, so learning media were needed. One medium that could be used by all students was digital-based learning media. It was found that students needed digital-based learning media that could improve their ability to memorize multiplication (Wulan et al., 2026). One medium that could improve learning ability in multiplication was the multiplication memorization game.

The design stage involved activities such as creating flowcharts and storyboards, which were used as guidelines for product development. This stage also involved selecting the software to be used for product development. The software used is the Canva application. In addition, instruments are created, including a material expert validation questionnaire, a media expert validation questionnaire, a teacher response questionnaire, a student response questionnaire, and pretest-posttest questions. The development stage consists of three stages, namely (1) the product creation stage. The multiplication memorization game media was created according to the flowchart and storyboard, which consisted of the application logo, intro, identity, main menu, learning consisting of multiplication tables,

and exercises consisting of multiple-choice questions. The research was conducted at SDN Pejagalan 01 in the even semester of the 2024/2025 academic year with 31 fourth-grade students as research subjects. The research approach was R&D research and development using the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model with the development of multiplication memorization game learning media in mathematics.

Table 1. Results of the Development of the Multiplication Memorization Game Learning

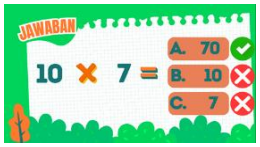
Media			
			
Application Logo	Front Display	CP and TP Display	Main Menu Display
			
Multiplication Table	Display Exercise	Question Display	Incorrect Display Correct Display

Table 2. Results of Expert Content Validation

No	Aspect Assessment	No Item	Subject Matter Expert Score	Total Score for Each Aspect	Total Expected
1.	Learning Aspect	1 2 3 4	4 4 5 5	18	20
2.	Material Aspects	5 6 7 8 9 10	4 4 4 5 5 5	27	30
Total				45	50
Percentage					90%

Based on the overall assessment by subject matter experts, the feasibility level of the multiplication memorization game media in mathematics subjects has a total score of 45 out of a maximum score of 50 with a percentage of 90%, thus falling into the "Valid"

category. Meanwhile, the results of the subject matter expert validation can be seen in Table 2.

Table 3. Expert Validation Results Media

No	Aspect Assessment	No Item	Subject Matter Expert Score	Total Score for Each Aspect	Total Expected
1.	Media Display Aspect	1 2 3 4 5	5 5 4 5 4	23	25
2	Media Material Aspects	6 7 8 9 10	5 5 5 5 5	25	25
Total				48	50
Percentage					96%

Based on the overall assessment by media experts, the media multiplication memorization game for mathematics received a total score of 48 out of a maximum score of 50, with a percentage of 96%, placing it in the "Valid" category. The results of the media expert validation can be seen in Table 3.

Table 4. Language Expert Validation Results

No	Aspect Assessment	No Item	Subject Matter Expert Score	Total Score for Each Aspect	Total Expected Score Expected
1.	Aspek Kebahasaan	1 2 3 4 5 6 7 8	5 5 5 4 5 5 4 5	38	40
2.	Aspek Komunikatif	9 10	5 4	9	10
	Total			47	50
	Percentage				94%

Based on the overall assessment by language experts, the feasibility level of the multiplication memorization

game media in mathematics subjects has a total score of 47 out of a maximum score of 50 with a percentage of 94%, thus falling into the "Valid" category. Meanwhile, the results of the language expert validation can be seen in Table 4.

Implementation Stage, the activity carried out was product testing. The test conducted was field testing. This stage was carried out to see the practicality and effectiveness aspects of the media. (1) The practicality aspect of the media was seen from the responses of teachers and students. The results of the teachers' responses can be seen in Table 5.

Table 5. Teacher Response Results for Grade IV

Description	Value
Teacher's Name	Lufthi Annisa, S.Pd
Total Score Obtained	48
Maximum Score	50
Percentage	96%

Based on the assessment by the fourth-grade teacher, the practicality level of the multiplication memorization game media in mathematics has a total score of 48 out of a maximum score of 50 with a percentage of 96%, which is categorized as "very practical".

Table 6. Responses from Fourth Grade Students

Description	Value
Number Of Student	31
Percentage	98,96%
Category	Valid

Based on student assessment, the practicality level of the media multiplication memorization game in mathematics has a percentage of 98.96%, thus falling into the "Valid" category. (2) The effectiveness aspect of the
media, as seen from the students' pretest and posttest scores. The data was processed using small and large trials.

Evaluation stage: this activity was carried out at every stage, starting from the analysis, design, development, and implementation stages. In the analysis and design stages, evaluation was carried out by asking the supervisor for advice on interview guidelines, media content, and questionnaires for media experts, subject matter experts, teachers, and students. Evaluation of the development stage was carried out by looking at comments and suggestions for improvement from media experts and subject matter experts. Evaluation of the implementation stage was carried out by looking at the responses of teachers and students to the application, as well as looking at the effectiveness of the media.

3.1 Discussion

The research method used was research and development (R&D). Research and development (R&D) is a process of research and development to design and create a product, which will then be tested for validity (Sugiyono, 2023). R&D is a type of development research that aims to produce a specific product, program, or design through a process of design, testing, and revision to meet certain standards and quality (Kamal 2020). The reason for choosing the ADDIE model is because this model provides actions

for evaluation and revision at each stage continuously until the product is produced to be valid and practical. Furthermore, according to the opinions of the experts above, the ADDIE model is also a simple and systematic model in each of its steps.

Learning media are items and tools used in learning to encourage students to understand the material and equip them with skills (Daulae, 2019). There is a saying that practice makes perfect. This also applies to students who are used to learning using media and those who only listen to what the teacher says. Its ability to transform conventional learning models into more flexible, dynamic, and responsive learning experiences shows how important media is in learning (Salahuddin, 2018). To achieve this, teachers need to develop their creativity in making interesting learning media that is, of course, in line with the abilities and needs of learners. Learners' abilities cannot be generalized. Teachers need to apply differentiated learning, where the material in the learning media is provided according to the learners' abilities. Learners who have mastered the material are given more challenging media so that their knowledge can increase, while learners who have not yet mastered the ICE 2025 – 4th International Conference on Education material are given media that is easier to understand. One of the media that can be used is the multiplication memorization game learning media.

Learning media basically functions as a source of learning, while other functions come from considering its general features, the language used to convey messages, and the impact or effects that arise (Sitepu, 2021). Learning media is able to convey messages and stimulate students' feelings and desires, encouraging each student to learn. Learning media can accelerate the teaching and learning process, which means that students can more easily and quickly understand the objectives and content of the lesson. The function of learning media is to make it easier for teachers to adjust learning competencies and attract students' attention to be active in the learning process. This creates an active and innovative learning process.

Learning media plays an important role as a teaching aid and influences the learning environment designed and regulated by teachers. This is done to ensure that the knowledge and material provided by a teacher can be absorbed well by students.

After going through the stages of media development and conducting product assessment and revision, this research and development resulted in a multiplication memorization game product for mathematics lessons. This media can be used online on the Canva application and carried out in groups. Each group can memorize the multiplication table of their choice and work on 10 multiple-choice practice questions. The score is calculated independently by the group leader by recording the number of correct and incorrect questions. The facilities and infrastructure at SDN Pejagalan 01 can support teachers in implementing this media well and can introduce students to the development of digitalization and the use of digitalization in daily learning activities at school.

The feasibility of the learning media based on subject matter expert validation can be concluded that the assessment in the learning aspect obtained a score of 18 out of 20, with a feasibility percentage of 90%. Therefore, it can be concluded that the learning media is included in the "Valid" assessment category. The material aspect obtained a percentage of 90%, with a score of 27 out of a total ideal score of 30, so it can be concluded that it is included in the "Valid" assessment category. The average total score for the assessment aspect obtained a percentage of 90%, so the multiplication memorization game learning media in mathematics lessons is declared in the "Valid" category from the material expert assessment.

The feasibility of learning media based on media expert validation can be concluded that the assessment in the media display aspect obtained a score of 23 out of 25 with a feasibility percentage of 92%, so it can be concluded that it is in the "Valid" assessment category. The media material aspect obtained a percentage of 100%, with a total score of 25, which is the ideal score, so it can be concluded that it is included in the "Valid" assessment category. The average total score for the assessment aspect was 96%, so the multiplication memorization game learning media for mathematics lessons was declared "Valid" based on the media expert assessment.

The feasibility of learning media based on language expert validation can be concluded that the assessment in the linguistic aspect obtained a score of 38 out of 40 with a feasibility percentage of 95%, so it can be concluded that it is in the "Valid" assessment category. The communicative aspect obtained a percentage of 90%, with a score of 9 out of 10 ideal total scores, so it can be concluded that it is included in the "Valid" assessment category. The average total score for the assessment aspect was 94%, so the multiplication memorization game learning media in mathematics lessons was declared "Valid" based on the language expert's assessment. The next stage is the field trial stage, which is divided into two parts, namely small class trials and large class trials. The response of students in small class trials obtained 97.3% with a "Valid" category. The response of students in large class trials obtained a percentage of 97.3% with a "Valid" category. Based on the field testing of the multiplication memorization game learning media in mathematics, it is considered valid and feasible.

4 CONCLUSION

This study concludes that the main obstacle for fourth-grade students at SDN Pejagalan 01 is understanding the material on multiplication of numbers 1-100. Teachers are advised to use learning media to make learning more varied and enjoyable. The development of the multiplication memorization game learning media in mathematics conducted in class IV of SDN Pejagalan 01 produced a multiplication game media that can support mathematics learning of multiplication of integers up to 100. The results of this media development were implemented in mathematics lessons on multiplication by utilizing the facilities and infrastructure available at the school, such as laptops, projectors, layers, speakers, and microphones. The students were very enthusiastic in participating in learning using this media and were motivated to learn it. The multiplication memorization game learning media also received a positive response from the school and motivated students with interesting media, thus becoming a new innovation in learning multiplication in mathematics because it utilizes digitalization with the game method.

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