Development of Two-Dimensional Figure *Jenga* Media to Improve Students' Learning Outcome in Elementary School

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Abstract

The aim of this research develops Two-Dimensional Figure *Jenga* Media which is valid, practical, and effective to improve the students' learning outcome of class IV in Mathematic lesson. The method used is Research and Development by applying a 4D model which has four stages including Define, Design, Develop and Disseminate. The test subjects for this research were 25 grade IV students at SDN Batu Ampar 02. The data collection technique used included media validation, material validation, language validation, teacher response questionnaires, student response questionnaires and student learning outcome tests. Analysis of the effectiveness of the Two-Dimensional Figure Jenga media used a paired sample T Test which was previously carried out for normality and homogeneity tests as a prerequisite test. The research results for the validity assessment assessed by the Media Validator obtained a score of 89% in the very good category, the Material Validator obtained a score of 89% in the very good category and the Language Validator obtained a score of 78% in the good category. Practicality assessment after being tested based on the value given by the class teacher obtained a score of 98%, and the average gain in small group trials was 97% and large group trials was 87%. Effectiveness assessment based on learning outcome test obtained an average pre-test score of 56.8 and post-test 75.6, as well as the results obtained from normality test calculations, the pre-test sig value was 0.209 and post-test 0.183 > 0.05 indicating that the data is normally distributed. The pre-test and post-test homogeneity test calculations are sig 0.347 and 0.172 > 0.05, which means the data is homogeneous. The paired sample t test calculation is sig (2-tailed) 0.000 < 0.05, which means that the Two-Dimensional Figure Jenga media has an influence on learning outcome. So, Two-Dimensional Figure Jenga media can be said to be suitable for use to improve learning outcome during the learning process.

Keywords: Development, Jenga Learning Media, Learning Outcome, Mathematic

Abstrak

Tujuan dari penelitian ini yaitu mengembangkan media Jenga Bangun Datar (Jebar) yang valid, praktis, serta efektif untuk meningkatkan hasil belajar siswa kelas IV pada pelajaran Matematika. Metode yang digunakan adalah Research and Development dengan mengaplikasikan model 4D yang memiliki empat tahapan meliputi Define, Design, Develop dan Disseminate. Subjek uji coba penelitian ini yaitu 25 siswa kelas IV di SDN Batu Ampar 02. Teknik pengumpulan data yang dilakukan mencakup validasi media, validasi materi, validasi bahasa, angket respon guru, angket respon siswa dan tes hasil belajar siswa. Analisis keefektifan media Jenga Bangun Datar (Jebar) menggunakan uji t sampel berpasangan yang sebelumnya dilakukan uji normalitas dan homogenitas sebagai uji prasyarat. Hasil penelitian untuk penilaian validitas yang dinilai oleh Validator Media memperoleh skor sebesar 89% dengan kategori sangat baik, Validator Materi

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memperoleh skor sebesar 89% dengan kategori sangat baik dan Validator Bahasa memperoleh skor sebesar 78% dengan kategori baik. Penilaian kepraktisan setelah diujicobakan berdasarkan nilai yang diberikan oleh guru kelas memperoleh skor sebesar 98%, serta rata-rata perolehan pada ujicoba kelompok kecil sebesar 97% dan ujicoba kelompok besar sebesar 87%. Penilaian efektifitas berdasarkan tes hasil belajar memperoleh skor rata-rata pre-test sebesar 56,8 dan post-test 75,6, serta perolehan dari perhitungan uji normalitas nilai sig pre-test 0,209 dan post-test 0,183 > 0,05 menunjukkan bahwa data terdistribusi secara normal. Perhitungan uji homogenitas pre-test dan post test adalah sig 0,347 dan 0,172 > 0,05, yang artinya data homogen. Perhitungan uji t sampel berpasangan adalah sig (2-tailed) 0,000 < 0,05, yang artinya Media Jenga Bangun Datar (Jebar) memberikan pengaruh terhadap hasil belajar. Sehingga, media Jenga Bangun Datar (Jebar) dapat dikatakan layak digunakan guna meningkatkan hasil belajar pada saat proses kegiatan pembelajaran.

***Kata Kunci:** Matematika, Media Pembelajaran Jenga, Hasil belajar, Pengembangan*

INTRODUCTION

Mathematics is a necessary learning topic and is widely used in everyday life, so it is important for students to have a strong understanding of this learning (Khotimah & As'ad, 2020). Therefore, it is necessary for every student, from elementary school level to higher level, to study mathematics in order to gain skills such as logical, critical and creative thinking (Sukma & Setyasto, 2024), and the ability to solve problems in everyday life (Radiusman, 2020). However, students tend not to like learning mathematics because it is considered complicated to learn and requires careful thinking in solving each problem. In accordance with the statement expressed by Amelia & Mustika (2022) that most students don't like mathematics because they consider mathematics to be a complicated and uninteresting subject. So many students experiencing obstacles in mastering mathematics lessons.

Based on observations of class IV students at SDN Batu Ampar 02 Pagi, it was found that the learning outcome obtained tended to be low because students did not have a strong enthusiasm for learning. This is shown by students' lack of interest in what the teacher teaches and students often ask to play during the lesson rather than paying attention to what is being taught. Apart from that, learning activities become less interesting and difficult for students to understand when learning is limited to the use of books and learning materials that are not diverse. The same thing was also found in the research carried out Dinayusadewi & Agustika (2020) that the limited amount of learning media will make it difficult for students to learn the material and a lack of motivation and interest in learning mathematics can lead to low learning outcome obtained by students (Asriyanti & Purwati, 2020). So that the use of media in the learning process can make interaction and communication between teachers and students more effective, it is hoped that this interaction can build and develop students' knowledge in an interactive and inspiring manner.(Nalendra et al., 2020; Lestari et al., 2022).

Jumiati et al. (2023) in his research stated that students' difficulties when learning mathematics regarding flat shapes are because students still find it difficult to distinguish the characteristics of flat shapes, find it difficult to remember various formulas for flat shapes, the basic calculations of multiplication and division are not yet well mastered, and low motivation to

learn among students. Therefore, interesting and varied teaching is needed to prevent students from becoming disinterested or bored, as well as being able to build student interest during learning in order to improve learning outcome (Febrita & Ulfah, 2019). Student learning outcome are changes in student behavior which become input for improving learning strategies (Abror, 2022). According to Mashuri et al. (2019) The core of learning is the teacher's efforts to facilitate the student learning process, such as choosing, finding out and creating strategies to achieve the learning objectives that have been designed. Thus, learning models and approaches are needed that are appropriate to students' actual conditions during the learning process, and media are needed that are able to support learning so that they can increase students' awareness and enthusiasm for continuous learning.

To overcome this challenge, learning media is needed that can foster student interest so that two-way learning activities occur and the learning process is not boring. According to Adawiyah & Kowiyah (2021), media has an important role in shaping the learning process. Media functions as an intermediary, conveying the learning content planned by the teacher and preparing students to be directly involved in achieving learning goals. As explained by Vawanda & Zainil (2020), the use of media during the learning process can motivate students, foster interest in learning, and have a psychological impact on students. Apart from that, the use of learning media not only makes students more interested in learning, but also makes it easier for teachers to teach the material and increases students' understanding of the material.

The use of Jenga as a learning medium has been successfully developed in research Suriata et al. (2022), Azizah et al. (2022), Rinata et al. (2023) And Khasanah et al. (2023). However, the components developed in this media do not yet have a forum for appreciation for students to target achievement goals while using this media. In the process of learning activities, students who use learning targets have a better impact on motivation and learning outcome (Pranawa & Priambodo, 2017) because there will be a tendency for students to carry out learning activities that are driven by the desire to achieve the best possible learning outcome (Surentu et al., 2024).

Based on the results that have been described, researchers developing Jenga Build Flat (Jebar) media as an educational game tool that can help the process of learning activities to improve student learning outcome. The use of educational game tools in learning activities is able to provide students with learning experiences, as well as supporting the growth of social skills, understanding rules, cooperation and sharing. Educational game tools are specifically made to provide fun learning activities but are still able to educate students, so with educational game tools it is hoped that they can support student learning to be more innovative and creative. (Hasanah, 2019; Al Mubarok, 2021; Fatmawati et al., 2023).

METHOD

This research applies the Research and Development methodology which is used to carry out product validation and development (Bujuri et al., 2022; Yan Marthani & Ratu, 2022) with the development model applied, namely 4D, which consists of four stages which include Define, Design, Develop and Disseminate (Rizki & Widyastuti, 2019). The results of the research in the form of Two-Dimensional Figure Jenga media were tested on small groups first and then tested on large groups at SDN Batu Ampar 02. The data collection used includes observation, media validation, material validation, language validation, validation of teacher response questionnaires,

student response questionnaires and student learning outcomes tests. Analysis of the effectiveness of media in improving learning outcome was tested by carrying out a paired sample t test before which prerequisite tests were carried out, namely the normality test and homogeneity test. In preparing the questionnaire, Likert scale data was used with five choices for each question item which were categorized into strongly agree (SS), agree (S), neutral (N), disagree (TS) and strongly disagree (STS) (Silviani & Amelia, 2023). The percentage of filling results is calculated using a formula $P = \frac{f}{N} X$ 100%, with the explanation that P = Percentage figure, f = Number of scores obtained and N = Maximum score (Ningsih et al., 2023). Interpretation of assessment criteria is needed to determine assessment criteria for development products. The criteria used for product assessment are as follows (Ulya & Rofian, 2019):

Table 1. Product Assessment Criteria

Interpretation	Criteria
81% - 100%	Very good
61% - 80%	Good
41% - 60%	Enough
21% - 40%	Not good
0% - 20%	Very Not Good

Based on calculations using the formula above, the assessment of the validation and response questionnaire will use the interpretation of the assessment criteria in the table. 2, so that the data results can be analyzed using descriptive analysis techniques. The paired sample t test will be used to assess learning outcome data from the pre-test and post-test on understanding class IV flat shape material in order to determine the effectiveness of the product. Before that, normality and homogeneity tests were carried out as prerequisite tests. SPSS 25 was used to calculate the results of the test.

RESULT AND DISCUSSION

Research and development of Two-Dimensional Figure Jenga media applies the 4D development model (Define, Design, Develop and Disseminate). An explanation of the stages carried out during the research is as follows:

1. Define

The definition stage is the initial stage of research carried out to obtain information regarding the needs for mathematics learning at SDN Batu Ampar 02. The following are the steps involved in the definition stage, first is Preliminary analysis. Based on the results of observations at SDN Batu Ampar 02, it is known that the use of learning media is less diverse and only textbooks are used during the learning process. resulting in students' lack of interest in learning during learning activities, as well as students having difficulty understanding the learning material presented by the teacher.

Second is student analysis. From the results of observations regarding student characteristics, it is known that the academic abilities of students in class IV at SDN Batu Ampar 02 show mixed results, namely students have high, medium and low abilities. So that learning media can be adjusted to existing problems. Third is task analysis. Results of determining the substance of the material included in the Two-Dimensional Figure Jenga

media which has been adapted to learning outcome in the Independent Curriculum namely, it lies in students' accuracy in analyzing properties, as well as calculating the area and perimeter of flat shapes.

Fourth is concept analysis. Based on the results of the preparation that has been carried out regarding the description the use of Two-Dimensional Figure Jenga media and the components required, it is determined that the specifications for this media are the use of media that can be used and stored anywhere, and has the components of question cards, knowledge cards, mission maps, stamps, dice and guidebooks. Fifth is formulation of learning objectives. The results of the formulation of learning objectives as indicated by changes in student behavior in accordance with the flow of learning objectives in the Independent Curriculum for Mathematics in Building and Flat material, are as students can analyze the properties of a flat shape correctly; Students can explain how to calculate the area and perimeter of a flat shape correctly; and Students can solve problems of area and perimeter of a flat shape correctly.

2. Design

At the design stage, the media and formats developed are determined to suit the needs of the student characteristics analysis that has been carried out. So the media used is Two-Dimensional Figure Jenga media which is equipped with a mission map made from HVS 80 gsm measuring 15 cm x 21 cm, a star-shaped stamp measuring 1.5 cm in diameter, dice which have six different colors on each side, a guidebook made from 190 gsm art paper measuring 15 cm x 15 cm which contains the definition of Two-Dimensional Figure Jenga media, media components, mission map, how to prepare the game, how to play and answer key to question cards, as well as knowledge cards and question cards made from 310 gsm art cardboard measuring 7, 5 cm x 9.5 cm, the media components were designed with the help of the Canva application. After that, a format is selected that adapts the creation of learning media materials to the subject matter and Independent Curriculum. The media development format chosen consists of learning objectives for flat shapes such as properties, area and perimeter.

3. Develop

At the development stage, researchers combine all the materials to make the desired product shape. After the product has been produced, the product is validated by media, material and language validators. Then the media is repaired according to the validator's suggestions. The following are the results of the validator's assessment of Two-Dimensional Figure Jenga media:
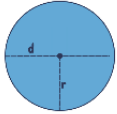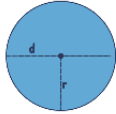
Table. 2 Recapitulation of Validator Assessment Results

Validation	Average Score	Category
Media	89%	Very good
Material	89%	Very good
Language	78%	Good
Question	89%	Very good

Based on the results of the analysis in accordance with the interpretation of the assessment criteria, an average score was obtained for validation from the validator of the media being developed, namely getting the category "Very Good" in terms of media, "Very Good" in terms of material, "Good" in terms of language and assessment for questions. get the criteria "Very Good". Thus, the media can be said to be valid and worthy of being tested with improvements to several validator suggestions and input as a basis for revision. The

following are the results of the revision of the feasibility of the Two-Dimensional Figure Jenga media:

Table 3. Expert Revision

Before Revision	After Revision

Based on the suggestions and input submitted by the validator, improvements and changes were made to the product, namely changing the material content on the question cards to be adjusted to operational verbs, improving knowledge cards to adapt to good and correct PUEBI, adding group identity information and reducing the number of circle steps. from the initial 20 steps to 10 steps on the mission map, and in the guide book there is a change in font type and the addition of the use of original images from the media being developed. The components suggested by the validator are answer keys and digital guidebooks which can be accessed via barcode scanning. These cards have the same size and material as the question cards and knowledge cards.
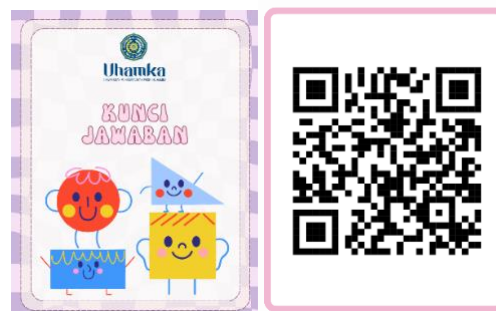

Figure 1. Answer Key Card

Figure 2. Guidebook card

After making product improvements in accordance with the suggestions and input provided by the validator, the Two-Dimensional Figure Jenga media is ready to be tested for widespread distribution of the media.

4. Disseminate

The dissemination stage is the final stage of research and development, where Two-Dimensional Figure Jenga media is distributed to measure its level of practicality and effectiveness. The level of practicality was assessed by the class teacher and class IV students based on a response questionnaire to the media developed and the level of effectiveness was assessed based on learning outcome tests. The following are the results of the assessment regarding the practicality of the media that has been developed:

Table 4. Recapitulation of Response Questionnaire Assessment Results n

Response Questionnaire	Average Score	Category
Class IV Students (Small Group)	97%	Very good
Class IV Students (Large Group)	87%	Very good
Teacher	98%	Very good

Based on the interpretation of the results of the analysis of the assessment of media practicality, the average score obtained from the three response questionnaires shows the "Very Good" category. So, the Jenga Build Flat (Jebar) media can be said to be practical to use during the learning process. The assessment of media effectiveness was calculated using SPSS 25 by carrying out a normality test, homogeneity test and paired sample t test to measure learning outcome carried out by 8 students in small groups and 25 students in large groups. The following are the results of these calculations:

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretes Kelompok Kecil	.220	8	.200[*]	.917	8	.408
Postes Kelompok Kecil	.284	8	.057	.906	8	.324

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Figure 3. Small Group Normality Test

The results of the Shapiro-Wilk table normality test on pre-test and post-test data for small groups are normally distributed based on a significance level of (a) 5% = 0.05, which is

indicated by the pre-test sig value (0.408) > a (0, 05) and post-test (0.324) > a (0.05). The following image displays the results of the large group normality test:

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretes Kelompok Besar	.156	25	.118	.947	25	.209
Postes Kelompok Besar	.150	25	.150	.944	25	.183

a. Lilliefors Significance Correction

Figure 4. Large Group Normality Test

The results of the Shapiro-Wilk table normality test for large groups, the sig value of pre-test (0.209) > a (0.05) and post-test (0.183) > a (0.05) shows that the data is normally distributed. Thus, based on the calculation results shown in Figures 3 and 4, a homogeneity test of the pre-test and post-test results can be carried out. Calculation of homogeneity test The pre-test obtained the following results:

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Pretest	Based on Mean	.911	1	31	.347
	Based on Median	.772	1	31	.386
	Based on Median and with adjusted df	.772	1	30.478	.386
	Based on trimmed mean	.941	1	31	.339

Figure 5. Pre-test homogeneity test

The homogeneity test results show a significant result of 0.347, as can be seen in Figure 5. Because (0.347) > a (0.05), the pre-test data is homogeneous. Next, calculations were carried out to see the homogeneity of the data in the post-test results. The results of the post-test homogeneity test calculation are as follows:

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Postest	Based on Mean	1.956	1	31	.172
	Based on Median	1.791	1	31	.191
	Based on Median and with adjusted df	1.791	1	30.607	.191
	Based on trimmed mean	1.990	1	31	.168

Figure 6. Post-test homogeneity test

The significant result of the homogeneity test is 0.172. The post-test result data is homogeneous because (0.172) > a (0.05). Therefore, the paired sample t test can be used to test the effectiveness of learning outcome on small group and large group data based on the calculation results shown in Figures 5 and 6. The paired sample t test calculation produces the following results:

Paired Samples Test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Pretes Kelompok Kecil - Postes Kelompok Kecil	-18.75000	6.40870	2.26582	-24.10781	-13.39219	-8.275	7	.000

Figure 7. Small Group Paired Samples t Test

Based on a significance level of (a) 5% = 0.05, the results of the paired sample t test with pre-test and post-test data for small groups produce a sig (2-tailed) value of 0.000, which is less small than 0.05. Following are the results of the large group paired sample t test calculations shown in Figure 8:

Paired Samples Test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Pretes Kelompok Besar - Postes Kelompok Besar	-18.80000	7.25718	1.45144	-21.79562	-15.80438	-12.953	24	.000

Figure 8. Large Group Paired Samples t Test

From the results of the paired sample t test calculations, the pre-test and post-test data for the large group shows a sig (2-tailed) value of 0.000, which is less than 0.05. The calculations in Figures 7 and 8 show that the Two-Dimensional Figure Jenga media is effective for use in improving learning outcome during learning activities.

As a result of a series of research and development activities carried out, a product was obtained in the form of Two-Dimensional Figure Jenga media which was considered valid because the product developed was interesting and very good for use as a learning medium, the use of language that was easy to understand for students also made it easier to use the media, as well as the preparation of materials and questions. which has been adapted to the Merdeka and KKO curriculum. Apart from that, practical media is used and can be used anywhere and is effective used during the mathematics learning process where the results of small group trials obtained an average score on the pre-test of 57.5 and post-test of 76.25 and the large group obtained an average score on the pre-test of 56.8 and post-test test 75.6. Overall student learning outcome have increased in value, so the product developed can be used to improve fourth grade student learning outcome. As explained in the introduction, regarding students' difficulties in learning plane material, media is needed that is able to increase students' understanding, so that maximum learning results are obtained.

Therefore, Jenga media is used to support learning activities to make them more interesting and able to help students during the learning process to understand the learning material. In line with what was stated Firdaus et al. (2023) in his research, the use of Jenga learning media showed a significant influence in helping to improve student learning outcome. And the delivery of material in learning media can be easily understood by students (Salawati & Suoth, 2020 ; Zulfa & Haryanto, 2021 ; Apriyeni et al., 2021).

The advantage of this product is that it uses game tools as learning media that are able to provide education to build quality learning, so that it can improve student learning outcome in learning activities, as well as improve motor skills and logical thinking.(Kholida et al., 2020 ; Gustina, 2021 ; Virianingsih et al., 2021 ; Sariasih et al., 2022 (Putri et al., 2023).

In addition, by using this product during learning, the learning activities that occur will be

student-centered, thereby encouraging students to play an active role in developing their knowledge, attitudes and abilities while studying (Sandria et al., 2022). Because it is very important to have a learning model that supports children in developing their interests, talents, especially by using student-centered learning, so that the learning process can foster a sense of joy and comfort and achieve maximum goals.(Febry et al., 2022 ; Dwiyanti et al., 2023).

CONCLUSION

From the research results, it was found that the overall learning outcome of class IV students had increased in value, so that the Two-Dimensional Figure Jenga media was effectively used to improve learning outcome in mathematics learning. Apart from that, this media is considered an interesting and fun learning tool to use. This media is also practical and easy to carry, making it suitable for use in various places. The use of mission maps can attract students' desire to do their best. However, this research has limitations in that the material used in the media developed only focuses on one material and is only applied to one school level, namely flat building material for elementary school level. In developing better media, it is recommended that Jenga media be developed using materials other than flat shapes or with wider materials in further research.

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