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# Developing Learning Multimedia to Improve Critical Thinking in Mathematics at Class V of Elementary School

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## Abstract

This study aims (1) to produce a learning multimedia which is feasible to improve critical thinking in mathematics at class V of elementary school, (2) to find out the effectiveness of learning multimedia to improve critical thinking in mathematics at class V of elementary school. This study is a research and development referring to the opinion of Borg & Gall. The subject trials are the fifth-grade students of SD Muhammadiyah Special Program Boyolali. The results of this research is a software of learning multimedia. The results showed that the developed of learning multimedia is feasible and effective to improve critical thinking of students. Based on the test results show that the effectiveness of the learning multimedia is effective in increasing critical thinking of students. It is based on the results of the implementation of the test field that indicates  $p < 0.05$ , which means a significant influence critical thinking on student learning using learning multimedia.

**Keywords:** learning multimedia, critical thinking, learning mathematics

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## 1. Introduction

In the world with the development of modern technology that is getting very fast, critical thinking skills are needed to get success, this is the reason for the need to develop critical thinking skills (Marin and Halpern, 2011: 1) [1]. With the ability to think critically, students can consider complex information from many sources and perspectives to make reasonable judgments that students can explain and defend (Lodewyk, 2009: 12) [2]. Based on these facts, it is realized that the role of mathematics is very important, so the need to cultivate mathematical concepts from the ground up comprehensively and correctly by prioritizing critical thinking.

The presence of science and technology in the form of multimedia enhances critical thinking. Multimedia as part of the media can be utilized in teaching and learning activities in the classroom. One of the benefits of using media is to improve students' critical thinking. This is in accordance with Rayandra Asyhar (2012) stated that one

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of the benefits of media is to stimulate students to think critically, using the ability of their imagination, to behave and develop further so that it gives birth to creativity and innovative works [3].

Based on interviews conducted by researchers at SD Muhammadiyah PK Boyolali in learning math found many weaknesses in teaching and learning activities. Learning takes place in one direction and interaction with students is not maximal yet. The problem that is being faced now in SD Muhammadiyah PK Boyolali is the school does not yet have the relevant multimedia learning on the mathematics class V integer matter in the form of multimedia learning. The author takes advantage of opportunities and opportunities to develop multimedia learning. Multimedia is designed in the form of Adobe Flash. The presence of Flash is expected to improve students' critical thinking by explaining something abstract approaching something concrete.

## 2. Related Works/Literature Review

There are some studies which are relevant to the study the researcher conducts here. Bardi (2015), the purpose of his research is to produce a computer-based multimedia that is feasible for learning mathematics for high school students, in terms of aspects of learning, material aspects, media aspects and percentage of students who achieve mastery learning after using multimedia products learning outcomes development. The results showed that the multimedia product learning outcomes of development included in the category of "very good". Percentage of students who achieved mastery learning after using multimedia learning and development outcomes as much as 77% and included in the category of "good" [4].

Research conducted by Titin Mulyaningsih in 2015 with a research that produces appropriate web-based mathematics learning for grade V students in SD Kotagede 3 Yogyakarta. In addition, web-based mathematics learning is developed in order to create a fun learning. There are similarities with research that will be done that is equally research multimedia development web-based mathematics learning [5].

### 25 2.1. Critical thinking in mathematics

Thinking is a conscious and deliberate process used to interpret and judge something inseparable from human life. Thinking happens in every human activity to find solutions to a problem, make decisions and understand something. Ennis dan Norris (Nikto and Brookhart, 2011: 234-236), divides the skills component into 5 skills, hereinafter called

critical thinking skills, namely: elementary clarification, basic support, inference, advance clarification, and strategies and tactics [6].

Critical thinking is necessary in learning mathematics. In understanding mathematics and applying it in everyday life to solve problems requires the mastery of a good concept. In the opinion of Evan Glazer (2001: 13) "Critical thinking in mathematics is the ability and disposition to incorporate prior knowledge, mathematical reasoning, and cognitive strategies to generalize, prove, or evaluate unfamiliar mathematical situations in a reflective manner" [7]. Mathematical critical thinking is a skill and disposition that combines early knowledge, mathematical reasoning, and cognitive strategies to generalize, prove and evaluate reflective mathematical situations.

## 2.2. The efforts to improve the ability of critical thinking in mathematics

Learning in grade V elementary school starts demanding students to think critically. So that students are expected to think high level, can analyze, solve problems, make decisions, and communicate what he got. It also requires teachers to be able to change the mindset of students from the simple to the high mindset. To be able to make it happen teachers need some strategies to make the material presented interesting and easy to understand students. Evan Glazer (2001) revealed that there are four categories that support students' critical thinking skills: support, inference, clarification, and strategies [8].

## 2.3. Multimedia to promote critical thinking

The existence of media in learning plays an important role to achieve learning objectives. Communication will work efficiently and better when using media. Media present to help in conveying the message, which role as a tool. According to Rayandra Asyhar (2012: 42-43) the benefits of learning media users, among others: 1) Expanding the horizon of learning content presented in the classroom; 2) Students will gain diverse experience during the learning process; 3) Providing concrete and direct learning experiences to students; 4) Presenting something that is difficult to hold, visited or seen by students; 5) Providing accurate and up-to-date information; 6) Increase the attractiveness of the display of material so as to increase motivation and interest and take the students' attention; 6) Stimulate students to think critically, using the ability of their imagination, to behave and develop further so as to create creativity and innovative works; 7) Can

improve the efficiency of the learning process; 8) Learning media can solve problems [9].

### 3. Material & Methodology

This type of research is research development (Research and Development). The test subject in this research and development is the students of SD Muhammadiyah Special Program Boyolali. Determination of classes used for initial trials, field trials, and field execution tests conducted randomly / randomly with drawing techniques. The model used by researchers in this development is the Borg & Gall (1983) development model [10].

The subjects of the trial were the students of Grade V of SD Muhammadiyah Special Program Boyolali. The limited trial subjects consisted of 3 students from grade V C. The field trial subjects consisted of 9 students from the VC class who had not been involved in the limited trial, and the field test subjects consisted of 24 VA class students as the experimental class and 24 class students VB is used as control class. Data collection techniques used in this study are interviews, tests, and questionnaires. The instruments used in the research and development are interview guides, critical thinking skills test questions, and questionnaires.

### 4. Results and Discussion

#### 4.1. Result

##### 4.1.1. Preliminary study results

Needs analysis (need analysis) is done through interviews and observation of the learning process. The purpose of the need analysis is to examine and obtain findings related to the implementation of mathematics learning materials integers. The development of multimedia learning to improve critical thinking on the subjects of class V Mathematics is based on the analysis of learning needs in schools. The overall information obtained through interviews, observation, and literature study.

### 4.1.2. Product design

Product specification developed in this research is multimedia learning. Preparation of learning design that is implemented, among others: 1) Establish material developed; 2) Identify SK, KD, indicators and learning objectives; 3) Formulate indicators of success. 4) Determine the evaluation tool. Procedure Development into design development, include: 1) Perform analysis of multimedia concepts, related to the material of integer class V semester I primary school; 2) Creating product design include: concept map writing, script writing, flowchart, and storyboard; 3) Determine the infrastructure facilities used in the implementation of research and development. Researchers observed the number of computers or laptops in the school and observed whether the software is compatible with the multimedia that will be developed.

## 4.2. Discussion

### 4.2.1. Product development results

#### 1. Results Validation Products

##### (a) Expert material validation results

The material contained in developed multimedia has been validated by two experts who have competence in writing mathematics subjects. The first material validation is instrument validation. The second material validation is product validation. The results of the assessment of the validation made by the material experts to the developed multimedia that is classified as very good. This is because the average amount of valuation of 4.43.

##### (b) Expert media validation results

Media contained in developed multimedia has been validated by two experts who have competence in making multimedia learning. The first media validation is instrument validation. The second material validation is product validation. Media experts advise the need for added title page, main menu function, display must not be stacked, video must be given navigation button, and checking material. The results of the assessment of validation by media experts on multimedia developed that is including the category very good. This is because the average amount of valuation is 4.15.

### (c) The result of validation of psychologist

The material contained in the developed multimedia has been validated by two experts who have competence in the field of psychology. The first material validation is the validation of psychological instruments. The second material validation is product validation. The results of the validation of the validation conducted by psychologists on multimedia developed that is including good category. This is because the average amount of valuation is 3.50.

## 2. Limited Trial Results

At the stage of initial field trials or limited field trial the developer involves 3 (three) students from VC SD Muhammadiyah PK Boyolali class. To obtain valid data from a limited field trial, then the selection of students who are subjected to trials based on different levels of ability. Subjects consisted of students with high ability level, students with moderate ability level, and students with low ability level.

The data of the trial results is limited, as a whole it can be concluded that the developed multimedia learning is feasible or good. This can be seen from the percentage of scores that get the answer "Yes" of 93.33%.

## 3. Field Trial Results

In this field trial, researchers involve 9 (nine) students of VC SD Muhammadiyah PK Boyolali class by involving a different subject with the previous. Based on the data of field trial results, overall it can be concluded that the developed multimedia learning is feasible or good. This can be seen from the percentage of scores that get the answer "Yes" by 85.56%.

## 4. Field Test Results

In this field implementation test is the stage of determining or testing the effectiveness of multimedia learning to measure the level of product feasibility as a medium of learning. The effectiveness and feasibility test was done in one class, the researcher took 24 students of VA SD Muhammadiyah PK Boyolali class.

All students are subjected to field test trials either with high level of ability, students with moderate ability level, or low ability students. Based on the data of field test results,

overall of the percentage of the assessment that obtained the answer "Yes" of 98.33%, then obtained the conclusion of the assessment is feasible and good.

Effectiveness tests are performed on products that have been developed to improve critical thinking skills. The activities as follows.

**(a) Product Effectiveness Testing Process**

The field implementation test is carried out in two classes, namely experimental class and control class. The experimental class and control class are equally engaged in learning activities with the same material. The experimental class performs the learning using multimedia developed by the researcher. As for the control class to carry out the learning as it should be done by teachers in the classroom.

Critical thinking data is obtained through test questions. Critical thinking test data is given prior to the first lesson and after completion of the lesson. Observational data were made during the meeting. Test and observation data are given to the experimental class and control class. This data is then processed for calculation. Data used to see the increase in value before and after using the product.

**(b) Test Result Effectiveness of Critical Thinking**

**i. Normality Test**

The normality test of pretest data is critical thinking of the experimental class and the control class is used to find out whether the sample is from a normally distributed population or not. Normality test calculation using Shapiro-Wilk test with SPSS 20. For more details about test result of normality of pretest data think criterion of experiment class and control class by using shapiro-wilk SPSS 20 test, can be seen in following table.

TABLE 1: Pretest Data Normality Test Critical Thinking of Students in Experiment Class and Control Class.

Class	Result	Condition	Description
Experiment	0,823	Sig>0,05	$H_0$ received
Control	0,569	Sig>0,05	$H_0$ received

Based on the above table shows that the level of significance (p) of critical thinking data is greater than 0.05. Thus  $H_0$  is received or the data is normally distributed.

TABLE 2: Normality Test of Posttest Data Critical Thinking of Students in Experiment and Control Classes.

Class	Result	Condition	Description
Experiment	0,114	Sig>0,05	$H_0$ received
Control	0,312	Sig>0,05	$H_0$ received

## ii. Homogeneity Test

Based on the homogeneity test of pretest and posttest data of critical thinking which have been done, it is known that the value of significance in pretest data is 0,606 > 0,05. While on the data posttest homogeneity test results showed the value of 0.216 > 0.05. Thus the test results show that  $H_0$  is accepted. So it can be concluded that both classes have a homogeneous variance.

TABLE 3: Homogeneity Test of Pretest and Posttest Data Critical Thinking of Experiment and Control Class Students.

Class	Result	Condition	Description	Class	Result	Condition
Experiment and Control	0,606	Sig>0,05	$H_0$ diterima	0,216	Sig>0,05	$H_0$ received

## iii. Effectiveness Test

Based on result of test of effectiveness of critical thinking experiment class and control which done, known value of significance 0,000 or sig value ( $p$ ) < 0,05. With these results, then  $H_0$  is rejected. That means there is a significant difference between the critical thinking of students using interactive learning multimedia in the experimental class with conventional learning in the control class.

TABLE 4: The Effectiveness Test of Experimental and Controlled Critical Thinking Class.

Class	Result	Condition	Description
Experiment and Control	0,000	Sig<0,05	$H_0$ rejected

## 4.3. Study of end products

The results of validation by the material experts show that multimedia learning is ready to be used for trial with an average score of 4.43 or excellent category. While the results of validation by media experts obtained an average score of 4.15 with very good category. While the results of validation by psychologists obtained an average score of 3.5 with good category. Based on the validation results from the material experts, media experts,

and psychologists, the developed multimedia learning product is declared ready to be used in later stages with revisions in accordance with the suggestion.

Based on the results of limited product testing to prospective users who are implemented in VC SD Muhammadiyah PK Boyolali class with a limited number of subjects ie 3 people, obtained the percentage of the assessment is 93.33% or belonging to the eligible category. After a limited trial is done then performed repairs in accordance with the input of potential users. Subsequently conducted field trials with the subject of 9 students in the same elementary school. The results of field trials obtained the percentage of assessment is 85.56% or belonging to the category worthy.

## 5. Conclusion

The results of the study of multimedia software learning. The result of the multimedia assessment is declared as feasible and effective to improve students' critical thinking. This multimedia feasibility can be seen from the assessment of the results of multimedia validation by the material experts of 4.43 categorized very well, the validation of the media experts of 4.15 good category, and the validation of the psychologist of 3.50 categorized well. Student responses to the use of multimedia categorized well with a percentage of 98.33% categorized feasible and good. Based on the results of effectiveness test shows that multimedia learning is effective in order to improve students' critical thinking. This is based on field test results showing  $p < 0.05$ , which means there is a significant effect of students' critical thinking by using multimedia learning.

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