



Development of flash-based learning media to improve critical thinking ability of grade VII middle school students

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Abstract: The development of technology is certainly very helpful for developing the world of education. But, many learning activities are carried out using conventional methods, namely lectures with books and blackboards which result in boring learning and poor critical thinking skills on the initial test. The purpose of this study was to determine the level of validity, practicality, and effectiveness of interactive media used to improve critical thinking skills. Research using the ADDIE model shows that the developed interactive media has very valid criteria based on the media validator's assessment of 97.67 and the material validator's assessment of 57 categories. The media developed with very practical criteria based on student practicality questionnaires of 85.06% and teacher practicality questionnaires of 96% categories. In addition, the developed media obtained an effectiveness score of 90.63% based on the posttest of critical thinking skills. From the above findings, it can be concluded that interactive media can be used validly, practically, and effectively to improve critical thinking skills.

Keywords: ADDIE; Critical thinking ability; Interactive media

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INTRODUCTION

Learning mathematics is an important lesson because it is often applied in life. Not a few students think that learning mathematics is difficult learning. Learning mathematics can be designed as fun as possible like game-based software. Teachers can use interactive media and utilize computer laboratories in learning so that it is more interesting for students. According to Umam and Yudi (2016), learning activities using interactive media are more attractive to students compared to learning without interactive media. This resulted in students with interactive media getting higher scores than classes without interactive media. In addition, according to Casnan, Mahpudi, & Puadi (2018) learning by using interactive media can increase student learning motivation so that students are more active in participating in learning.

At the research location, it was found that learning activities were still carried out in the traditional way, namely using the lecture learning method. Even though this method is less effective in learning if it is not combined with other learning methods. According to Adilah (2017), learning using the lecture method will make students tend to be silent and only obey what the teacher says. Learning with the lecture method will make learning teacher learning. In addition, according to Sianturi, Sipayung, & Simorangkir (2018), learning models other than conventional learning models such as Problem-Based Learning can improve students' critical thinking skills because students are motivated to participate in learning using the Problem-Based Learning model.



Learning activities with interactive learning media will make it easier to deliver material between teachers and students because basically, students prefer learning by utilizing technological developments such as computers. Interactive videos are learning media that provide material with a variety of audio-visual illustrations and interesting animated images in the hope that they are easier to understand [Rahmawati, et al. \(2021\)](#). Software that can be used to create interactive media is Macromedia Flash 8. According to [Wahyono \(2006\)](#), Macromedia Flash 8 is software that can be used to design and produce presentations, publications, or other activities that require media interaction with its users. In practice, teaching and learning activities that use interactive learning media can be carried out independently.

[Ennis \(1991\)](#) states that critical thinking skills are the ability to think effectively about what a person uses in deciding what to believe or decide. Based on [Ennis \(1991\)](#), critical thinking indicators are summarized in 5 stages namely: (a) Clarification, (b) Basis for decision making, (c) Conclusion, (d) Presupposition and integration, and (e) Additional critical thinking skills (these abilities are not requirements to become a critical thinker). Based on [Permendikbud No. 58 of 2014](#) concerning Middle School or MTs Curriculum, the purpose of learning mathematics is to demonstrate the ability to think critically, logically, creatively, analytically, systematically, innovatively, and collaboratively to solve problems related to everyday life. The level of critical thinking of students who will be used as research subjects is low, namely as many as 71.88% of 32 students score below 75 which is known from the student's initial test.

Statistics is a branch of science that is considered difficult, so in the process of doing it, students need to understand the questions well and use appropriate formulas, especially in data presentation material. Critical thinking skills are also needed in solving problems in data presentation material. Starting from understanding the problem, using the appropriate formula to present data according to the instructions in the problem. Students do not understand how to apply existing concepts in statistics so that in the end the results obtained are unsatisfactory. According to [Ryandi and Santri \(2022\)](#), electronic teaching materials used when learning mathematics can help students understand and construct an understanding of the concepts of statistics. Based on this description, the researcher intends to conduct research and development of Flash-based interactive media that meet valid, practical, and effective criteria to improve the critical thinking skills of grade VII junior high school students.

METHOD

Research and Development (RnD) is the type of research used in this study. [Sugiyono \(2013\)](#) stated that research and development is a research method used to make a product and test its effectiveness. The development model used in this study is the ADDIE model by [Dick & Carry \(1996\)](#), namely the development model used, namely the stages are: (1) Analysis: interviews, observation, and provision of a needs questionnaire to analyze existing problems. (2) Design: by designing learning media that will be made starting from making flowcharts, storyboards, making lesson plans, and making validity questionnaires. (3) Development: then the validity sheet is submitted to the expert to determine the validity of the media made. (4) Implementation: after repairs have been made and the media is declared valid, the media is ready to be implemented in practice in class. (5) Evaluation: In the final step, students and teachers are given a practicality sheet to measure the level of practicality of the media.

The subjects of this study were students in class VII E of SMP Negeri 1 Sawangan, mathematics teachers, media validators, materials, lesson plans, and questions. Interviews, observations or observations, questionnaires, documentation, and test questions are the data collection techniques used. The research instruments used were a needs questionnaire and a media evaluation questionnaire which consisted of a validation questionnaire, critical thinking ability test questions, and a practicality questionnaire.

Interactive learning media before being used is tested for validity with 3 validators to determine the feasibility of the media to be used. The number of statements on the media

validity sheet is 22 statements. The formula used to measure the level of media validity is the Sukardjo (2008) formula. The benchmarks that apply to media validity are presented in Table 1.

Table 1. Benchmarks of Interactive Media Validity

Intervals	Criteria
$X > 92,41$	Very Valid
$74,80 < X \leq 92,41$	Valid
$57,20 < X \leq 74,80$	Quite Valid
$39,60 < X \leq 57,20$	Less Valid
$X \leq 39,60$	Very Less

The material contained in interactive learning media before use is tested for validity with a total of 3 validators to determine the feasibility of the material to be used. The number of statements on the material validity sheet is 12 statements. The formula used to measure the level of material validity is the Sukardjo (2008) formula. The benchmarks that apply to material validity can be seen in Table 2.

Table 2. Interactive Material Validity Benchmark

Intervals	Criteria
$X > 50,4$	Very Valid
$40,8 < X \leq 50,4$	Valid
$31,2 < X \leq 40,8$	Quite Valid
$21,6 < X \leq 31,2$	Less Valid
$X \leq 21,6$	Very Less

RPP is a guideline used at the time the research was conducted. Before use, the RPP is tested for validity with 3 validators to determine the feasibility of the RPP to be used. The number of statements on the lesson plan validity sheet is 15 statements. The formula used to measure the validity level of lesson plans is the Sukardjo (2008) formula. Table 3 displays the applicable benchmarks for the validity of the RPP.

Table 3. Benchmark for the Validity of RPP

Intervals	Criteria
$X > 63$	Very Valid
$51 < X \leq 63$	Valid
$39 < X \leq 51$	Quite Valid
$27 < X \leq 39$	Less Valid
$X \leq 27$	Very Less

Critical thinking skills test questions are tested on students to measure the level of effectiveness of the media used. But before that, a validity test was carried out with 3 validators to find out the feasibility of the test questions to be used. The number of statements on the media validity sheet is 10 statements. The formula used to measure the level of validity of the test items is the Sukardjo (2008) formula. Table 4 presents the applicable benchmarks for test item validity.

Table 4. Benchmark of the Validity of Critical Thinking Ability Test Questions

Intervals	Criteria
$X > 42$	Very Valid
$34 < X \leq 42$	Valid
$26 < X \leq 34$	Quite Valid
$18 < X \leq 26$	Less Valid
$X \leq 18$	Very Less

To measure the level of practicality of the media using the Akbar (2017) formula:

$$P = \frac{TSe}{TSh} \times 100\% \quad (1)$$

Information:

P : End value

TSe : Score obtained

TSh : Maximum score

Table 5 presents the applicable benchmarks for the practicality of learning media.

Table 5. Benchmarks of the Practicality of Learning Media

Mark	Criteria
$85,01\% < P < 100\%$	Practical
$70,01\% < P < 85\%$	Practical Enough
$50,01\% < P < 70\%$	Less Practical
$0,01\% < P < 50\%$	Impractical

To measure the level of effectiveness of the product, students' critical thinking test scores are compared to the applicable KKM, which is 75. Based on Hobri (2010), effective media is when at least 80% of students who use learning media succeed in arriving at a predetermined reference value.

RESULTS AND DISCUSSION

Based on the steps taken, the following results were obtained.

Analysis

This step is the first step of research, by conducting an analysis of media needs by teachers and students. The results obtained are as follows.

Interview

Interviews are a process of interactive communication between two parties, where at least one of the parties has a predetermined goal involving the activity of asking and answering questions (Wicaksana, 2022). Based on interviews with teachers who support mathematics subjects, it was found that learning had never used a computer laboratory at all. Mathematics learning is carried out using traditional methods, namely the use of books and blackboards. The learning aids used are also traditional, such as geometric shapes, or measuring instruments.

Observation

Observation is a form of gathering information that occurs through systematic observation and recording of phenomena that are used as objects of observation (Djaali & Muljono, 2008). Based on the observations made, the teacher did not use a method where students were active during the teaching and learning process. Learning is carried out using the lecture learning method, so that when the teaching and learning process takes place, students sometimes pay close attention to the teacher's explanation, but sometimes they also do other activities outside of learning activities. In addition to distributing media needs questionnaires, interviews, and observations, pre-tests were also carried out as a step to find out the level of students' ability to think critically. The results of the work show that 71.88% scored less than the KKM, which means that students' critical thinking skills are low.

Needs Analysis

This activity is carried out to obtain information about the level of need of teachers and students for interactive learning media. According to Batubara (2020), the more students need and are interested in learning, the faster students will adopt learning materials. This step was carried out by distributing media needs questionnaires to one of the VII graders of junior high school and the mathematics teacher. In addition, as supporting data, direct interviews were

also carried out with subject teachers, and observations during learning activities took place. Based on Table 6, it is known that 76.25% of students like learning using interactive media. To find out the complete data, see Table 6.

Table 6. Recapitulation of Student Needs Questionnaire

No	Statement	Percentage
1.	Mathematics is a difficult subject	75%
2.	The material for presenting data is difficult material	70%
3.	I have difficulty understanding the elements in the presentation of data	63,75%
4.	I have trouble memorizing formulas	71,88%
5.	I have difficulty working on data presentation problems in the form of stories	71,25%
6.	My math teacher often gives assignments, both homework and assignments at school	80,63%
7.	My math score reached KKM	53,13%
8.	I often ask when I have difficulty in learning mathematics	70%
9.	I prefer learning from electronic devices rather than learning directly from textbooks	70%
10.	My school has a computer lab	91,25%
11.	I can operate the computer well	71,25%
12.	I often operate the computer	62,5%
13.	I like learning media containing data presentation material with interactive games	76,25%

In addition to students, teachers were also given a needs questionnaire. After obtaining the data, the teacher has never carried out learning activities using a computer laboratory, even though the teacher can operate a computer well. Teachers also argue that conventional learning is less effective in learning. To find out the complete data see Table 7.

Table 7. Teacher Needs Questionnaire

No	Statement	Scoring Scale				
		TS	KS	CS	S	SS
1.	The teaching materials used are aligned with SK and KD				√	
2.	The mathematics teaching materials used are aligned with the indicators				√	
3.	Students experience difficulties in understanding the material presented in the data			√		
4.	Submission of mathematics material includes an introduction, content, closing, and evaluation				√	
5.	In learning mathematics, the use of conventional methods is less effective			√		
6.	Motivate students to ask questions in learning activities				√	
7.	Using OHP or LCD in learning activities	√				
8.	I often give assignments both homework and assignments at school				√	
9.	My school has a computer lab				√	
10.	I can operate the computer well				√	
11.	I often operate the computer				√	
12.	I have used interactive media when learning mathematics	√				
13.	Using interactive media allows students to repeat material and motivates students to learn				√	
14.	Making interactive media takes a long time				√	

Design

After knowing the facts found at the research location, the concept of interactive learning media was designed which was carried out in 5 stages, including (1) Preparation of media frameworks, (2) Making flowcharts and storyboards, (3) Selection of material references, (4) Preparation of designs, and media features, and (5) Preparation of learning media assessment instruments.

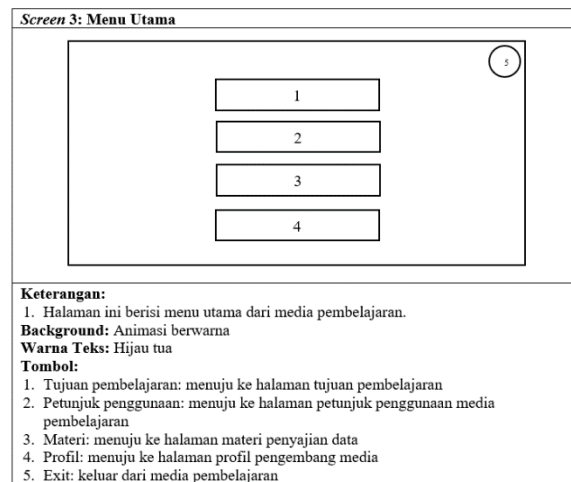


Figure 1. Example of Interactive Media Storyboard

After the storyboard is made, interactive media is created using Macromedia Flash 8. After the media display is created, material, sound and other animations are also included to make the media even more interesting. Umam and Yudi (2016) state that the use of interactive media is able to attract students' interest rather than learning that does not use interactive media.



Figure 2. Interactive Media Main Menu Appearance

Development

After preparing a media assessment questionnaire aimed at media validators, material validators, lesson plans validators and critical thinking skills validators. The following are some of the media views that have been made which are then ready to be validated by the validator.

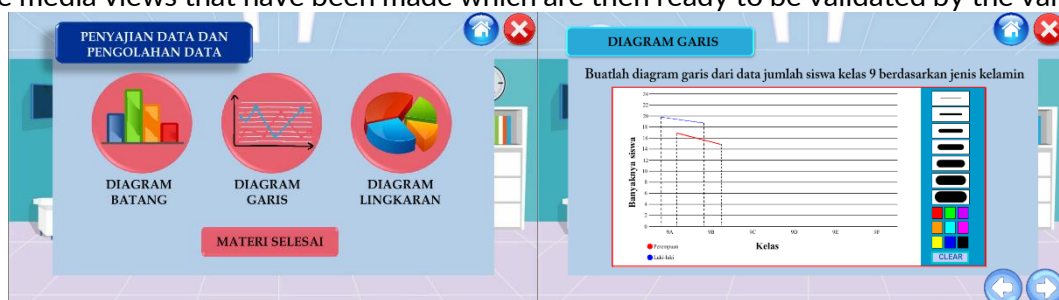


Figure 3. Example Display of Interactive Learning Media

Media validation is carried out to determine validity starting from the appearance of the media, and material. After knowing the level of validity, improvements are made according to input from the validator and the media is ready to be implemented in learning activities in class.

The media validity questionnaire that has been filled in is then analysed to determine the validity level of the interactive learning media. Based on the results of the analysis, the final result was 97.67 with the criteria "Very Valid" indicating that interactive learning media is suitable for use in learning with a little revision. According to [Lestari \(2019\)](#), interactive media can create a fun learning atmosphere supported by the presentation of images and sound or video which allows students to learn better, thereby minimizing boredom which causes a lack of interest in learning.

Table 8. Summary of Assessment by Media Validators

No.	Aspect	Average	Category
1.	Appearance	45,33	very valid
2.	Program	30,67	very valid
3.	Language	21,67	very valid
	Amount	97,67	very valid

The material validity questionnaire that has been filled in is then analyzed to determine the level of validity of the material in interactive learning media. Based on the results of the analysis, the final result was 57 with the criteria "Very Valid" indicating that the material in interactive learning media is suitable for use in learning without revision. According to [Lestari \(2019\)](#), subject matter created and visualized in the form of animated images is easier to accept, understand, and attract students' attention to the material presented.

Table 9. Summary of Assessment by the Material Validator

No.	Aspect	Average	Category
1.	Content Eligibility	20	very valid
2.	Language	14,67	very valid
3.	Presentation	22,67	very valid
	Amount	57	very valid

The RPP validity questionnaire that has been filled in is then analyzed to determine the validity level of the RPP used. Based on the results of the analysis, the final result was 66.67 with the criteria "Very Valid" indicating that the lesson plan is appropriate for use in learning without revision.

Table 10. Summary of RPP Validity Assessment

No.	Aspect	Average	Category
1.	Formulation of Learning Objectives	22	very valid
2.	Presentation	22	very valid
3.	Language	14	very valid
4.	Time	8	valid
	Amount	66,67	very valid

Table 11. Summary of Test Question Validity Assessment

No.	Aspect	Average	Category
1.	Material	18,33	very valid
2.	Construction	14,33	very valid
3.	Language	14,33	very valid
	Amount	47	very valid

The questionnaire validity of the test questions that have been filled in is then analyzed to determine the level of validity of the critical thinking ability test questions. Based on the results of the analysis, the final result was 47 with the criteria "Very Valid" indicating that critical thinking skills questions were appropriate for use in learning without revision.

Implementation

In this step, real learning is carried out in class. When the implementation of this stage was carried out, it was attended by 32 students and held 2 meetings in class with a total of 5 hours of learning hours. The following details the time of implementation of learning. Learning went well without encountering significant obstacles, this shows that interactive media is able to support the learning process. In line with that, [Indartiwi, Wulandari, & Novela \(2020\)](#) stated that interactive media based on the use of technology really supports the learning process because technology is an approach in terms of hardware that aims to implement media in the implementation of education through the utilization of teaching tools.

Table 12. Date and Time of Implementation of Learning

No.	Date	Activity	Time Allocation
1.	6/9/2022	Learning with interactive media	2 × 40 minutes
2.	6/10/2022	Learning with interactive media Test and Evaluation	3 × 40 minutes

Evaluation

After the implementation step is carried out, then a media assessment is carried out to meet practical and effective criteria. The practicality aspect is seen from the product practicality questionnaire after learning using learning media. While the aspect of effectiveness is seen from the results of students' scores working on the questions given, compared to the existing KKM scores. The following is a presentation of the results of the evaluation stage.

The practicality questionnaire was filled out by teachers and students after learning with interactive learning media. In the practicality questionnaire the students obtained a final result of 85.06% in the "Very Practical" category, while in the practicality questionnaire the teacher obtained a final result of 96% in the "Very Practical" category. The average of the two is 90.53% in the "Very Practical" category. It can be concluded that interactive learning media is practically used in learning. In line with that, [Umam and Yudi \(2016\)](#) stated that the use of interactive media is able to attract students' interest than learning that does not use interactive media.

After learning using interactive learning media, students are given critical thinking skills tests to measure the level of critical thinking skills after using interactive learning media. From this activity, it was found that as many as 29 students out of 32 students scored above the KKM or 90.63%. It can be concluded that interactive learning media is effectively used to improve critical thinking skills. In line with that, [Hendi, Caswita, dan Yayah \(2020\)](#) stated that interactive learning media is effective for increasing students' critical thinking skills than learning that does not use interactive learning media. Learning using interactive media will make every student active during learning. In addition, with interactive media, students can repeat material that they have not understood.

CONCLUSION

The development of interactive learning media is highly regarded due to its exceptional validity and practicality. With a media validity score of 97.67 and a material validity score of 57, interactive learning media proves to be a reliable and trustworthy tool for education. These high validity scores indicate that the media is well-structured and accurately represents the intended content. Moreover, its practicality is evident with an average practicality score of

90.06% among both teachers and students. This suggests that interactive learning media is user-friendly and easily integrated into the classroom environment.

The effectiveness of interactive learning media is demonstrated by the positive outcomes it has yielded. Among a group of 32 students, an impressive 90.63% of them scored above the minimum passing grade (KKM). This indicates that interactive learning media has successfully facilitated student learning and comprehension. By engaging students in an interactive and immersive manner, this media has proven to be an effective tool in achieving academic success. The combination of high validity, practicality, and effectiveness makes interactive learning media a valuable asset in the field of education.

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