

Understanding Logarithmic Concept: How to Develop LOGAMATHICS Media Validity Instruments?

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ABSTRACT

Background: Understanding the concept of logarithms is very important. However, in fact, logarithmic learning media in secondary schools in the city of Kediri, Indonesia, is still lacking. Based on this, researchers will develop research related to logarithmic learning media (LOGAMATHICS). One of the development stages is the development of a validity instrument to measure the validity of LOGAMATHICS. Therefore, this research aims to develop a feasible LOGAMATHICS validation instrument.

Methods: This research is a type of development research that aims to produce products in the form of validation instruments as a means of assessing validity by expert review. This research uses the ADDIE model combined with Tessmer's Formative evaluation. The ADDIE stage consists of analysis, design, and development while Tessmer is only at the expert review stage. The subject of this research was one expert, namely a mathematics education lecturer with doctoral qualifications. In this study, a content validity approach was used to determine valid criteria based on quantitative assessment by expert review. Validation instruments developed refer to the development of learning media. Data analysis in this study used Aiken's assessment score.

Result: The results at the expert review stage for content validation obtained a score of 0.9111 with a high category.

Conclusion: Based on the evaluation results, it shows that the validation instrument has met the valid criteria.

Keywords: *Validity instrument, LOGAMATHICS learning media, and content validity*

INTRODUCTION

In the world of education, technological developments have greatly influenced all educational activities and have changed traditional learning systems into modern, technology-based ones. Education plays an important role in developing quality and broad-minded HR (Human Resources). One of the important subjects in education is mathematics (1). Because mathematics is universal and realistic that can be applied to other branches of science (2). However, until now mathematics has become a frightening specter for students because the processing steps are too complicated. This can be caused by learning mathematics which is abstract in nature so it makes students difficult to solve mathematical problems (3). Students who experience this difficulty can make mistakes in solving problems in every subject of mathematics.

Based on research (4), it is known that the mistakes made by students occur in conceptual and calculation errors in solving mathematical problems. Conceptual

understanding is a person's ability to understand the meaning of mathematical material, to re-explain the material that has been studied in a rational, coherent, and correct manner, and to be able to apply it in solving everyday problems. Where students will experience difficulties in a higher mathematics learning process if they do not understand the concept (5). Thus, understanding these mathematical concepts is an important basis for thinking and solving mathematical problems.

In 2015 Indonesia was ranked 44th out of 49 countries stated in the TIMSS results (Trend In International Mathematics and Science Study) (6). Logarithm material is also just taught in class X Senior High School, so students are new to logarithm material. Moreover, the many properties of logarithms can cause students difficulties in understanding the concept of logarithms (7). This has proven the low understanding of students in mathematics, especially logarithm material. Logarithmic material also requires conceptual understanding and proper application to solve various problems in real life so logarithms are indispensable for the development of science (8). In addition, the lack of use of learning media is one of the causes of low understanding of mathematical concepts, especially logarithmic material (9).

Media is one of the factors that influence the learning process (10). In the era of technological advances, the Metalathics learning media has collaborated with an Android application that can be accessed via smartphone. Android-based learning media is easier for students to use because it is flexible, attracts students' interest in learning, and can be accessed anywhere and anytime (11). The Metalathics application has several features such as logarithmic materials, learning videos, and minigames. The existence of this application is expected to be able to help students understand the material, especially logarithmic material.

The development of globalization has had a major influence on the world of education. Technology is considered an effort to

improve the quality of education (12). The most popular use of technology in the current era is the smartphone one of which has an Android system. On the Android operating system, there are various application developments to produce representative learning media (13).

In the 2018-2023 range, research discussing the development of technology-based media and information websites, computer-assisted instruction, and Android there are approximately 1,030 studies. There are two types of learning media, namely learning media designed (by design resources) and learning media used (by utility resources). Various objects that are around can be classified into the types of learning media used (by design resources). Compared to the types of learning resources designed, the types of learning resources utilized are far more numerous and varied (14). One of the learning media that can be used by design resources) by the teacher is an Android-based learning media. Android is a mobile operating system whose growth is relatively fast and rapid among other operating systems. Even the majority students or the millennial generation also have Android-based smartphones.

Android-based learning media has many advantages in the learning process, and the results show a significant impact on increasing learning independence (15). The use of Android-based mathematics learning media can be an effort to increase student learning independence in online learning. Android-based learning media or mobile learning can enable the learning process to occur anytime and anywhere. The use of mobile learning can support the learning process and increase flexibility in teaching and learning activities to improve student learning outcomes.

In the process of developing a learning media, validation instruments are needed to find out which media has been developed by learning objectives, learning characteristics, and the suitability of media functions so that the media can be used in learning. Validation is a method to determine the accuracy and

precision of data in research (16). The results of the assessment on the validation instrument will bring up several conclusions such as valid, invalid, or invalid by fulfilling certain categories. This research is development research that aims to produce products in the form of indicators of the validity of LOGHAMATHICS learning media instruments as well as produce validity instruments of LOGHAMATHICS learning media.

MATERIALS & METHODS

This research is a type of RnD research (Research and Development) with the ADDIE development model in collaboration with Tesmer's formative evaluation. The ADDIE development model includes Analyze, Design, Development, Implementation, and Evaluation. In this study, the ADDIE model was used only up to stage development with Tessmer's formative evaluation on stage expert review. Content validity data in this study were obtained from the stage expert review tested by an expert validator in their field. The subject in this study is the validator, while the object of this research is the validity instrument that has been developed. Sources of data and information were obtained from observing validation instruments by modifying learning media development research.

The development steps in this research include: 1) Stage analyze carried out by analyzing the results of observations made by researchers on the validation instruments used in previous research related to the development of learning media, which then obtained several indicators related to the validity of learning media; 2) Stage design aims to design indicators to become validity instruments by preparing the aspects needed in the preparation of validity instruments and researchers begin to develop indicators from the developed validation instruments; 3) Stage development carried out by designing several indicators of the validation instrument that has been made and further developed and evaluated so as to produce a product in the form of a validation

instrument; 4) Stage expert review, This is done by conducting content or content validation involving mathematics education lecturers with doctoral qualifications, so that content validity reflects the extent to which the items in the instrument reflect the substance presented.

An instrument can be said to have content validity if the questions/statements can represent the content/substance of the content domain (17). This aims to determine the validity of the validity instrument that has been developed. Furthermore, this validation sheet was analyzed by researchers using data processing formulas that referred to research (18).

$$V = \frac{\sum s}{[n(c - 1)]}$$

Information:

V = validity

s = the lowest score in the validity assessment

c = the highest score in the validity assessment

n = number of validators or expert lecturers

The index criteria used in this study were taken from (19) namely:

Table 1. Aiken Validity Index Criteria

Aiken Validity Index Range	Validity Criteria
$V \geq 0,8$	High
$0,4 < V < 0,8$	Medium
$V \leq 0,4$	Low

RESULT AND DISCUSSION

Based on the results of the assessment from the expert review, data processing was carried out using Ms. Excel with the Aiken V formula so that a validity score is produced for each item statement in the table as follows:

Table 2. Results of Media Expert Validation Instrument Scores

Statement Points	Validator Value	$\sum s$	n(c-1)	V	Inform
1	4	3	3	1	High
2	4	3	3	1	High
3	4	3	3	1	High
4	4	3	3	1	High
5	4	3	3	1	High
6	3	2	3	0.67	Medium
7	3	2	3	0.67	Medium
8	4	3	3	1	High
9	4	3	3	1	High
10	4	3	3	1	High

Table 3. Results of the Total Score of the Media Expert Validation Instrument

Points	Validator	$\sum s$	n(c-1)	V	Inform
1-10	38	28	30	0.93	High

Table 4. Results of Material Expert Validation Instrument Scores

Statement Points	Validator Value	$\sum s$	n(c-1)	V	Inform
1	4	3	3	1	High
2	4	3	3	1	High
3	4	3	3	1	High
4	4	3	3	1	High
5	3	2	3	0.67	Medium
6	3	2	3	0.67	Medium
7	3	2	3	0.67	Medium
8	4	3	3	1	High
9	4	3	3	1	High
10	4	3	3	1	High

Table 5. Results of the Total Score of the Material Expert Validation Instrument

Points	Validator	$\sum s$	n(c-1)	V	Inform
1-10	37	27	30	0.90	High

Table 6. Results of Expert Practitioner Validation Instrument Scores

Statement Points	Validator Value	$\sum s$	n(c-1)	V	Inform
1	4	3	3	1	High
2	4	3	3	1	High
3	3	2	3	0.67	Medium
4	3	2	3	0.67	Medium
5	4	3	3	1	High
6	3	2	3	0.67	Medium
7	4	3	3	1	High
8	4	3	3	1	High
9	4	3	3	1	High
10	4	3	3	1	High

Table 7. Results of the Total Score of the Expert Practitioner Validation Instrument

Points	Validator	$\sum s$	n(c-1)	V	Inform
1-10	37	27	30	0.90	High

Table 8. Statement of Media Expert Validation Instrument

No.	Statements	1	2	3	4	Comment
1	Ease of operation of media					
2	The instructions for using the media are clear					
3	The choice of colour, size, and type of font/text is appropriate					
4	Colour match <i>background</i> with the colour of the letters/text					
5	The accuracy of the size and location of the navigation					
6	Compatibility of animations and images					
7	The video presentation and <i>game</i> in accordance					
8	The attractiveness of media design					
9	Media provides a pleasant learning atmosphere					
10	User-friendly language					

Table 9. Material Expert Validation Instrument Statement

No.	Statements	1	2	3	4	Comment
1	Suitability of the material with Learning Outcomes					
2	Appropriateness of the material with indicators of achievement of learning objectives					
3	Clarity of discussion of questions					
4	Appropriateness of video material and <i>games</i>					
5	The systematic presentation of the material is clear					
6	Completeness of the material presented					
7	The accuracy of the form of material descriptions, examples and practice questions					
8	The attractiveness of the presentation of the material					
9	Ease of understanding the material					
10	User-friendly language					

Table 10. Expert Practitioner Validation Instrument Statement

No.	Statements	1	2	3	4	Comment
1	The material according to the indicators of achievement of learning objectives					
2	The systematic presentation of the material is clear					
3	The accuracy of the description of learning video material and <i>mini games</i>					
4	Completeness of the material presented					
5	Clarity of question formulation					
6	Compatibility of images and animations					
7	The choice of colour, size, and type of font/text is appropriate					
8	Ease of operation of media					
9	The attractiveness of media design					
10	User-friendly language					

From the results of the validity of each item that has been tested by an expert validator, it shows that the overall content validity is 0,9111 which lies at intervals > 0.8 within the V Aiken scoring range. This shows that the validity of the validation instrument product that has been developed is included in the high category based on the category from Aiken mentioned in (19, 20).

Research conducted by researchers is limited to fulfilling the eligibility criteria based on the content validity of the instrument as previously described within the limitations of the research problem. The evaluation stage was also not carried out because it relates to the overall evaluation of each stage formatively and summatively so the effectiveness of the product cannot be determined yet.

CONCLUSION

Based on the results of the development research that has been carried out, it can be concluded that the validation instrument for the expert review of the developed validity instrument meets the valid criteria based on the assessment of content validity by the expert review. The validity was obtained at the expert review stage with Aiken's data analysis, the yield coefficient was obtained at 0,9111. From the quantitative data, the validation instrument product for expert review is included in the high category based on the Aiken score category table so that this instrument is declared valid or feasible.

Declaration by Authors

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