DEVELOPMENT OF INTERACTIVE MULTIMEDIA LEARNING MATHEMATICS LEARNING MEDIA USING ADOBE FLASH CS6

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Abstract. Ongoing advancements have profoundly reshaped the development of educational media, with validity being a pivotal factor in creating high-quality products, representing a critical phase in their development. In essence, validity holds a key position in the production of superior educational materials. The primary objective of this study is to design and assess the validity of interactive multimediabased mathematics learning tools using Adobe Flash CS6. This research belongs to the category of Research and Development (R&D) or developmental research. The methodology adopted for this developmental research follows a modified Plomp procedure, involving three of its five stages: the initial investigation phase, the development phase or prototyping, and the assessment phase. To gauge the validity of the media, the research employs a validation sheet as the data collection instrument. The analysis process entails scoring based on assessments made by the validator. The outcomes of the validation testing indicate that the media is deemed highly valid, achieving an impressive validation rate of 90.59%. The media is now deemed ready for use with only minor revisions required. One notable advantage of this learning media is its compact size, ensuring compatibility with all computer types, including those with low specifications.

Keywords: Development, Learning Media, Interactive Multimedia, Adobe Flash CS6

1. INTRODUCTION

The very rapid development of technology and science makes the lifestyle and global order change rapidly [1]. Rapid technological advances have made very rapid changes, including in the world of education [2], [3], [4]. Education is one of the foundations of human rights where all have the right to education which aims to build life and live with dignity [5]. Education is also an important tool in the progress and development of the nation and has been proven by developed countries in the world [6]. Education is expected to be able to create a quality generation so that it is able to face and respond to the challenges of an ever-changing era [7].

Mathematics is a subject that must be taught at all levels of education, from elementary schools to tertiary institutions [8]. Mathematics is an interdisciplinary subject, because mathematics deals with all aspects of everyday life [9]. The goal of learning mathematics is not only to make students work on the given questions, but the teacher

must focus on concepts that must be mastered by students [10]. Given the importance of teaching mathematics, teachers must be able to train students in learning mathematics so that learning objectives in school can be achieved [11].

Based on OECD (Organization for Economic Coorperation and Development) data, Indonesia is ranked 64th out of 65th countries with a score of 375, even though the average score of mathematical literacy is 494 [12]. Therefore, there needs to be new innovations in improving students' mathematical abilities, one of which is by developing interactive multimedia-based media. Interactive multimedia can present material that is efficient, effective, and attractive so that it can help students achieve targeted learning outcomes [13].

Technological progress in the era of the Industrial Revolution 4.0 has progressed very rapidly, and there is no need to doubt it [14]. The times are increasingly sophisticated, and technology is developing very rapidly. It makes it easier for humans to do their work, both office work and other jobs. In the current era of globalization, classes have started to design technology-based learning, either with books, media, or software [15]. The times have also made teaching and learning technology more sophisticated. This is evidenced by the number of applications that can help teachers and students learn. One application that helps teachers in teaching and learning is an audio-visual application, namely Adobe Flash *Cs6*.

Adobe Flash is an animation program that supports programming with programming languages or ActionScript [16]. The Adobe Flash application is a graphic animation that is widely used by designers to produce professional work, especially in the animation field [17]. Adobe Flash Cs6 is an application for creating interactive learning media that is not difficult to function and can be used by everyone, with several advantages, namely having several features, namely a link between animation, images, video, and sound together and can be of high extension, so that The learning media can be stored on a laptop to make it more practical [18]. By using the Adobe Flash CS6 application, teachers can develop learning media such as games, media, interactive teaching materials, and others [19].

Research conducted by Sukariasih et al., (2019) entiled "The Development of Interactive Multimedia on Science Learning Based Adobe Flash CS6", The results showed that the results of the validation on the learning media got a score of 76.56% with the valid

category and the media was ready to use. In addition, research conducted by Sabtu et al., (2019) entiled "Development of Digital Information Management Learning Media Based on Adobe Flash in Grade X of Digital Simulation Subject", shows that the final result of interactive multimedia validation on the design aspect is 91.67% and the content aspect is 91%, in other words that the media is very valid and ready to use Based on the background previously described, the researcher will try to develop interactive multimedia-based mathematics learning media using the Adobe Flash Cs6 software.

2. RESEARCH METHOD

This type of research is R&D (Research and Development) research. Development research is a research model directed at developing commercial products [22]. The development model that will be used in this research is the Plomp development model which consists of three phases, namely the preliminary phase, the development phase or prototyping, and the assessment phase [23]. At the stage of making preliminary observations for the basis of developing interactive multimedia-based learning media using Adobe Flash Cs6 on the material of linear one-variable equations and inequalities. After that, the learning media will be validated by four validators consisting of media experts and material experts using validation sheets. As for the scale of assessment for instructional media, researchers will use the Likert scale found in table 1.

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Validity Category	Description	
Very Good	4	
Good	3	
Less Good	2	
Not Good	1	

Table 1. Categories of the Validation Sheet Assessment Scale

Source: [24]

After filling in the validation sheet by the validator, then the data will be calculated to obtain descriptive validity data. The formula for calculating descriptive validity data uses the following formula:

$$Va_i = \frac{TSe}{TSh} \times 100\%$$
 (Source: [25])

To find out the final result of the validity of the media from the validator, it will be calculated using the mean formula. The final validation formula is as follows:

$$V = \frac{Va_1 + Va_2 + Va_3 + \dots + Va_n}{n} = \dots \%$$

Information : V_{a_1} = The validity of the i-th expert

Van	=	The	validity	of the	n-th	expert
un			-			1

= Number of Validators n

TSe = Total empirical score (result of validation and validator)

TSh = Maximum total score expected

= Combined Validity V

After obtaining the validity results from the validator, the next step is to match the percentage level with the validity criteria table. The validity table is in table 2.

No	Validity Criteria	Level of Validity
1	80,01% - 100,00%	Very valid, or can be used without improvement
2	60,01% - 80,00%	Valid, or can be used but needs a little improvement
3	40,01% - 60,00%	Quite valid, or can be used but needs major revision
4	20,01% - 40,00%	Less valid, it is recommended not to use it because it needs improvement
5	$\leq 20,00\%$	Invalid, or may not be used

Table 2. Criteria for the Validity of Learning Media

Source: [25]

3. RESULTS AND DISCUSSION

3.1 RESULTS

The results of the development of mathematics learning media using the Plomp method, which consists of 3 stages, will be explained as follows:

Initial Investigation Phase

At this analysis stage, it aims to determine the need for developing instructional media, and researchers conduct curriculum analysis, character analysis of students, analysis of technology, and analysis of instructional media. For curriculum analysis, the curriculum used in learning media is the 2013 curriculum. In addition to material, researchers also take Core Competencies, Basic Competencies, and competency achievement indicators also refer to the 2013 curriculum. For material on linear equations and inequalities of one variable, researchers made as many as four meetings in the media.

After conducting curriculum analysis, the next stage is the character analysis of students, while junior high school students who are in class seven have on average reached their teens (13-15 years). At this time, students are also able to use increasingly

sophisticated technology. This is reinforced by the increasing number of students using sophisticated smartphones that are not only used for communication but can also be used for learning.

After analyzing the character of the students, the researcher conducted a technology analysis and analysis of instructional media. The technology to be used is the Adobe Flash Cs6 application. Adobe Flash Cs6 is a software that has many functions. Besides being able to create two-dimensional animation, this software can also make software presentations and interactive learning media. One of the advantages that this software has is that the resulting file size will be small so that it is not too heavy when the storage process is for learning media. But the weakness of this application is that this application is difficult to use for beginners so it takes a long time to learn. Analyzing media for the use of media that will be used when learning mathematics. The media often used by teachers is powerpoint which contains material on linear equations and inequalities of one variable.

Development Phase or Prototype Marking

At this stage, the researcher conducts storyboard design and media development, including media collection and learning media validation sheet design. For the Storyboard design, the researcher designed the appearance of this media including the homepage, main menu, exit menu, preliminary view, competency display, material display, evaluation view, and profile view.

After doing the design, the researcher collected the materials needed to make the media. First, download Adobe Flash Cs6 which is available on the internet. Then, the researchers collected teaching material and practice questions obtained from books and the internet. In addition, researchers also made other materials in the form of backgrounds, button icons, home icons, and exit icons using the Adobe Photoshop application which can be downloaded on the internet. Then the researchers also made learning videos consisting of three videos to make it easier for students to do learning.

After collecting the media, the researcher also made a research instrument, namely a validation sheet that would be filled in by the validator. The design of the validation sheet is based on 3 aspects, namely the media format aspect, the content format aspect, and the language format aspect. Each aspect is translated into several points according to the

needs of the researcher. The media format aspect is translated into 5 assessment items, the material content format aspect is translated into 6 assessment items, and the language format aspect is translated into 2 assessment items. So that there are 13 points of validator's assessment of the media being developed.

After designing and collecting media-making materials, the next stage is the process of developing learning media. At this stage, the researcher installed the Adobe Flash Cs6 application that had been downloaded. All materials that have been collected will then be compiled and put together according to what has been designed at the design stage using the features found in the *Adobe Flash Cs6* application. In this media, the material is divided into 4 meetings, namely the first meeting about solving one variable linear equation problems and solving equations by addition and subtraction, the second meeting is solving equations using multiplication and division and solving real problems using one variable linear equations, the third meeting is find the concept of linear inequality and the properties of the linear inequality of one variable, and the fourth meeting is to solve the linear inequality problem of one variable and solve the real problem using the inequality.



Figure 1. Main Menu Display and Material Menu Display



Figure 2. Evaluation Menu Display

Assessment Phase

Before carrying out the validity test, the product will be shown to the validator. After discussing and checking the learning media, there were several revisions, namely:

Table 3. Validator Comments and Suggestions and Product Revision Results





After the product is repaired, validation is carried out by the validator using an assessment instrument, namely the validation sheet of interactive multimedia-based mathematics learning media using Adobe Flash Cs6. The validators in this study were 2 lecturers from Mathematics Education at the Islamic University of Riau and two teachers from SMP Witama Nasional Plus Pekanbaru. The validation results obtained from each aspect of the assessment can be seen in the table below:

I able 4. Assessment Results of Learning Media Aspects			
Rated AspectPercentage of ValidityCategory			
Media Format	93.13%	Very Valid	

Format of Material Content	93.49%	Very Valid	
Language Format	85.16%	Very Valid	

Based on the results of the analysis of the learning media aspects, it can be seen that each aspect obtains an average with a very valid category. The highest average is in the format aspect of the material content and the lowest is in the aspect of language format. The results of the assessment of each validator can be seen in table 5 below.

Validator	Indicator	Validation Average	Category
	Media Format	85%	Very Valid
Validator 1	Format of Material Content	81.25%	Very Valid
	Language Format	68.75%	Valid
	Media Format	88.75%	Very Valid
Validator 2	Format of Material Content	95.83%	Very Valid
	Language Format	75%	Valid
Validator 3	Media Format	98.75%	Very Valid
	Format of Material Content	98.96%	Very Valid
	Language Format	96.88%	Very Valid
Validator 4	Media Format	100%	Very Valid
	Format of Material Content	97.92%	Very Valid
	Language Format	100%	Very Valid
	Average	90.59%	Very Valid

Table 5. Assessment Results of the Validator and Learning Media Aspects

Based on the assessment of the four validators, the learning media that the researcher developed had a very valid level of validity with a percentage of 92.07% which was included in the very valid category. Even though the media can be used without revision, the researchers still make small revisions that have been suggested by the validator. After the media has been revised, the learning media is ready for use.

3.2 DISCUSSION

The overall stage of developing interactive multimedia-based mathematics media using Adobe Flash CS6 includes two important steps, namely 1) Developing a product consisting of an initial investigation phase and a prototype-making phase; 2) Testing the product through a validator process by media experts and material experts to get a valid product. These steps are in accordance with the opinion of [26] which states that educational development research (R&D) is a process of developing and validating an educational product. From the research procedures carried out by the researcher, the results of the score given by the four validators have a percentage of 92.07% with very valid criteria based on the criteria according to [25]. So that interactive multimedia-based learning media using Adobe Flash Cs6 can be used by making small revisions first. The validity of testing interactive multimedia-based learning media is in line with several researchers, one of which is the researcher by [27] with the final result of its validity, namely the very valid category with a percentage of 85.75%. There are also the results of research from [28], It is said that the media used can be used in the learning process. In this media, there are several shortcomings, namely the difficulty of operating this media without being equipped with a manual so that users must read the manual first. Apart from the drawbacks, there are advantages to this interactive multimedia-based learning media, namely the small file size so that it is not too heavy when running this application when on a computer that has low specifications. Another advantage is that the features provided by this application can be utilized so that it can present good, more interesting, and not monotonous learning material [29], so that the media can be used properly.

4. CONCLUSION

The results of this research show that the validation results confirm that the learning media has a very high level of validity, reaching a percentage of 90.59%, and the media is ready to be used with minor improvements. One of the advantages of this learning media is its small size so it can be operated on various types of computers, including computers with low specifications. However, it should be noted that this research has weaknesses, namely the lack of practical tests or feasibility assessments. Therefore, it is hoped that further research can develop these aspects so that this learning media is truly ready for use in the classroom.

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