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Development of Mathematics Learning Media using Visual Basic based on STEAM Educatio*n*

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Abstract
This development research aims to develop mathematics learning media using visual basic based on STEAM education and to describe the quality of the media based on aspects of validity, practicality, and effectiveness. This is development research with the ADDIE model, which includes 5 stages: analysis, design, development, implementation, and evaluation. The instruments in this research consist of media assessment sheets by the material expert, media expert, and teacher used to measure validity; response questionnaires to the media and learning implementation observation sheets used to measure practicality, and learning outcomes test used to measure the effectiveness of the media. The respondents of the product trial were students of grade VIII. The results show that the assessment by a material expert, media expert, and teacher obtained very good criteria to declare the media valid. The results of the questionnaire data analysis of teacher and student responses to the media were categorized as very good. The observation of the implementation of learning also shows a very good classification so that the media is declared practical. The percentage of classical completeness of the student learning outcomes test reached 83.3%, so the media was declared effective.

Keywords*: Development; Visual Basic; STEAM; ADDIE.*

INTRODUCTION

Mathematics is one part that plays an important role in the world of education. As evidence, mathematics is a subject taught at elementary, junior high, senior high, and college levels. *Mathematics* is a science that is obtained from the learning process results, which are obtained by reasoning or thinking (Zebua, 2020). In learning activities, each mathematics' subject has various levels of difficulty. Mathematics has the abstract object of conversation.

One of the mathematical materials that have abstract properties is geometry, especially in the material of solid figures. Abstract geometric shapes are thought objects with perfect shapes and sizes (Hudanagara & Anita, 2018). The subject matter in geometry that is taught to students in grade VIII is a solid figure. The geometry of space is the set of all points, lines, and planes in a three-dimensional space located in a closed section, along with all the surfaces that limit it (Yayuk & Prasetyo, 2019). The types of spatial geometry include cubes, cuboids, prisms, and pyramids. Among various mathematics branches, geometry is the most concern (Nurani et al., 2016).

Difficulties in learning geometry cause an imperfect understanding of geometric concepts, which hinders the process of further learning geometry. Sutama et al. (2014) suggest that students' geometry test results are less satisfactory compared to other mathematical materials, especially on a spatial structure. The weakness of students in the material of spatial structure can also be seen in the results of PISA 2012, which show that students are weak in geometry, especially in understanding space and

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shape (Muslimin & Sunardi, 2019). Therefore, a renewal is needed from the teacher as a facilitator in the learning process in the classroom.

Utilizing learning facilities and infrastructure, such as the use of learning media, can help teachers to create a more engaging learning atmosphere. Learning media are everything that is used to channel messages from the sender to the recipient to stimulate the thoughts, feelings, attention, interests, and willingness of students in such a way that the teaching process occurs to achieve learning objectives effectively (Prayoga, 2018). The presence of media in learning is one of many things. Nevertheless, the use of media in learning can make a significant contribution to achieving learning objectives. Mathematics learning media can be developed using the *Visual Basic* 6.0 application program.

Visual basic is one of the computer programming languages (Aminudin, 2016). With the existence of Microsoft Visual Basic 6.0, it is easier for programmers to create programs that are familiar to users because they use visualizations and animations as well as an attractive appearance to look. So, it is hoped that using computers in visual basic can make it easier for students to understand and master abstract material, especially polyhedrons.

Several studies have been conducted related to the development of visual basic. Rosmayanti and Zanthy (2019) developed visual basic application powerpoint-based learning media used in the learning process on two-variables linear equation system material. Rohaeti, Bernard, and Novtiar (2019) developed a visual basic application of the probability material to show that the media is suitable for classroom learning.

In addition, Kuswanto (2017) researches the development of counting games using visual basic 6.0 in mathematics subjects. The research results show that the counting game product is declared good based on the assessment by the experts. In comparison, the respondents gave a very good response because with the application of counting games, the learning process is not dull, and students can learn while playing.

The media can be integrated with learning approaches in developing visual basic-based mathematics learning. One of the learning approaches that can be used is the science, technology, engineering, art, and mathematics (STEAM) approach. STEAM is the development of STEM, which focuses on applying science, technology, engineering, and mathematics through art or design (Sudarmin et al., 2021). Not only increasing students' knowledge of art and beauty, but STEAM education can also improve students' mathematical operation skills, ability to make designs, and imagination skills about space, which can encourage students to have innovative abilities that cannot be obtained from traditional/conventional learning (Sudarmin et al., 2021).

This research focuses on developing mathematics and learning media using visual basic based on STEAM education for junior high school students in the material for a polyhedron, especially cubes and cuboids. This study aims to develop and describe the quality of learning media in terms of validity, practicality, and effectiveness.

METHOD

This research is a development using Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model. The respondents of the product development trial were students of SMPN 10 Selayar. This research was carried out during the COVID-19 pandemic, so the subjects were selected based on the distance from the school.
Data collection techniques used to develop learning media are validation sheets, observations, questionnaires, and tests. The research instruments used were (1) media assessment sheets by media experts, material experts, and teachers used to measure validity, (2) learning implementation

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observation sheets, teacher response questionnaires, and student responses used to measure the practicality of the media, and (3) learning outcomes tests used to measure effectiveness. Furthermore, there are learning tools in the form of lesson plans and student worksheets.

Data Analysis of the Validity of Mathematics Learning Media

The assessment sheet is a tool to measure the validity quality in the form of completeness of content, objectives, writing format, language, and instructional and technical aspects. The data from the assessments of media experts, material experts, and mathematics teachers were analyzed using equation 1.

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} \quad (1)$$

where,

$\bar{x}$: the average score obtained

$\sum_{i=1}^{n} x_i$: the number of scores obtained by the-i

n : the number of questions

Table 1. Criteria for Validity and Practicality of Learning Media

Interval	Criteria
$x > 4{,}2$	Very Good
$3{,}4 < x \leq 4{,}2$	Good
$2{,}6 < x \leq 3{,}4$	Average
$1{,}8 < x \leq 2{,}6$	Deficient
$x \leq 1{,}8$	Unsatisfactory

(Widoyoko, 2009)

The research product in the form of developed mathematics learning media declares valid qualifications if the average score of the assessment of media experts, material experts, and mathematics teachers on the developed media reaches a minimum criterion of good.

Practical Data Analysis of Mathematics Learning Media

The questionnaire instrument for teacher and student responses to the media aims to determine the quality of practicality based on teacher and student responses to the benefits and ease of using media. The assessment is done by calculating the average score using equation (1). Furthermore, the average score was converted into five-scale qualitative data referring (Widoyoko, 2009), as presented in Table 1. The criteria for assessing the implementation of learning are shown in Table 2.

Table 2. Assessment Criteria for Implementation of Learning Activities

Percentage Range	Criteria
$p \geq 90\%$	Very Good
$80\% \leq p < 90\%$	Good
$70\% \leq p < 80\%$	Average
$p < 60\%$	Deficient

(Sudjana, 2013)

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The developed learning media declare the practical classification if the media provides convenience to users, and the average score of teacher and student questionnaire responses to the media declare the minimum criteria in good. The average percentage of the implementation of learning activities declares the minimum criteria in good.

Data Analysis of the Effectiveness of Mathematics Learning Media

The effectiveness analysis was carried out using a learning outcome test. The analysis was carried out by calculating the average score of students, then counting the number of students who passed the minimum criteria of mastery learning. These namely students scored more than or equal to 75 based on the school's minimum criteria of mastery learning. After that, the percentage of classical completeness using formula 2.

$$p = \frac{L}{n} \times 100\% \quad (2)$$

where,

p : the percentage of students passing classically
L : The number of students who passed the minimum criteria of mastery learning
n : the number of students

Then the data is converted into qualitative data using the assessment criteria presented in Table 3.

Table 3. Criteria for the Effectiveness of Learning Media

Interval	Criteria
$80\% < p$	Very Good
$60\% < p \leq 80\%$	Good
$40\% < p \leq 60$	Average
$20\% < p \leq 40\%$	Deficient
$p \leq 20$	Unsatisfactory

(Widoyoko, 2009)

The media quality is said to be effective if the experts and users declare that the media is effective and provides results that align with expectations.

RESULT AND DISCUSSION

Analysis

Student Characteristics Analysis

Observations during learning show that students can solve problems well, especially in everyday contexts. However, students still need help from teachers and media assistance in mathematics learning activities to understand the material being studied well. Students can easily understand the matter that is real and concrete, especially in everyday life. Students' ability to operate computers is also quite good, such as turning on the computer, opening applications, typing, and turning off the computer along with current technological developments.

Situation Analysis

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During the pandemic, face-to-face learning at each school in the Selayar Islands Regency was not allowed to be carried out and is still online (on the network). According to the direction of the principal, the research is carried out at home with the condition that it follows the health protocol and the number of students is not more than six people. The laptop used in this study is provided with details; two students can use one laptop.

Curriculum Analysis
The curriculum applied to the school is the 2013 curriculum. Adjustment of the content of the material in the learning media is adjusted to the Mathematics book and directs students to be active in learning.

Design

Develop Flowchart
The flowchart is a chart with certain symbols describing the sequence of processes in detail and the relationship between a process (instructions) and other processes in a program.

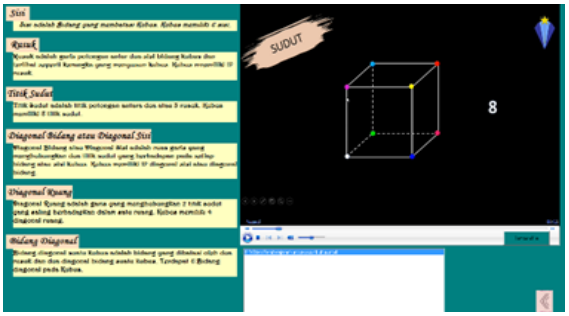
Develop Research Instruments
Instruments Research instruments are arranged as a tool to obtain research data. Media assessment sheets by material experts, media experts, and teachers to measure the quality of media validity. The teacher's response questionnaire to the media, the student's response questionnaire to the media, and the learning implementation observation sheet were used to determine the practicality of the media. The student learning outcomes test measures the effectiveness of learning the media.

Composing Materials and Practice Questions
The material text consists of polyhedron material, especially cubes and cuboids. To train students' ability to understand the material on the media, questions are also compiled that are included in the developed media. Practice questions are given to measure the extent to which students understand the material in visual basic.

Making Lesson Plans and Student Worksheets
Learning Tools include time allocation, competency standards, basic competencies, indicators, learning objectives, material descriptions, steps for learning activities, tools, the media, and learning resources. Learning tools consist of a lesson plan equipped with student worksheets as a forum to train students' understanding of the material obtained.

Development

Making Visual Basic Learning
Media The developed learning media contains various activities grouped into five main menu options: instructions, competencies, materials, exercises, and profiles.-based mathematics learning media visual basic is presented in Figure 1.



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(a) (b)

Figure 1. Mathematics Learning Media Display Visual Basic

Validation of Learning Media

Media assessment aims to measure the validity of the media and obtain input or improvements to the developed learning media. Media assessment also aims to determine the content and objectives, instructional quality, and technical quality of visual basics to be applied in schools. That is in line with Nieveen's reference, which declares that the learning media developed is said to be valid if the media developed is based on a strong theoretical foundation (content validity) and internal consistency between media components (construct validity) (Aufa et al., 2021).

There are several improvements made according to the advice of experts and mathematics teachers. Some sentences have nothing to do with the material displayed, the description is too long, and the media coverage is not presented. In addition, it is recommended to present a display that attracts students' attention at the beginning of learning so that students explore first.

Implementation

Learning Media Trial

The product trial was carried out on class VIII SMP students, totaling six students, with one laptop unit used by two students. The trial was carried out for four meetings, and one test of student learning outcomes was used to measure the effectiveness of developed mathematics learning the media.

Observation of Learning Implementation by Observer

In each trial, *the observer* will record and observe all situations when learning occurs. Observations through the observation sheet on the implementation of learning play an important role in measuring the practicality of the ease of using media by teachers and students during the learning process.

Evaluation

Evaluation is carried out at each stage of development. The evaluation is in the form of input and revision in each stage of development. Evaluation of product quality carried out by material experts, media experts at development, and teachers at the implementation.

In addition, an evaluation was carried out on whether the use of learning media was practical by observing the observer's observations and filling out questionnaires for the responses of students and teachers to the learning media. An evaluation was also carried out on whether the use of learning media was effective in implementing the learning outcomes test. Data analysis results of learning observation sheets are presented in Table 4.

Table 4. Details of Learning Activities with Visual Basic

Meeting	**Percentage**	**Criteria**
First Meeting	85,7%	Good
Second Meeting	100%	Very Good
Third Meeting	100%	Very Good
Fourth Meeting	100%	Very Good
Average Overall	96,43%	Very Good

Table 4 shows that the media trials went smoothly at the second, third, and fourth meetings. Meanwhile, at the first meeting, students had difficulties when they wanted to find and running learning videos.

Filling Out Questionnaire Responses of Teachers and Students to Media

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The following are the results of the questionnaire analysis of teacher responses *to* visual basics presented in Table 5.

Table 5. The Results of Questionnaire Analysis of Teacher Responses to Media

Aspects		**Average Score**	**Criteria**
Quality Content and Objectives	Accuracy	5	Very Good
	Satisfaction	5	Very Good
Instructional Quality	Curiosity	4	Good
	Spirit	4	Good
Technical Quality	Ease	4,5	Very Good
	Interest	4	Good
Overall Average		4,42	Very Good

Table 5 shows that the learning media developed conveys the material of solid figures appropriately and can attract students' attention so that the learning process is not tedious.
The following are the results of the questionnaire analysis of student responses to the visual basic presented in Table 6.

Table 6. The Results of Questionnaire Analysis of Student Responses to Media

Aspects		**Average Score**	**Criteria**
Quality Content and Objectives	Pleasure	4,92	Very Good
	Interest	4,75	Very Good
Instructional Quality	Activity	4,84	Very Good
	Seriousness	4,83	Very Good
Technical Quality	Convenience	4,67	Very Good
	Interest	4,83	Very Good
Overall Average		4,8	Very Good

Table 6 shows that during the learning process using media, students feel happy and become active when learning by using visual basic. That matter indicates that the quality of the developed media in practicality declares practical qualifications based on the implementation of learning, teacher responses, and student responses to the media.
The following are the results of the analysis of student learning outcomes, presented in Table 7.

Table 7. The Description of Student Learning Outcomes Test

Description	**the Test Group**
Number of Subjects	6
Average score	80,67
Number of students who completed	5
Number of students who did not complete	1
Percentage of completeness	83,3 %
Maximum score	90
Minimum score	74

The completeness criteria for mathematics in junior high school is 75. Students are said to be complete if they get a score ≥ 75. Table 9 shows that five students have completed and only one is incomplete, and the percentage of completeness obtained classical is 83.3% with very good criteria. So the visual basic learning media developed is declared effective and can be used in the mathematics learning process, especially in the material for polyhedrons.

CONCLUSION

Mathematics learning the media using visual basic based on STEAM education declare valid qualifications based on the media assessment criteria by material and media experts, obtained an average score of 4 out of a maximum score of 5 with good criteria. Media assessment by the teacher obtained an average score of 4.26 with very good criteria.

The quality of the developed media in terms of practicality declares practical qualifications in the form of ease of use. The data from the teacher and student response questionnaires obtained average scores of 4.42 and 4.8, with very good criteria. The learning implementation observation sheet of media use obtained a percentage of 96.43%, with very good criteria. Thus, the media is declared practical.

The media quality is said to be effective if the experts and users declare that the media is effective and provides results that align with expectations. The effectiveness of the media can be measured by conducting a test of student learning outcomes. The percentage of classical completeness is 83.3%, with very good criteria, so the media is declared effective.

The development of learning the media carried out has met the valid, practical, and effective qualifications. That shows that mathematics learning the media using visual basic based on STEAM education is feasible to be used as a learning resource in the learning process.

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