



DEVELOPMENT OF MATHEMATICS TEACHING MATERIALS WITH TRIGONOMETRIC RATIO WITH ADDIE MODEL REVIEWED FROM STUDENTS' LEARNING RESULTS AT PUBLIC SENIOR HIGH SCHOOL 1 TILAMUTA

¹Nursam, Evi Hulukati², Ismail Djakaria³

S2-Mathematics Education Study Program

State University of Gorontalo, Indonesia

Email: nursam1987@gmail.com

Article history:	Abstract:
Received: 10 th June 2022 Accepted: 10 th July 2022 Published: 14 th August 2022	This study aims to determine (1) the validity of mathematics teaching materials developed with the ADDIE model in terms of student learning outcomes at SMA Negeri 1 Tilamuta, (2) the effectiveness of mathematics teaching materials developed with the model in terms of student learning outcomes at Public Senior High School 1 Tilamuta, (3) students' perceptions of the implementation of mathematics learning by using teaching materials that have been developed with the ADDIE model. This research is a development research using the ADDIE development model. In this study, 5 development steps were carried out, namely Analysis, Design, Development, Implementation and Evaluation. The products produced in this research are teaching materials. The resulting teaching materials are then validated by material and language experts, design experts and students. The results showed that the developed mathematics teaching materials were declared valid based on the results of the validity test on the aspect of the content of the module. In general, the percentage of validity was 84.76% with the criteria of Very Valid, the systematic aspect of the content of the module, the percentage value of the validity was 79.22% and the criteria were valid. In terms of content coverage, the percentage level of validity is 83.33% with very valid criteria and in the contextual approach aspect, the validity level is only 75% but still in the valid category. For the language aspect, the percentage of validity is 84.17% with very valid criteria, the aspect of delivering module content in general has a percentage of 79.26% and is stated with valid criteria, module content design has a percentage of 82.50% with very valid criteria, while for The typeface, font size and illustrations in this teaching material have a percentage of 80% validity and the criteria are included in the valid category. The effectiveness of mathematics teaching materials for trigonometric ratio materials that have been developed, obtained based on the learning outcomes tests given to students, obtained the Classical Learning Completeness Percentage value of 78.70. Based on the criteria with references that have been proposed previously, the percentage of classical learning completeness obtains the criteria of "Good". Furthermore, the N-Gain test was carried out to obtain an N-Gain score = 0.73. The N-Gain value is included in the High category. Students' perceptions of mathematics teaching materials for trigonometric ratios obtained a figure of 82.22% for the level of acceptance of students in the very good category.

Keywords: Teaching Materials, Trigonometric Rati

INTRODUCTION

Mathematics is one of the subjects that require high concentration to be understood. Mathematics is a subject that contains abstract and deductive knowledge, namely conclusions drawn from certain rules through discussion. In the current learning process, concept planting is prioritized so that children know the role of mathematics in everyday life, Azmi (2017). The Indonesian Encyclopedia states that the term mathematics comes from the Greek "Mathematikos" in exact science or "Mathesis" which means teaching, abstract and deductive knowledge, where conclusions are not drawn based on sensory experience, but on conclusions drawn from certain rules through deduction. So, based on the origin of the word mathematics means knowledge gained by thinking (reasoning). Mathematics is fundamental in many ways that informs certainty in all areas of life. Teaching and learning mathematics is at the heart of education. Learning

mathematics aims to connect school with everyday life, provide skill acquisition, prepare students for the workforce, and cultivate mathematical thinking, Ontario Ministry of Education (in Azmi, 2017).

Learning achievement of students, especially in mathematics, is very far from what is expected. Although in general, the student's report card scores are on average above the Minimum Completeness Criteria (KKM), it is different if these scores are juxtaposed with the National Final Examination scores or School Final Examination scores. There is a very striking gap between the grades listed on the report card and the grades on the student's diploma.

In addition to the problems mentioned above, the world of education is faced with a COVID-19 pandemic situation that requires every individual, both students and teachers, to be at home, limiting all direct interaction activities and activities that cause people to gather. Situations that do not support the stability of learning activities. All aspects related to the implementation of education find it difficult to carry out this process, be it teachers, students and parents. Students find it difficult to complete assignments, while not all parents are optimally able to accompany their children in learning, which in addition to being due to their daily activities, can also be caused by the lack of parental knowledge of learning materials. This of course has an impact on the achievement of student learning outcomes.

One component of the lesson plan that plays an important role in the overall curriculum content is teaching materials. Meanwhile, in terms of students in an effort to obtain optimal learning outcomes, students are required not only to rely on the knowledge or skills that occur in the classroom, but must be willing and able to explore the various teaching materials needed. Teaching materials have the potential as tools, facilities, actors and vehicles to improve the quality of education. Teaching materials are also seen as everything that can provide the possibility to obtain a number of information, knowledge, experience and skills in learning.

Based on what has been described above, the researchers are interested in developing teaching materials to improve student learning outcomes by using the ADDIE model. For this reason, researchers conducted a study entitled "Development of Mathematics Teaching Materials for Trigonometric Ratios with the ADDIE Model in terms of Student Learning Outcomes at Public Senior High School 1 Tilamuta"

METHOD

The method used in this research is development research. The research approach used in this learning model development research is a research and development approach. R&D is a process used to develop accountable educational products.

Stages of Model Development / Product Design Activities

No.	Stages	Activity	Product
1	<i>Analyze</i>	Competency needs analysis, content analysis (learning materials)	The results of field observations about mathematics learning outcomes
2	<i>Design</i>	Set the development type	Instruments of teaching materials to be developed
3	<i>Development</i>	Designing a learning model	Syntax of teaching materials
4	<i>Implementation</i>	Product Trial	Revision of teaching materials
5	<i>Evaluation</i>	Test student learning outcomes	Effective, efficient, and interesting teaching material products

Validation by validators is a requirement before and after teaching materials are tested. The validation results provide information or input that will be used in revising the resulting Teaching Materials so that they are suitable for use. On the validation sheet, the validator writes an assessment of the resulting Teaching Materials. The assessment consists of 5 categories, namely: very less valid (score 1), less valid (score 2), quite valid (score 3), valid (score 4) and very valid (5). The expert validation sheets used in this study were Material and Language Expert Validation, Design Expert Validation Sheets, and Student Validation Sheets. The following is a grid of instruments from each validation sheet.

Table 3.3 Material and Language Expert Validation Instrument Grid

No	Dimension	Indicator	Questionnaire Items	Total
Theory				
1	Contents of the module in general	Material suitability with curriculum	1, 2	2
		Compatibility with thinking stage	3	1
		Material presentation	4,5,6,7	4

2	Systematics of module content	Problems example	8,9,10	3
		Exercises	11,12,13,1	4
		Summary	15,16,17	3
		Evaluation	18,19,20,21,22	5
		Feedback	23	1
		Answer key	24	1
3	Content coverage	Angle measure and the basic concept of angle	25,26,27	3
		Trigonometric ratios / ratios in right triangles	28,29,30	3
4	Contextual Approach	Material linkage with everyday life	31	1
		Application of 7 contextual principles	32,33,34,35,36,37,38	7
Language				
5	Language	Language compatibility with the level of development of students	39,40,41	3
		Grammatical accuracy	42,43,44,45	4
		Vocabulary use and sentences	46	1

Table 3.4 Design Expert Validation Instrument Grid

No	Dimension	Indicator	Questionnaire Items	Total
1	General presentation of the module	Module attraction	1,2	2
		Module convenience	3	1
		Color composition	4	1
		Context fit	5	1
		Physical quality	6,7,8	3
		Module systematics	9	1
2	Module content design	Content layout format	10,11,12,13,14,15,16,17	8
		Font type	18,19	2
		Font size	20,21	2
		Illustration	22,23,24,25,26,27	6

Table 3.5 Student Validation Instrument Grid

No	Dimension	Indicator	Questionnaire Items	Total
1	Contents of the module in general	Content attraction	1	1
		Clarity of module instructions	2	1
		Motivation	3	2
		Module convenience	4,5	2
2	Language	Easy language used	6	1
		Use of language rules	7	1
3	Appearance	Illustration	8	1
		The legibility of the letters used	9	1
		Content layout	10	1
		Use of color	11	1
		Mold clarity	12	1
4	Theory	Material description	13,14	1
		Problems example	15	1

	Exercises	16	1
	Summary	17	1

Learning outcomes test is used to determine the level of mastery of students on the material that has been taught. From the results of this test, it can be seen whether the resulting teaching materials are effectively used in the learning process or not. The lattice of the test instrument is as follows.

Table 3.6 Mathematical Learning Outcome Test Instrument Grid

No	Indicator	Question Points	Amount
1	Describe the relationship between radians and degrees	1	1
2	Describe the relationship of degrees to radians	2	1
3	Explain the sine of a right triangle	3	1
4	Explain the cosine of a right triangle	4	1
5	Explain the cosecant of a right triangle	5	2
6	Explain the secant in a right triangle	6	1
7	Explain the cotangent of a right triangle	7	1

FINDINGS

This research was conducted at Public Senior High School 1 Tilamuta. After the teaching materials have been developed, they are then validated by material and language experts and design experts. The researcher chose four validators for the validation of material and language experts. The validations that have been given by the expert team are as follows.

Table 4.4 Results of Material and Language Expert Validation

Validator	Σx	Σxi	$\frac{\Sigma x}{\Sigma xi}$ /	Percentage	Qualitative Criteria
Expert 1	176	230	0.77	77%	Valid
Expert 2	190	230	0.83	83%	Very Valid
Expert 3	191	230	0.83	83%	Very Valid

Table 4.6 Design Expert Validation Results

Validator	Σx	Σxi	$\frac{\Sigma x}{\Sigma xi}$ /	Percentage	Qualitative Criteria
Expert 1	108	135	0,8	80%	Valid
Expert 2	110	135	0,81	81%	Very Valid
Expert 3	108	135	0,8	80%	Valid

Based on table 4.6 above, it can be seen that the validation by design experts is in the valid category, so it can be concluded that the teaching material products that have been developed are valid in terms of design and can be tested.

After getting recommendations for the validity of the experts, the researchers tested the product in the form of teaching materials that had been made. This stage is carried out at two levels, namely small group trials with 9 students and followed by large group trials with 27 students.

Assess the validity of the material and language by a team of experts as shown in the table below

Table 4.8 Percentage of Material and Language Expert Validation Results

No	Rated aspect	Percentage (%)	Qualitative Criteria
1	Contents of the module in general	84.76	Very Valid
2	Module Content Systematics	79.22	Valid
3	Content Coverage	83.33	Very Valid
4	Contextual Approach	75.00	Valid
5	Language	84.17	Very Valid

As for the design validity, the expert team consisting of two lecturers and 1 teacher produced the percentage as shown in the table below

Table 4.9 Percentage of Design Expert Validation Results

No	Rated aspect	Percentage (%)	Qualitative Criteria
1	General module delivery	79.26	Valid
2	Module Content Design	82.50	Very Valid
3	Font type	80.00	Valid
4	Font Size	80.00	Valid
5	Illustration	80.00	Valid

After completing the trial of the use of teaching materials to students, the researchers distributed questionnaires to students to find out how students perceived the products that had been produced. This validation questionnaire uses an attitude statement consisting of 5 scales. From the results of the analysis obtained the results as in the following table.

Table 4.10 Students' Perception Values

Number of Respondents	Total Score	Criteria Score	P (%)
36	2516	3.060	82,22%

Based on the results obtained, namely 82.22%, it can be concluded that students respond well to the products that have been produced, with very good categories.

DISCUSSION

The final product of this research is in the form of printed mathematics teaching materials for trigonometric ratios for class X. The product development that has previously gone through a validation process is from material and language experts as well as design experts and subject teachers. Suggestions and inputs obtained from the validation process are used to improve and improve the quality of the teaching materials that have been prepared. Furthermore, the product was tested on a small group class of 9 people. The results of the trial analysis stated that the teaching materials were very suitable to be used as a source of learning mathematics for trigonometric ratios. The advantages of the teaching materials that have been developed include being concise and easy to understand, interesting to read and encouraging students to have discussions with friends. While some of the shortcomings of this teaching material, is the trial scale which is only limited to small-scale field trials. This is due to the limitations of the cost and time of the study.

CONCLUSION

Based on the results of the research and discussion that the researchers carried out previously, several conclusions were obtained as follows.

1. Mathematics teaching materials for trigonometric ratios developed with the ADDIE model in terms of learning outcomes of Public Senior High School 1 Tilamuta students can be declared valid based on the results of the validity test on the aspect of the module content in general, the percentage of validity is 84.76% with Very Valid criteria. In the systematic aspect of module content, the percentage value of validity is 79.22% and the criteria are valid. Meanwhile, for the aspect of content coverage, the percentage level of validity is 83.33% with very valid criteria and in the contextual approach aspect, the validity level is only 75% but still in the valid category. And for the language aspect, the percentage of validity is 84.17% with very valid criteria. Meanwhile, for the design validity, the module content delivery aspect generally has a percentage of 79.26% and is stated with valid criteria. The content design of the module has a percentage of 82.50% with very valid criteria, while for the typeface, font size and illustrations in this teaching material it has an 80% validity percentage and the criteria are in the valid category. For this reason, it can be concluded that in terms of material and language and design, teaching materials can be declared valid.
2. For the effectiveness of mathematics teaching materials, the trigonometric ratio material that has been developed, obtained based on the learning outcomes tests given to students, obtained the value of Classical Learning Completeness Percentage of 78.70. Based on the criteria with references that have been proposed previously, the percentage of classical learning completeness obtains the criteria of "Good". Furthermore, the N-Gain test was carried out to obtain a score of $N - Gain = 0.73$. Score The N-Gain is included in the High category. This indicates that the level of effectiveness of the teaching materials used is high in influencing student learning outcomes, especially in mathematics subjects with trigonometric ratios.

3. For students' perceptions of mathematics teaching materials, the trigonometric ratio material that has been developed, researchers have given questionnaires to students to see if students respond well. Researchers obtained a figure of 82.22% for the acceptance rate of students in the very good category.

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