

Development of Media Puzzle Using Game Based Learning Approach to Improve Learning Outcomes Student Mathematics in Elementary School

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ABSTRACT

This research is a Research and Development (RnD) study, using a 4-D development model. The subjects of this study were 25 grade IV students consisting of 9 male students and 16 female students. Based on the validation results of the puzzle media with the game-based learning approach, it shows that: (1) the validity level of the puzzle media with the game-based learning approach obtained an average score from material and media experts of 4.29 and 4.17 in the "very valid" and "valid" categories, (2) the level of effectiveness was tested through a test with the results of 80% of students being said to have completed. This means that the puzzle media with a game-based learning approach is very effective in improving student learning outcomes, (3) the practical level of the puzzle media with a game-based learning approach through a teacher and student response questionnaire with an average score of 4.09 and 3.86 in the "practical" category. Based on these results it can be concluded that puzzle media with a game-based learning approach is feasible and effective for use in elementary schools. (3) the practicality level of puzzle media with a game-based learning approach through a teacher and student response questionnaire with an average score of 4.09 and 3.86 in the "practical" category.

Introduction

Education is currently progressing. This is evident from the use of learning media by teachers in supporting the learning process in the classroom. by using instructional media in the classroom, teachers are required to create a lively and enjoyable classroom atmosphere (Rambe et al., 2023). To make learning fun the teacher must use learning media. The use of this learning media certainly helps teachers in transforming knowledge to their students (Lubis & Rambe, 2021). One of the learning media that can be used by teachers to support the learning process is puzzle media. Media puzzle is a game consisting of pieces of one image that can train the concentration level of Soebachman (2012). The use of puzzle media can encourage students to be active, creative, and increase their curiosity in learning activities so that they can develop problem-solving skills and group abilities by arranging pieces of pictures based on question cards and their answers (Sari, 2016). This fact is supported by the results of research conducted by Darmawan (2019), where it was found that the use of stacking puzzle game media was very effective and practical in learning for grade V in elementary schools. To support the use of puzzle media in the learning process in the classroom, teachers can use an approach. One approach that has been proven effective in supporting interesting and interactive learning is the game based learning approach. The game based learning approach is a form of learning centered on learning that uses games for learning purposes (Rohayati & Suwiwa, 2018). This approach integrates game elements into the learning process, creating a fun learning experience, high motivation and active

involvement of students. This is in line with research (Maulidina, et al, 2018) which says that the game-based learning approach is able to stimulate children's intellectual, emotional, and psychomotor.

Use of puzzle media with approach *game-based learning* can be used in learning mathematics in elementary schools. Learning mathematics in elementary schools is an important foundation in forming an understanding of basic mathematical concepts for students. However, in practice, many students experience difficulties in understanding and applying the mathematical concepts being taught, this is based on observations at SD Negeri 0506002 Lorong Ibadah. Based on the results of observations at the school, it is known that the problem is in the form of students' lack of understanding of learning mathematics and the minimal use of learning media as a tool in learning, so that it has a negative impact on learning outcomes. This problem is not much different from Fauzia (2018) who said that mathematics is one of the subjects that is considered difficult because the learning outcomes of students are still lacking. This problem is often caused by learning that is less interesting, not interactive, and unable to motivate students to participate actively in the learning process. This can result in a decrease in interest and motivation to learn, as well as a negative impact on students' learning outcomes in mathematics. The results of learning mathematics are the abilities possessed by students in accordance with mathematical competence in understanding basic competencies, the subject matter for each aspect of mathematics. According to Lestari (2013) mathematics learning outcomes are patterns of changes in a person's behavior which include cognitive, affective, and psychomotor aspects after taking mathematics teaching and learning activities whose level of quality is largely determined by factors that exist within students and the social environment that influences them. This is also related to applying concepts, performing mathematical operations and solving mathematical problems. Student learning outcomes that are not in accordance with expectations, automatically many learning objectives are not resolved. Based on these descriptions, researchers are interested in doing research on the development of puzzle media with a game based learning approach in improving students' mathematics learning outcomes in elementary schools.

Research Methodology

Research conducted by researchers is a type of Research and Development (R&D) research. According to Sugiyono (2015) research and development (R&D) is a research and development method used to produce products and test the effectiveness of a product. This study uses a 4-D development model. According to Thiagarajan (1974) the stages of the 4-D development model include: (1) define stage, (2) design stage, (3) develop stage and (4) disseminate stage. But this research is only up to the development stage (develop). The subjects in this study were 25 grade IV students consisting of 9 male students and 16 female students. The research object is puzzle media with a game based learning approach. Data collection techniques used include observation, questionnaires, and tests.

Table 1. Likert Scale Criteria

No	Answer	Score
1	Very good	4
2	Good	3
3	Enough	2
4	Not good	1

(Kesumawati et al, 2022)

The formula used to measure the percentage of validation results is as follows:

$$NPs = X 100\% \frac{R}{SM}$$

(Khaeriyah et al, 2022)

Information:

NP = Desired percent value
R = Intermediate score obtained
BC = Maximum score
100% = Fixed number

Table 2. Five Scale Interval Data Conversion Guidelines

No	Score Intervals	Category
1	$x > 4.2$	Very Valid
2	$3.4 < x \leq 4.2$	Valid
3	$2.6 < x \leq 3.4$	Valid Enough
4	$1.8 < x \leq 2.6$	Invalid

5	$x \leq 1.8$	Totally Invalid
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(August, 2014)

To be more accurate, the calculation of the effectiveness test uses the classical completeness formula as follows:

$$P = x \ 100\% \frac{f}{N} \quad (\text{Parenduri et al., 2022})$$

Information :

P:Percentage

f :Frequency

N:Total Activity Total

After the researcher finished testing the students, the researcher then measured the practicality of the media to find the percentage of the implementation of product use. Data analysis to determine the practicality of the media *puzzles* using a teacher's perception questionnaire (users). The formula for measuring practicality is as follows:

$$P = x \ 100\% \frac{\sum(\text{seluruh skor jawab angket})}{n \times \text{tertinggi} \times \text{jml responden}}$$

(Lubis et al., 2023)

Information:

P : states the percentage of assessment

N : states the number of questionnaire items

To find out the percentage and determine the level of practicality, you can refer to the table below:

Table 3. Media Practicality Level Criteria *Puzzles*

No	Criteria	Category
1	81% - 100%	Very Practical
2	61% - 80%	Practical
3	41% - 60%	Pretty Practical
4	21% - 40%	Impractical
5	0% - 20%	Very Impractical

Zummiassa et al (2023)

Results and Discussion

This development research produces a product in the form of puzzle media with a game-based learning approach. This media was developed to facilitate fourth grade students to be able to study in groups and work together with other group members. The model applied in product development is a 4D model. However, this research only covers the development stage, so it does not reach the disseminate stage. The following are the results of research based on these stages:

1) Defining stage (define)

At this stage, data was collected through in-class observation and interviews with fourth grade teachers at SD Negeri 056002 Lorong Worship. The focus of observation is on the curriculum used in the learning process, learning in the classroom, availability of facilities, and student characteristics. Pthere was this opportunity, the researcher also collected students' responses and responses through the distribution of questionnaires related to the needs analysis carried out. After obtaining information and an overview of the field conditions that occurred, the researcher conducted an analysis with the following description: (a) Even though schools have complete learning support facilities, such as student books, blackboards, teaching aids, LCD projectors, the use of these facilities in learning is not optimal. For example, LCD projectors are rarely used. This is because most of the learning material is still in the form of printed media (hardcopy), (b) in the aspect of learning implementation, the teacher has succeeded in combining various learning methods such as lectures, discussions, and giving assignments, to manage the class well. However,

2) Design stage (design)

After collecting media development data, the next step is to enter the design stage. This stage includes media design and media creation. The process of designing and producing the media was carried out based on an analysis of needs in the field, especially the need for learning media that can be used in learning mathematics on the topic of fractions. Media puzzles consist of elements which include images and text material that can be used when studying and playing in groups. These elements have their respective functions. (1) Companion book for puzzle learning media which contains learning materials, forms of puzzle learning media, instructions for use (slide/disassemble puzzles) and covers. (2) The board on which to place the puzzle pieces. (3) The puzzle piece itself.

Table 4. Media Puzzle Design

Design	Information
Physical form <ul style="list-style-type: none"> ➤ Material ➤ Size 	Plywood 30cm x 25cm x 1cm
Material	Fractions
Content	Instructions, material text and pictures

All the components in the puzzle media are combined into one and placed in a box made of cardboard. There are 7 steps in making puzzle media, which are as follows: (a) collecting references about broken material, (b) laying out content, pictures, instructions using Microsoft Word, (c) printing pictures and materials into the form of stickers to be pasted on puzzle pieces, (d) cutting plywood according to the media, (e) the wood that has been attached to the pictures is then cut to form puzzle pieces, (f) painting the wood, and (g) sticking cover stickers and putting them together in a cardboard box.

3) Development stage (develop)

After finishing making the media, the next step is to validate and test the product. The aim is to identify and correct errors that may exist in the learning media that have been developed. At this stage the following things are done:

a. Material Expert and Expert Validation ResultsMedia Puzzle With Game Approach *Based Learning*

Material Expert Validation Results

In material validation, it is carried out by two validators who have expertise in that field. The process of validating this material involves three aspects of the requirements, namely the didactic aspect, the construction aspect, and the technical aspect. From the results of the analysis of the data generated from the material validation process, validation results were obtained from the first material expert and the second material expert with a validity level of 4.29. Thus, it can be concluded that the learning material contained in the puzzle mediawith a game-based learning approachthis could be considered "highly valid" material.

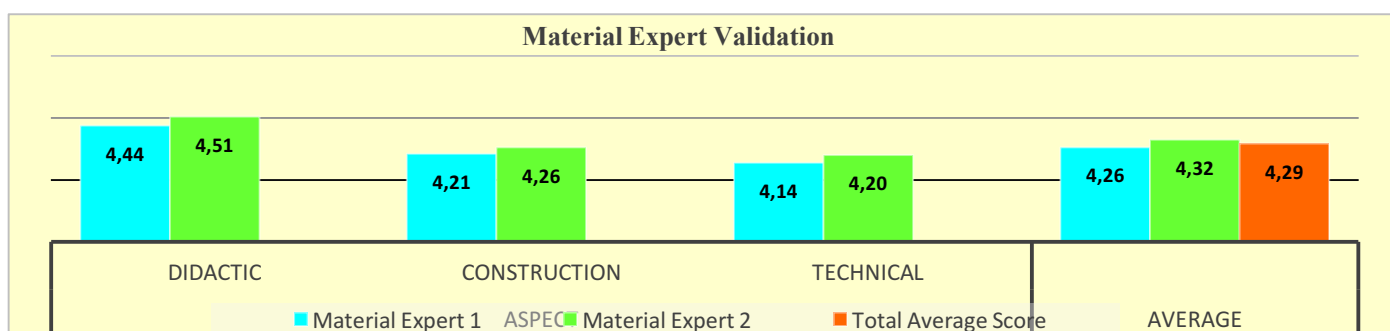


Figure 1. Material Expert Validation Result

Media Expert Validation Results

Media validation is a process of validating the product design of the media that has been made. This material validator involves two testers who are experts in the media field. This media validation includes four aspects of the requirements, namely the quality of the content, learning, interaction, and appearance. From the results of media validation data processing, validation values were obtained from validator one and validator two with a value of 4.17. Thus, it can be concluded that the puzzle media with a game based learning approach can be considered "valid".

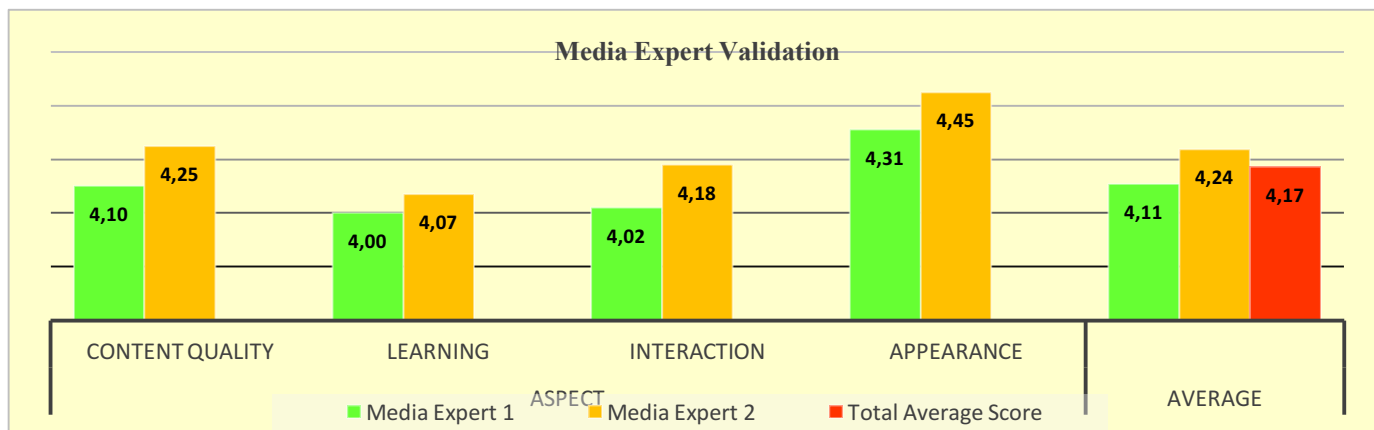


Figure 2. Media Expert Validation Results

b. Effectiveness Results Media Puzzle With Game Approach *Based Learning*

The effectiveness test is carried out to measure the extent of usemedia puzzle with a game based learning approachcan improve student learning outcomes. Differences in learning outcomes were evaluated through the completeness of student learning outcomes, which were measured through the pretest (initial test) and posttest (final test) which were followed by 25 students from class IV who usedmedia puzzle with a game based learning approachwhich was tested. The results of the analysis using the Ms. application program. Excel 2010 of the 25 students who had been tested showed that the percentage of classical completeness for pretest scores was 40% and the percentage of classical completeness for posttest scores was 80%. From the comparison of pretest and posttest values, it can be concluded that there are differences in values before and after usemedia puzzle with a game based learning approachin learning mathematics. Regarding the completeness of student learning outcomes, the following percentages are obtained:

Table 5. Student Learning Outcomes Using Puzzle Media

Variation	Media Puzzles	
	Before	After
	<i>Pretest</i>	<i>Posttest</i>
The highest score	77	91
Lowest Value	42	61
Average	64.03	79.28
Completeness	44.00%	80.00%

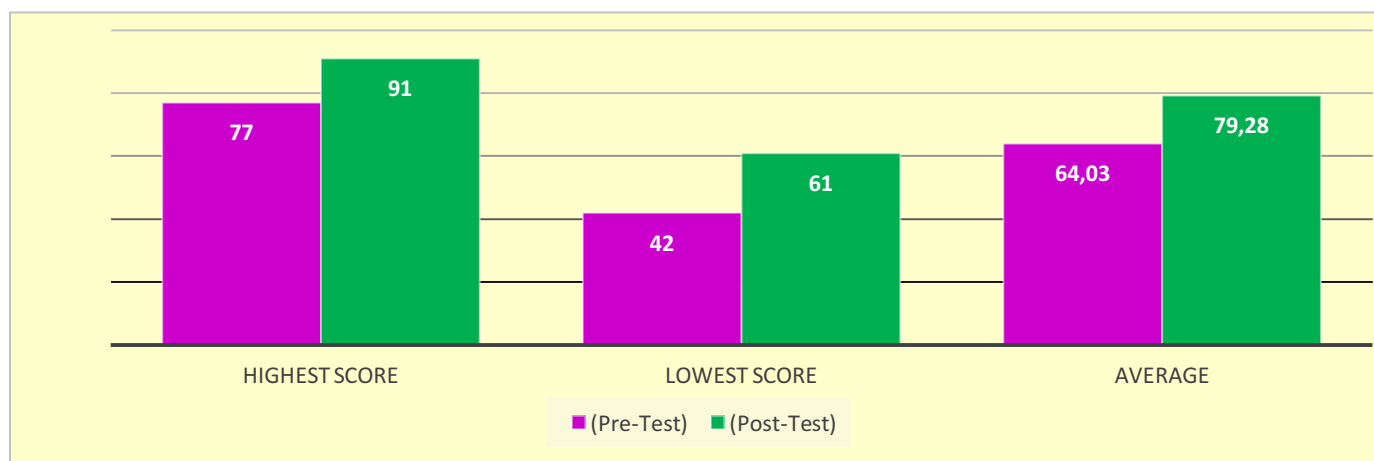


Figure 4. Student Learning Outcomes Using Puzzle Media

c. Practicality Test Media Puzzle With Game Approach Based Learning

The next stage is testing media puzzle with a game based learning approach that has been developed. Testing was carried out by examining the use of media in the context of classroom learning involving the participation of teachers and students. The data was obtained in the form of a teacher's response practicality test. Practicality test data based on responses obtained from two classroom teachers who teach mathematics. The test results show the acquisition of practicality scores from the responses of teacher one and teacher two with a value of 4.09. Therefore, it can be concluded that the puzzle media with a game based learning approach is considered "practical". Furthermore, for the practicality test of student responses, it was obtained from two students who took part in learning using puzzle media with a game based learning approach, with a value of 3.86.

Based on the description above, it shows that the use of puzzle media with a game based learning approach has a significant role in helping motivate students in learning mathematics to think creatively and logically. Thus, students are given the opportunity to develop their knowledge through interesting manipulation and visualization of the puzzle media presented by the teacher in class, so that this can improve their mathematics learning outcomes in elementary schools, especially at SD Negeri 0506002 Lorong Ibadah. This is in line with the results of the study Sholihah et al (2019) states that there is a significant difference in which it is stated that this make a match-based puzzle media has an influence on students' learning outcomes in learning addition material. Likewise, with Alzanah & Dewi (2022) which says that the development of creative puzzle learning media is effective in increasing the thematic learning outcomes of the theme of my experience on Pancasila material. In addition, with the development of puzzle media, it will make it easier for teachers, especially at the school, to deliver mathematics learning material on fractional material. This is in line with the research of Indiyanti et. al (2020) which states that the development of puzzle media is recommended to be developed to make it easier for teachers to understand learning material for students. In addition, game elements in the game-based learning approach offer interactive, fun and challenge-based learning experiences for students, thereby increasing active student involvement in learning mathematics. The same thing was also expressed in Sari & Ahmad's research (2022) that aspects of learning mathematics that are presented in game play through elements of concrete problems and adventure themes provide a more attractive learning experience because it involves students' activeness and creativity in problem solving.

Conclusion

Based on the results of the research and discussion described above, several conclusions can be drawn that the development of puzzle media with a game based learning approach can be seen through validity, effectiveness and practicality tests as follows: (1) The level of validity of the puzzle media with the game based learning approach obtained an average score of 4.29 from material experts in the "very valid" category and 4.17 from media experts in the "valid" category (2) The level of effectiveness of puzzle media with a game based learning approach through tests on research subjects totaling 25 students. Based on the test results, 80% of students can be said to be complete and 40% of students are incomplete. This means that puzzle media with a game based learning approach is very effective in improving student learning outcomes (3) The level of practicality of puzzle media with a game based learning approach through a teacher and student response questionnaire with an average score of 4.09 and 3.86 in the "practical" category. Based on the description above, it can be concluded that the development of puzzle media with a game based learning approach can improve student learning outcomes at SD Negeri 0506002 Lorong Ibadah.

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