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Submission date: 25-Nov-2022 04:17PM (UTC+0700)

Submission ID: 1963012579

File name: Sartika_Dedek.pdf (469.44K)

Word count: 4762

Character count: 26420

Research Article

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Development of interactive multimedia based mathematics learning media macromedia flash 8

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6
Received: 15 March 2022

Revised: 24 April 2022

Accepted: 26 May 2022

Available online: 30 June 2022

5
ABSTRACT

The development of interactive multimedia-based mathematics learning media using Macromedia Flash 8 is included in research and development. This study aims to produce learning media products based on Macromedia Flash 8 mathematics on the material similarity and congruence for grade IX junior high school students. This research refers to the development of ADDIE which includes five stages, namely Analysis, Design, Development, Implementation, and Evaluation. The instruments used are media validation sheets and student response questionnaires. The data collection technique used is validity data by 3 validators consisting of 2 Lecturers of Mathematics Education and 1 Mathematics Teacher. The data analysis technique used is the analysis of the validity and practicality of the learning media. The results of the analysis of the average validity of learning media are 86.57% with very valid criteria, while the average practicality of learning media is 89.53% with very practical criteria. Based on the results of research and development, it can be concluded that the learning media developed is suitable for use in learning mathematics.

Keywords: Interactive Multimedia; Mathematics Learning Media; Macromedia Flash 8; Similarity and Congruence

7
1. INTRODUCTION

The rapid development of technology in the current era of globalization provides multiple benefits for the world of education. Education has a very important role to support human life. Because basically humans in carrying out their lives cannot be separated from education (Yolanda & Wahyuni, 2020). A person can know many things or have broad insight through education with the help of technology and information. Therefore, the rapid development of technology and information today can be used to improve the quality of education (David & Dedek, 2022; Yunus et al., 2022). Dahlia & Rohana (2022) stated that education is all conscious and planned efforts made by schools to their students which aims to develop their potential actively which is useful for many people, especially in socializing in society. According to Law Number 20 of 2003, education aims to develop the potential of students to become human beings who believe and fear God Almighty, have noble character, are knowledgeable, creative, independent, and become democratic and responsible citizens.

Curriculum and teachers are factors that can affect the education system, therefore teachers are required not only to focus on transferring knowledge but also to provide learning activities that train thinking skills to be able to innovate so that the quality of the learning process increases and the quality of education also increases (Wahyuni & Angraini, 2021). Learning with the 2013 curriculum trains students to find out, not just being told about science, emphasizing the ability to think logically, systematically and creatively as well as the assessment of memorization of concepts and processes and student learning outcomes, but high-level thinking skills that require critical, creative thinking, analytical, to information and data in solving problems called Higher Order Thinking Skill (HOTS) (Jailani et al., 2017).

Allah explains the recommendation to seek knowledge in the Qur'an Q.S. Al-Mujadalah.

"Halloo! you who believe, when it is said to you: "Be spacious in the assembly", then be spacious, Allah will make room for you. And when it is said: "Stand up", then stand up, Allah will raise those who believe among you and those who are given knowledge by several degrees. And Allah is knowing of what you do." This verse explains how Allah will raise the degree of those who seek knowledge several times higher than those who do not seek knowledge.

Tsany et al., (2020) say that in the learning process, the teacher provides knowledge as a provision for students to solve problems in life. The teaching and learning process or the learning process is an activity to implement the curriculum of an educational institution in order to achieve educational goals. The teaching and learning process is also very influential on the success of students in understanding the material presented by educators. As stated in the Teacher Law Number 14 of 2005 article 8, it is stated that teachers are required to have academic qualifications, be physically and mentally healthy, and have the ability to realize national education goals. The competence of teachers as referred to in the Act includes

pedagogical competence, personal competence, social competence and professional competence obtained through professional education. So that educators are required to use media that attract the attention of students, especially mathematics.

Learning mathematics can be used to improve critical thinking skills. Wahyuni & Angraini (2019) Critical thinking will also help someone in sorting out information that is relevant or not with various mathematical problems or out-side mathematics. Therefore, mathematics learning should be maximized to improve critical thinking skills. Mathematics is a science that studies quantity, shape, arrangement and size, and most importantly is a method in the process of finding the right concept and consistent symbol, the nature and relationship between number and size, both in the abstract and its benefits in everyday life. With mathematics, students have the attitudes and habits to think more logically and critically, systematically, diligently and responsibly (Arbayanti et al., 2021).

Umam (2016) If the mathematics learning process is monotonous and less creative, sometimes it makes students very bored and very bored, this usually causes students to be sleepy, not concentrating, etc. students so that students are less motivated in learning. Rezy & Suripah (2021) so the role of educators is very important, because educators are class coordinators who regulate the course of the teaching and learning process. Abstract mathematics lessons such as similarity and congruence are not effective when taught by teachers using conventional methods that only explain the subject matter in words. Briefly according to Setyawan & Wahyuni (2019) that mathematics learning is said to be effective if the teaching and learning process runs in accordance with the learning objectives, so it takes a teacher's role in choosing methods, media, and evaluations for students. For this reason, a tool is needed in the form of learning media so that it can assist teachers in conveying similarity and congruence material (Diu et al., 2020).

According to Asyar (2011) Learning media can help educators to facilitate the learning process of students. Learning media can also help educators to facilitate the learning process, clarify learning materials with a variety of concrete examples through the media and facilitate interaction with learning. The selection of media that will be used by the teacher must be adjusted to the objectives to be achieved. Therefore, teachers should choose learning media that can attract the attention and interest of students (Ariska et al., 2018). In addition to adjusting to the objectives achieved, the teacher must also choose the right learning media, namely learning media that are in accordance with the material to be delivered so that the learning media developed can function and assist teachers in delivering the subject matter (Penelitian & Pengabdian, 2014). According to Febliza & Afdal (2019) Learning media can be used to overcome the boredom of students. If students are interested in what they are doing, they will enjoy the teaching and learning process and understand the material provided. This is in line with what was stated by Sundayana (2016) the use of learning media helps teachers in delivering material so that it is more interesting that students can understand the material presented well and can improve student learning achievement.

Rapid technological developments have led to various kinds of software that can be used as learning media, one of which is Macromedia Flash 8. Macromedia Flash 8 is a software that can be used to create presentation media and vector-based interactive learning media that has action script facilities. Mayana et al., (2021). Action script is a simple programming language created to make it easier for flash developers to control animation, sound, timeline and other elements. Users of this program can be creative easily and freely to create animations with flexible movements according to the desired animation scene flow, producing files with relatively small sizes. Then, Hafiz (2021) stated that this allows the use of Macromedia Flash can be used for various purposes as desired.

Based on the results of an interview on November 20, 2020 at SMP Negeri 4 Tambang, Tambang sub-district, Kampar district, information was obtained that the mathematics teacher at the junior high school still did not use interactive media during the learning process, while the facilities in terms of technology were adequate, such as laboratory facilities. who have enough computer devices and allow them to use interactive multimedia-based learning media. The learning resources used by students are only grade IX Math textbooks and Student Worksheets (LKS), so that in delivering abstract mathematics subject matter such as similarity and congruence material, students still find it difficult to understand the material and cause students' learning interest to decrease. Therefore, it is necessary to develop an interesting learning media to meet the needs of students. Therefore, researchers want to optimize the function of computers for learning mathematics through the development of learning media based on macromedia flash 8, which is expected to assist teachers in conveying abstract similarity and congruence subject matter and can increase students' attention and interest in the learning process. Thus learning mathematics will feel more interesting. Based on the results of interviews with teachers described above, researchers can see problems that illustrate the importance of an innovative and creative learning media, so researchers are interested in conducting research on the development of mathematics learning media with the title of developing interactive multimedia-based mathematics learning media using macromedia flash 8 in material for the similarity and congruence of class IX SMP.

2. RESEARCH METHOD

The development model used in this study is the ADDIE development model. The ADDIE development model consists of five steps or stages of development, namely Analysis, Design, Development, Implementation, and Evaluation (Septian et al., 2021). Researchers chose the ADDIE model because the ADDIE development model is effective, dynamic and supports the performance of the program itself (Warsita, 2011). The ADDIE model consists of five interrelated components and is structured systematically, which means that from the first stage to the fifth stage, its application must be systematic and cannot be ordered randomly. These five stages or steps are very simple when compared to other design models. It is simple and structured systematically so this design model is easy to understand and apply.

According to Sugiyono (2014) the stages of the ADDIE development model are as follows:

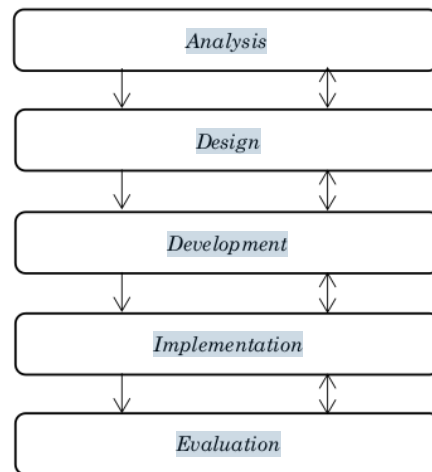


Figure 1. ADDIE Model Development Stage

Techniques and data collection instruments used in the research of interactive multimedia-based learning media using Macromedia Flash 8 on the material similarity and congruence of class IX SMP compiled in this study are:

Validation Data from Experts (Lecturers and Teachers)

Data sourced from experts, namely lecturers in the field of mathematics education and teachers at SMP N 4 Tambang. In this study, the data used is the data from the validation questionnaire test results. The products produced and developed by researchers will be validated by experts or validators. Furthermore, the experts filled out the validation questionnaire sheet by ticking (√) in the available column according to the validator's assessment based on the Likert scale as shown in the table below (Sugiyono, 2015).

Table 1. Category Assessment Validation Sheet

Rating Score	Category
4	Very good
3	Well
2	Not good
1	Not good

Validation Instrument

This instrument is in the form of a validation sheet made by the researcher and given to the validator to determine the validity of the learning media that has been developed by the researcher. The purpose of filling out the validation sheet is to test whether the mathematics learning device that the researcher has developed is valid or not. In this study, what will be validated is interactive multimedia-based learning media using Macromedia Flash 8 in the Congruence and Congruence Materials for Class IX SMP. The aspects that are assessed on interactive multimedia-based learning media are media formats, content formats, and language formats.

Practicality Data from Students

This practicality data is obtained from the data from the questionnaire responses of students to the learning media Macromedia Flash 8 that has been developed. On the scale of this study using a Likert scale that has been modified as shown in the Table 2.

Table 2. Category Assessment Sheet Practicality

Rating Score	Category
4	Very good
3	Well
2	Not good
1	Not good

Source: Modification Sugiyono (2015).

Learning Media Validation Analysis

The data analysis technique used in this research is descriptive analysis, namely by calculating the score of each indicator of the data collection instrument that is filled in by the validator. The validation of the assessment instrument is determined by the average score given by the validator. To measure the level of validation descriptively according to (Akbar, 2017) the formula is as follows:

$$Va_1 = \frac{Tse}{Tsh} \times 100\%$$

$$Va_2 = \frac{Tse}{Tsh} \times 100\%$$

$$Va_3 = \frac{Tse}{Tsh} \times 100\%$$

After obtaining the validation results from each validator, then to find out the final result of the validity of the learning media from the experts, the researcher can calculate the combined validation of the analysis results into a formula according to (Akbar, 2017) namely:

$$V = \frac{Va_1 + Va_2 + Va_3}{3} = \dots \%$$

Information:

V = Combined validation

V_{a_1} = 1st expert validation

V_{a_2} = 2nd expert validation

V_{a_3} = 3rd expert validation

T_{se} = Total empirical score

T_{sh} = Expected Maximum Total Score

After obtaining the results of the combined validation analysis to see whether the developed learning media is valid or not, it is determined by matching it with the specified criteria. The criteria are as follows (Akbar (2017):

Table 3. Categorization of the Validity of Learning Media

Validity Criteria	Validity Level
81,00% – 100%	Very valid or can be used without revision
61,00% – 80%	Valid or usable but needs minor revision
21,00% – 60%	Not valid, it is recommended not to use it because it needs a major revision
00,00% – 20%	Invalid or cannot be used

The media assessment instrument is considered valid if the average validation assessment is categorized as valid or very valid.

Practical Analysis of Learning Media

The data collected from this study is the result of a student response questionnaire to the mathematics learning media developed by the researcher. According to Akbar (2017) to find the value of each questionnaire using the following formula.

$$P = \frac{Tse}{Tsh} \times 100\%$$

Information:

P = Practical Percentage

T_{se} = Total Empirical Score

T_{sh} = Expected Maximum Total Score

After obtaining the results of the combined practicality analysis to see whether or not the learning media developed was determined by matching it with the specified criteria. The criteria are as follows:

Table 4. Categorization of Practical Learning Media

Practical Criteria	Practical Level
81,00% – 100%	Very valid or can be used without revision
61,00% – 80%	Valid or usable but needs minor revision
21,00% – 60%	Not valid, it is recommended not to use it because it needs a major revision
00,00% – 20%	Invalid or cannot be used

7 RESULTS AND DISCUSSION

In this section, it is explained the results of research and at the same time is given the comprehensive discussion. Results can be presented in figures, graphs, tables and others that make the reader understand easily. The discussion can be made in several sub-chapters.

3.1 Learning Media Validation Analysis

After the validator provides suggestions and input, then the validator will then fill out the validation sheet for interactive multimedia-based learning media. The validation results obtained from each aspect of the assessment can be seen in the Table 5.

Table 5. Results of Validity Analysis of Each Aspect of Learning Media

Rated Aspects	Percentage Validity (%)				Category
	1	2	3	Average	
Meeting 1	78,75%	87,50%	92,50%	86,25%	Very Valid
Meeting 2	78,75%	88,75%	92,50%	86,67%	Very Valid
Meeting 3	78,75%	88,75%	92,50%	86,67%	Very Valid
Meeting 4	78,75%	88,75%	92,50%	86,67%	Very Valid
Average				86,57%	Very Valid

5 Based on the results of the analysis of the learning media aspects, it can be seen that each aspect obtained an average of 86.57% with a very valid category. The highest average in the aspect of content format and the media is the content format of the material. The results of the research from the four validators of the media that the researchers developed can be seen in the Table 6.

Table 6. Learning Media Validation Results Meeting 1

Validators	Empirical Score	Maximum Score	Percentage	Category
Validator 1	63	80	78,75%	Quite Valid
Validator 2	70	80	87,50%	Very Valid
Validator 3	74	80	92,50%	Very Valid
Combined Validator	207	240	86,25%	Very Valid

2 The results of the validation of learning media at the first meeting were on the material of similarity and congruence, including very valid criteria with an average percentage of 86.25%.

Table 7. Learning Media Validation Results Meeting 2

Validators	Empirical Score	Maximum Score	Percentage	Category
Validator 1	63	80	78,75%	Quite Valid
Validator 2	71	80	88,75%	Very Valid
Validator 3	74	80	92,50%	Very Valid
Combined Validator	208	240	86,70%	Very Valid

2 The results of the validation of learning media at the second meeting were on the material of similarity and congruence including very valid criteria with an average percentage of 86.7%.

Table 8. Learning Media Validation Results Meeting 3

Validators	Empirical Score	Maximum Score	Percentage	Category
Validator 1	63	80	78,75%	Quite Valid
Validator 2	71	80	88,75%	Very Valid
Validator 3	74	80	92,50%	Very Valid
Combined Validator	208	240	86,70%	Very Valid

2 The results of the validation of learning media at the third meeting were on the material of similarity and congruence including very valid criteria with an average percentage of 86.7%.

Table 9. Learning Media Validation Results Meeting 4

Validators	Empirical Score	Maximum Score	Percentage	Category
Validator 1	63	80	78,75%	Quite Valid
Validator 2	71	80	88,75%	Very Valid
Validator 3	74	80	92,50%	Very Valid
Combined Validator	208	240	86,70%	Very Valid

The results of the validation of learning media at the fourth meeting were on the material of similarity and congruence including very valid criteria with an average percentage of 86.57%. After that, the practicality data obtained from the student response questionnaires were analyzed to determine the level of practicality of the learning media. The data from the practical results of the student response questionnaires were carried out in a small group test to represent the target population of 10 respondents from class IX students on learning media.

3.2 Figures

Place figures at the places where they needed and must center as shown below and cited in the manuscript.

Table 10. Students Response Questionnaire Results Assessment Data

No.	Rated Aspects	Percentage	Category
01.00	Ps1	92,19%	Very Practical
02.00	Ps2	96,35%	Very Practical
03.00	Ps3	90,63%	Very Practical
04.00	Ps4	87,50%	Very Practical
05.00	Ps5	80,73%	Very Practical
06.00	Ps6	86,98%	Very Practical
07.00	Ps7	86,46%	Very Practical
08.00	Ps8	89,58%	Very Practical
09.00	Ps9	86,46%	Very Practical
10.00	Ps10	98,44%	Very Practical
Combined Total	895,32	89,53%	Very Practical

Based on the table above, the average student response questionnaire assessment of learning media using Macromedia Flash 8 on similarity and congruence material is 89.53% with very practical criteria. Interactive multimedia-based mathematics learning media using Macromedia Flash 8 on similarity and congruence material in class IX SMP has included very valid criteria (86.57%) and very practical (89.53%) because it has met the assessment indicators. Thus, this learning media is feasible and practical to use in the teaching and learning process.

According to Wardani & Setyadi (2020) the validity of the experts to assess a learning media includes 3 aspects, namely; (1) aspects of media format related to media use, material suitability, media systematics, and attractiveness of images or animations; (2) aspects of the content of the material related to the suitability of the material, learning objectives and the suitability of the questions; (3) language aspects related to improved spelling (EYD/ *Ejaan Yang Disempurnakan*) suitability, language standards and making it easier for students to understand the language used.

Based on the validity test of mathematics learning media using Macromedia Flash 8 which has been carried out on three validators with several revisions and improvements, it can be stated that the mathematics learning media on the congruence and congruence material produced is very valid. Valid learning media is the best procedure to get information about students' skills according to the learning goal (Rezeki, et al. 202; Yunus, et al. 2021). Valid in terms of educational development is an obligation needed to do by every researcher because it was part of guaranteeing to transfer of skill or knowledge to students (Luthfiana, et al. 2021). Every development educational product should be attention to the validating process because it was very important for getting the best quality of the educational product (Risnawati, et al. 2019; Maclinton & Dedek, 2022).

Development of Interactive Multimedia-Based Mathematics Learning Media Macromedia Flash 8 has stated Practical by users and experts. This learning media can contribute to teachers in managing class for better results. Learning media that has developed with the best way, procedure, and process will help schools, teachers, and students in master the mathematics materials (Wahyuni, et al. 2020). Practical is the best term for developing a learning media because the learning media is stated to have a good quality when the learning media can be used easily by students or teachers (Zubaidah, et al. 2021). Learning media development is needed proper procedure, strict process and control will generate the quality learning media (Gusfitri, 2022).

4. CONCLUSION

Based on the results and discussion, the Development of Interactive Multimedia-Based Mathematics Learning Media Macro-media Flash 8 has developed was valid and Practical. This learning media has fulfilled the development standard so that this learning media can be used to help teachers and students in transferring mathematics material in the classroom.

ACKNOWLEDGEMENTS

The authors would like to thank you for Universitas Islam Riau has given facilities and support to solve this research.

6

AUTHOR'S CONTRIBUTIONS

The authors discussed the results and contributed to from the start to final manuscript.

CONFLICT OF INTEREST

There are no conflicts of interest declared by the authors.

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