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"Geometrical Land" Learning Media Design Material for Building Flat Side Spaces

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Abstract

Flat-sided space shapes are mathematical materials in the scope of geometry which discusses cubes, blocks, pyramids, and prisms. In this material, students often find it difficult to visualize objects and relate them to contextual problems. The role of teachers in overcoming these problems is certainly very necessary. One way that can be used is to utilize technology to create learning media. The application software that can be used is Articulate Storyline 3. This research aims to produce a learning media design for flat-sided building materials called "Geometrical Land". This research is part of development research which is limited to the development stage only. The stages carried out in this research include: needs analysis, media design, and media validation. The instrument used is a media expert and material expert validation sheet. There are 6 validators, consisting of 3 material expert validators and 3 media expert validators. The results of this development research are in the form of a percentage of the validation test scoring of material experts and media experts. The average percentage of validity test results for material experts was 86.18% and media experts showed 84.61%. This states that the learning media "Geometrical Land" is 'very valid' for use according to the conversion level of achievement.

Keywords: instructional media, flat-sided, geometrical land, technology-based learning

INTRODUCTION

The development of science and technology influences all aspects of life, especially in the field of education (Mawarsari et al., 2023). The rapid development of technology is not only felt by adults but also children (Novita Pujianingtias & Januar Saputra, 2019). Currently, every human being is always dependent on technology (Muhammad & Juandi, 2023). The development of technology in the education sector demands renewal (Mawarsari et al., 2020; Listiawan & Antoni, 2021; Sonya et al., 2022). Various efforts and new ideas are needed to improve the quality of school learning (Dona Fitriawan et al., 2023; Mashuri, 2021). Education is a form of effort to

develop the potential of every human being (Muhammad & Juandi, 2023) (Nursyamsiah et al., 2020). Improving the quality of education is very important (Research et al., 2022). Teachers, as an important element in the learning component, are required to be creative and innovative in delivering learning. Learning media is an intermediary tool for delivering learning from teachers to students, in this case, teachers and students can communicate well and effectively (Hada et al., 2021). Teachers need learning media as a tool to convey material in the learning process (Listiawan & Antoni, 2021). Interesting, creative, and innovative learning media will certainly be able to foster students' enthusiasm for learning (Nurbani & Puspitasari, 2022). One of the learning materials that requires learning media and can be made into learning media is mathematics.

The subject that underlies the development of science and technology is mathematics (Simarmata & Siregar, 2024; Suantiani & Wiarta, 2022). Mathematics makes a positive contribution in achieving intelligent and dignified humans which is the basis for the development of modern technology. Apart from that, mathematics is useful as a subject that allows students to explore new things (Yeni D. Fonataba et al., 2023). Mathematics plays a role in forming critical, creative and independent thinking patterns in students. However, mathematics is often considered by students to be an unpleasant subject and difficult to understand (Vironika Zubaidah & Sulistyaningrum, 2020). This is because mathematics is often seen as a science whose content is only symbols, numbers, and confusing formulas and the experience of learning mathematics is less enjoyable (Adi Candra Kusuma et al., 2023; Mashuri, 2021). Apart from that, within the scope of geometry, students also often find it difficult to visualize abstract objects in the material they are studying, especially in flat-sided geometric material.

Flat-sided space shapes are mathematical material within the scope of geometry discusses cubes, blocks, pyramids, and prisms, this material requires visualization in learning (Saputra et al., 2021). In studying flat-sided geometric material, students need learning media to make it easier for students to visualize abstract objects in the material (Alyusfitri et al., 2020). Students will also find it easier to visualize abstract objects if the abstract objects are linked to real objects that students often encounter in everyday life. Yuwono (2009) also believes that students should be given material or problems related to real situations in mathematics learning (Prastitasari et al., 2018). The learning model that is suitable to be applied to flat-sided geometric material is the contextual learning model. Contextual learning is learning that links learning material to real situations in everyday life. The use of contextual learning models turns out to make students more active in learning (Rusani & Anwar, 2021).

Based on the description above, there are two problems, namely: (a) students think that mathematics is an unpleasant subject and difficult to understand and (b) students find it difficult to visualize lateral spatial objects. Therefore, there needs to be a solution to resolve this problem. The right solution to solve this problem is the teacher's role in creating learning media that is interesting, easy to use, and contains flat-sided geometric material that is appropriate for students (Suseno et al., 2020). The key to enjoyable learning lies in the teacher's ability to design and implement

learning media designs (Undiksha & Tenri Ampa Economic Education, 2020). According to Nasir (2019), in his research, learning media can increase students' learning motivation. Choosing the right learning media is one of the main aspects in supporting a learning process (Firmansyah et al., 2020). Technological developments also influence the educational aspect, it is hoped that the learning process is required to be able to adapt to current developments, therefore in this research, researchers developed technology-based learning media. In creating learning media, there needs to be an appropriate learning media design, teachers can use existing application software that they feel is easy to use in making learning media (Rosiyanti et al., 2020), for example by using the articulate storyline 3 application software (Solo et al., 2023). Articulate Storyline 3 is application software that can be used to create interactive learning media with the results later being web-based applications or media (Sabil et al., 2021). Creating learning media using Articulate Storyline 3 is very easy, the features in this application software are similar to the features in Microsoft Powerpoint, only in ArticulateStory 3, the content that can be loaded is more complete, such as being able to create interactive practice questions that can directly show the results of your score. (Sabil et al. 2021). The results of this learning media can later contain text, images, sound, animation, and video.

Based on the description of the problem that has been explained, the objectives of this research are: (a) designing learning media for building flat-sided spaces with "Geometrical Land" and (b) testing the validity of the "Geometrical Land" learning media. The learning media "Geometrical Land" contains material on flat-sided spatial shapes presented in the form of text and contextual images, there is a teacher animation in it, which contains evaluation questions that students can work on accompanied by the results of their scores.

RESEARCH METHODS

This research is part of development research which is limited to the development stage only. The stages in this research include the analysis stage, namely analyzing needs. The design stage is carried out to prepare and design the learning media that will be created. In the development stage, product validation is carried out by validators. In this research, there are two categories of validators, namely material experts and media experts. The criteria for material validators are people who are experts in school geometry and mathematics material. The criteria for a media validator is a person who is an expert in creating learning media.

The instrument used is a validation sheet. The validation sheet is used to determine the validity of the "Geometrical Land" learning media. This research consisted of three validators' material expert validation and three validators' media expert validation. The indicators used in this research are as table 1.

Table 1. Material Expert Assessment Indicators

No	Aspect	Indicator	Number of Items	Item No
1.	Curriculum	1) Identity	3	1,2,3,
		2) Learning indicators/outcomes		
		3) Learning Objectives		
2.	Material	4) Material collapse	5	4,5,6,7,8
		5) Suitability of Material Content		
		6) Interactiveness		
		7) Clarity of material		
		8) Ease of understanding the material		
3.	Language	9) Clarity of Information	4	9,10,11
		10) Use of Language		
		11) Readability		
4.	Evaluation	12) Suitability of questions to learning objectives	3	12, 13, 14
		13) Use of question language		
		14) Clarity of assessment		

Table 2. Media Expert Assessment Indicators

No	Aspect	Indicator	Number of Items	Item No
1.	Cover Design	1) The background matches the content of the material	5	1,2,3,4,5
		2) Color composition		
		3) The figure/characters match the background		
		4) Suitability of font type, font size and color settings.		
		5) Suitability of image and text object settings.		
2.	Text Design	6) Suitability of type, color, spacing and font size	5	6,7,8,9,10
		7) The accuracy of the sentences used		
		8) Accurate use of the sentence balloon effect in writing		
		9) Match the color of the text with the background		
		10) Balance between text and images		
3.	Image Design	11) Suitability of the image to the material	5	11,12,13
		12) Quality of images presented		
		13) Layout the image with the material		

The data analysis technique used is the quantitative data analysis technique. The results of validation data obtained from media experts and material experts are in the form of scores. Data analysis resulting from validation by material experts and media experts is as follows:

1. Calculate the total score obtained from the validation results of material experts and media experts with the assessment criteria according to (Riduwan, 2013:13) as follows.

Table 3. Assessment Criteria

Rating	Score
Very Good	5
Good	4
Not Good	3
Not Good	2
Very Not Good	1

Source: (Riduwan, 2013)

2. Calculate the percentage of validation results based on the validation questionnaire obtained from the validator, using the formula according to (Riduwan, 2013) as follows:

$$P\ (\%) = (\text{obtained score})/(\text{maximum score}) \times 100\%$$

3. Changing the score results into qualitative form, referring to the validity categories according to Sa'adun Akbar (Sa'dun Akbar, 2013:82) as follows:

Table 4. Validity Categories According to Sa'dun Akbar

Achievement of Values (Scores)	Validity Category
81,00%-100,00%	Very valid, very effective, very complete, and can be used without correction
61,00%-80,00%	Quite valid, quite effective, quite complete, but needs small improvements.
41,00%-60,00%	Invalid, less effective, less complete, needs major improvement, it is recommended not to use it.
21,00%-40,00%	Invalid, ineffective, incomplete, cannot be used.
00,00%-20,00%	Very invalid, very ineffective, very incomplete, not usable.

Source: (Sa'dun Akbar, 2013)

4. Analyze the validity of the "Geometrical Land" learning media based on validity categories to determine whether the learning media is valid to use or still needs revision. The "Geometrical Land" learning media will be declared valid if the percentage of validity score calculation results shows a figure in the range of 81.00%-100.00% by the percentage category guidelines (Sa'dun Akbar, 2013).

RESULTS AND DISCUSSION

This research is part of development research with the ADDIE development model, namely Analysis, Design, Development, Implementation, and Evaluation, which is limited to the development stage only. The stages carried out in this research include the analysis stage, design stage, and development stage. The analysis stage is carried out by analyzing student and teacher needs. Students often consider mathematics as a subject matter that is unpleasant and difficult to understand. Mathematics is often considered a science whose content is only symbols, numbers, and confusing formulas, and the experience of learning mathematics is less enjoyable (Mashuri, 2021) and many of them find it difficult to visualize abstract mathematical objects such as in the scope of geometry, flat-sided geometric material. Teachers, in the geometry learning process, also feel the need for learning media that makes it easier for students to understand the geometry material being taught. So, there needs to be a solution to solve this problem. The role of teachers in creating learning media that is creative, innovative, interesting, and easy for students to understand is very necessary.

Apart from determining the problems faced by students, the researcher also analyzed the character of class VIII students at SMP Muhammadiyah 3 Semarang City using open interviews. This analysis is needed to design learning media, students will more easily understand learning if it is linked to real situations in everyday life. By the results of the students' analysis, the researchers decided to create the learning media "Geomerical Land", a material for building flat-sided spaces with a contextual approach.

In the design stage, analysis of student needs at the analysis stage is used as a design material for the development of the learning media product "Geometrical Land". At this stage, the researcher created a learning media design based on students' needs, the "Geometrical Land" learning media was designed according to the material that students would study, material for flat-sided spatial shapes taken from book literature and the internet. Preparing the "Geometrical Land" learning media requires a scenario. The scenarios are arranged in the form of flowcharts and storyboards, with the aim that the "Geometrical Land" learning media is arranged neatly and systematically.

Create Flowcharts

A flowchart is a program flow, a process of a program that is created starting from the start. The flowchart of the "Geometrical Land" learning media is as follows:

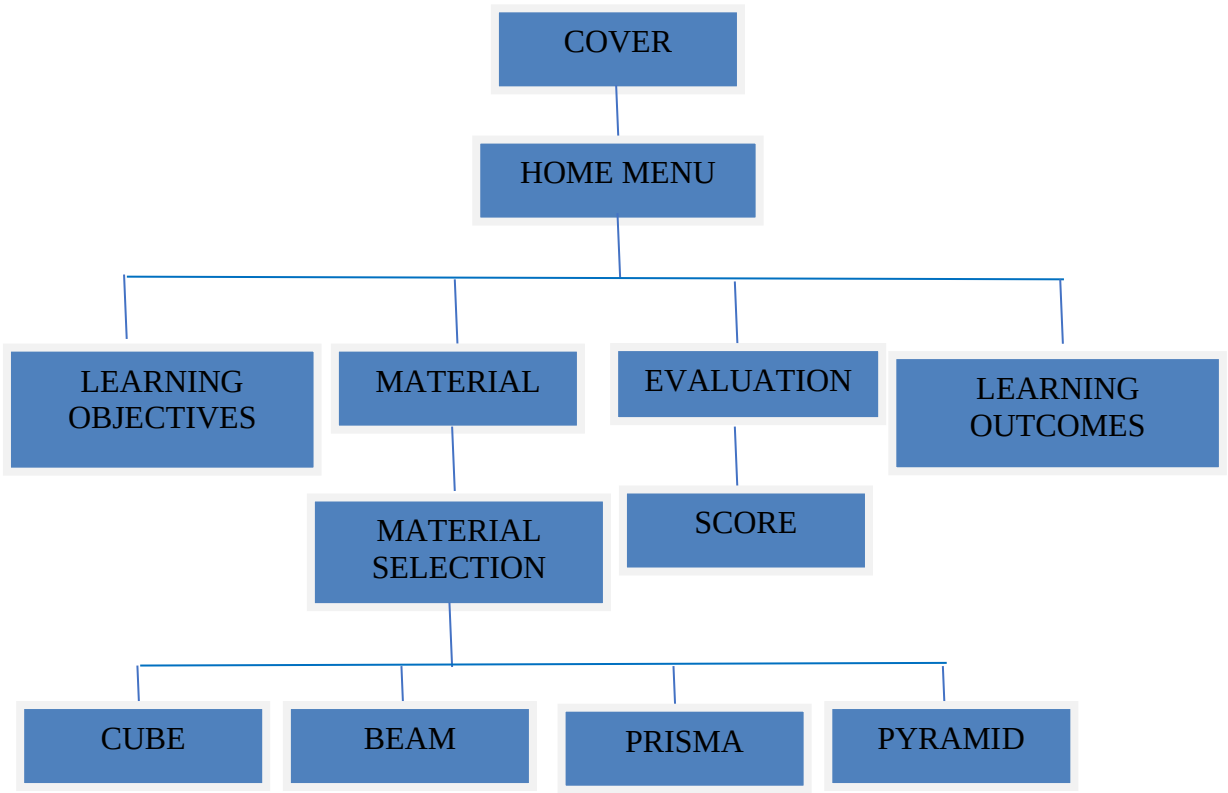
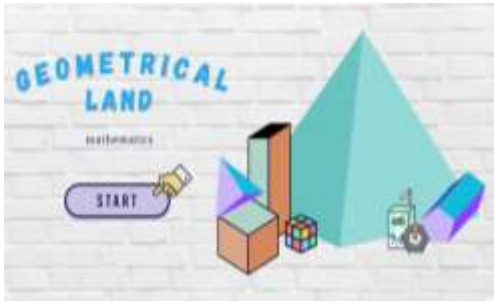
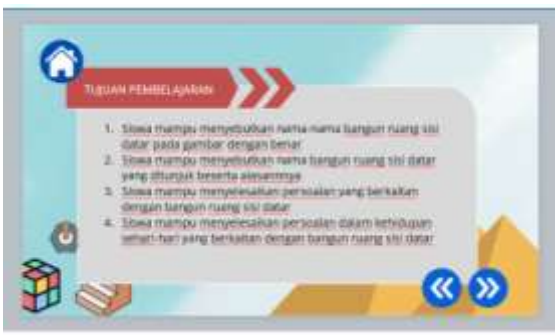


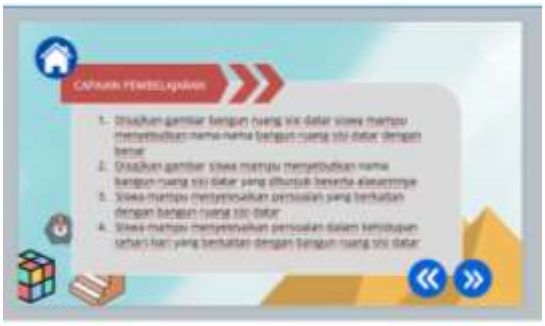
Chart 1. Flowchart of "Geometrical Land" learning media

Create Storyboards

The storyboard is a description of each flow in the flowchart. The storyboard for the "Geometrical Land" learning media is as follows:

Table 5. Storyboard for learning media "Geometrical Land"

No	Part	Visual	Audio
1		Cover contains: -title -start	Accompaniment Backsound
2		The login menu contains: -input name -input from school	Accompaniment Backsound
3		The home menu contains: -learning objectives button -learning achievement button -button material -evaluation button	Accompaniment Backsound
4		Learning objectives	Accompaniment Backsound

No	Part	Visual	Audio
5		Learning Outcomes	Accompaniment Backsound
6		Evaluation questions begin with instructions for working on the questions.	Accompaniment Backsound
7		The material selection menu contains: -cube selection -beam selection -prism option -limas option	Accompaniment Backsound
8		Slides contain learning media material: cubes, blocks, pyramids, prisms	Accompaniment Backsound

No	Part	Visual	Audio
9		Slide of the results obtained from the evaluation questions	Accompaniment Backsound

Once designed, the "Geometrical Land" learning media enters the development stage. The learning media "Geometrical Land" was created using the articulate storyline 3 application software on a laptop or PC.

Learning media is said to be suitable for use if it has gone through a feasibility test (validation). Validation tests have several assessment criteria that must be met. Whether a learning media is valid or not depends on the test results obtained. Validation is carried out by experts in the field. Validators are expected to be able to provide input suggestions to improve the quality of the learning media being developed. In the "Geometrical Land" learning media, validation was carried out by three material experts and three media experts. Material expert validation was carried out by 3 validators. Media expert validation is carried out by 3 validators. Aspects of material validation include curriculum aspects, material aspects, language aspects, and evaluation aspects. Media validation aspects include cover design, text design, and image design. The validation results that researchers have carried out for the "Geometrical Land" learning media with a contextual approach are as follows:

Table 6. Material Expert Validation Results

No	Rated aspect	Score Frequency		
		1	2	3
1	Curriculum Aspects	15	14	9
2	Material Aspects	24	22	19
3	Language Aspects	15	14	12
4	Evaluation Aspect	14	12	11
	Total score:	68	62	51
	Maximum total score:	70	70	70
P (%)	$= \frac{Maximum\ total\ score}{maximum\ score} x\ 100\%$	97,14%	88,57%	72,85%
	Average percentage		86,18%	

The average percentage of data obtained from calculating the validation results of material experts is 86.18%. This states that the "Geometrical Land" learning media is 'very valid' for use following the achievement level conversion according to (Sa'dun Akbar, 2013).

The input suggestions for improvement from material experts for the "Geometrical Land" learning media are as follows:

Table 7. Suggestions for Improvement from Material Experts

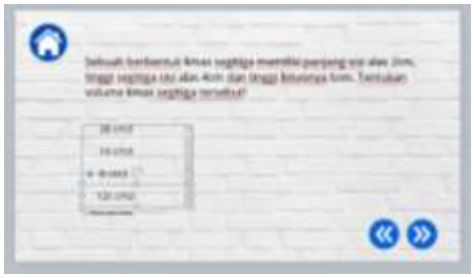
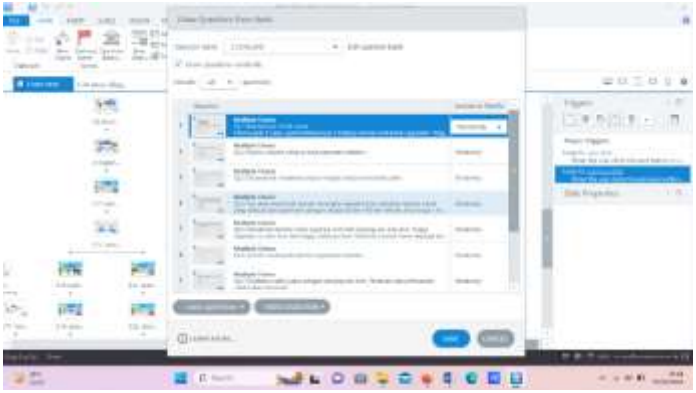
No	Suggestions/input for improvements	Improvement Results
1	Learning outcomes & learning objectives have been revised and adjusted slightly	 
2	Added example questions	
3	Answer choices are adjusted to the level portion if junior high school means there are 4 multiple choices	
4	Results Slides use Indonesian	

Table 8. Media Expert Validation Results

No	Rated aspect	Score Frequency		
		1	2	3
1	Cover Design	25	18	19
2	Text Design	25	19	22
3	Image Design	14	11	12
	Total score:	64	48	53
	Maximum total score:	65	65	65
P (%)	$= \frac{Maximum\ total\ score}{maximum\ score} x\ 100\%$	98,46%	73,84%	81,53%
	Average percentage		84,61%	

The average percentage of media expert validation results calculations is 84.61%. This states that the "Geometrical Land" learning media is 'very valid' for use but needs minor improvements following the conversion of achievement levels (Sa'dun Akbar, 2013). The input suggestions for improvement from material experts for the "Geometrical Land" learning media are as follows:

Table 9. Suggestions for Improvement from Media Experts

No	Suggestions/input for improvements	Improvement Results
1	Loading & switching between slides is accelerated	
2	The questions presented are random	

No	Suggestions/input for improvements	Improvement Results
3	Learning media can be accessed via links/barcodes, applications are created that can be accessed by Android and laptops/computers	Link: http://bit.ly/geometricalandmp Barcode:  Application 

The learning media "Geometrical Land" is a mathematics learning media for flat-sided geometric material with a contextual theme that contains flat-sided geometric material complete with characteristics, elements, calculation formulas, and practice questions. Geometrical Land is presented with a contextual theme, with a contextual approach students will easily understand the learning material because it is linked to the context of everyday life (Ridwan et al., 2023; Mawarsari et al., 2024). Learning with a contextual approach makes learning refers to student activities that can later build knowledge, not just memorizing Suyanti (Suyanti, 2011). The "Geometrical Land" learning media is also accompanied by accompanying music and is equipped with animated images of teacher characters, Kim, et al. stated, "Animation may be more interesting and motivating". The "Geometrical Land" learning media can be accessed via link/barcode or also via the Geometrical application Land (for Android users). The learning media "Geometrical Land" was made based on Android as a learning support to make learning easier for students (Mahuda et al., 2021).

CONCLUSION

Based on the research results that have been confirmed, it can be concluded that: (1) The research is part of development research with the ADDIE development procedure which only reaches the development stage. This development research produces the learning media "Geometric Land" which contains spatial building material. flat side, accompanied by contextual images, teacher animations, and evaluation questions that can directly show the value of the results of the work. (2) The (analysis) stage is carried out

by analyzing student needs. Students often consider mathematics as an unpleasant subject matter and difficult to understand. The (design) stage creates a design for learning media that will be made based on students' needs, the "Geometrical Land" learning media is designed according to the material that will be studied by students, and the flat-sided building material is taken from book literature and the internet. The development stage of the "Geometrical Land" learning media was tested for validity by three material experts and three media experts. Aspects assessed by material experts include curriculum aspects, material aspects, language aspects, and evaluation aspects. Media validation aspects include cover design, text design, and image design. (4) The average percentage of material experts' validity test results was 86.18% and media experts showed 84.61%. This states that the learning media "Geometrical Land" is 'very valid' for use according to the conversion level of achievement.

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