

INTERACTIVE MULTIMEDIA LEARNING BASED ADOBE FLASH ON THE SUBJECT OF SYSTEM OF LINEAR EQUATIONS IN TWO VARIABLES

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ABSTRACT

Mathematics is one of the science that grow as technology advances. One way to achieve the learning objectives of mathematics learning media is to make an exciting and fun resource in the learning process. The availability of media learning in school is still limited to print media. Teachers have not used multimedia interactive learning lab space, so it is rarely utilized in learning. This research aims to develop research to generate media learning math using adobe flash CS6 in learning mathematics on linear equations in two variables (SPLDV) grade 8 Junior High School. Research development uses the ADDIE model of development through five stages of development: the stage of the analysis, design, development, implementation, and evaluation. The research subject is material expert, media experts, and State Junior High School (SMP Negeri) 1 Kalasan. The instruments used in this is a questionnaire. The data analysis technique was carried out quantitatively and qualitatively to count the score test results of the feasibility study developed media. The research development of interactive multimedia learning-based adobe flash based on the quality of every aspect of the media learning in terms of expert material in categories with a perfect percentage of an average score of 93,33%, in terms of media experts in categories with a significant percentage of an average score of 94,73%, and the response of the students in the category is exciting with a percentage of an average score of 85,84%. Based on the assessment, then interactive multimedia learning-based adobe flash is handy in the learning process.

Keywords: Interactive Multimedia Learning, Adobe Flash, Systems of Linear Equations in Two Variables

INTRODUCTION

Education is an effort to develop every aspect of the human personality to be formed into full human beings. To implement these educational goals, every Indonesian person must be given the broadest opportunity to obtain an education. For educational equality to be carried out, the education system should serve all school-age people to enjoy education, at least in the necessary skills, namely reading, writing, and arithmetic (mathematics).

Mathematics is one of the sciences that has evolved as technology advances. The development of Science and Technology (Science and Technology) has contributed to progress in various life fields. One noticeable impact of technological development is progress in education, which gave rise to the term, namely educational technology. In Indonesia, educational technology is utilized to develop instructional media, such as learning mathematics using multimedia technology. The development of multimedia technology in mathematics learning has promised to change how a person learns, obtains information, and adjusts information.

One way to achieve the goal of learning mathematics is to create exciting and fun learning media suitable for the learning process.

Based on government regulation number 19 of 2005 article 42 concerning national education standards, many schools have laboratory space to support the learning process, such as in SMP Negeri 1 Kalasan. However, not all educators can use it to the fullest in helping the learning process. Based on interviews conducted by researchers with teachers and class VIII students on August 23, 2017, at SMP Negeri 1 Kalasan, it can be concluded that mathematics is a subject that is still difficult to understand. Especially in the material system of two-variable linear equations (SPLDV), students still complain of difficulties in understanding the method of solving the two-variable linear equation system and

translating story questions into mathematical models. SMP Negeri 1 Kalasan has two computer laboratory rooms. However, this school is still lacking in using computers as a learning tool. That is due to the incomplete learning media, especially on SPLDV material. Besides that, it requires considerable time to prepare to learn.

Based on these considerations, it is deemed necessary to develop innovative interactive learning multimedia and help mathematics teachers teach and are expected to attract more students' interest in learning. Making interactive learning multimedia requires graphical applications. One software that can create interactive learning multimedia is Adobe Flash, one program that can create attractive and interactive learning multimedia.

Based on the research development of interactive multimedia-based learning media conducted by Yuliandari, Sintia (2011), the results of the research conducted are multimedia learning developed in economic subjects to be used as an alternative learning media with the assessment of material quality experts contained in the media including the very criteria good with the percentage of feasibility 84.85% while that of the interface quality media expert is very good with a percentage of eligibility of 86.18%, and the average percentage of the attractiveness of learning media from student responses have a positive response of 90.83%. Other research also conducted by Novyarti, Elsa, Jefri Marzal, and Rohati (2014), this development research has produced a product in the form of learning media using Adobe Flash and autoplay media studio in inquiry-based learning online material and angle VII grade of junior high school that can provide convenience for students in understanding concepts and increasing their interest in learning. In this study, the results showed that an average percentage of activity is 89.57% included in the excellent category or students' perceptions of learning media are very positive. Then this learning media can be said to be effective.

The purpose of this study, among others, is to describe the procedures for developing instructional media, describe the results of learning media validation, describe students' responses to learning media, and determine the feasibility of instructional media. The developed learning media is expected to be useful for all parties, including to assist students in learning the material system of two-variable linear equations and as a teaching aid for teachers in learning activities.

METHODS

This type of research is included in the development research category. This research was conducted to produce learning media types of interactive learning multimedia based on Adobe Flash on the material system of two-variable linear equations for eighth-grade students of Junior High School by conducting a feasibility test on instructional media. This research was conducted in August 2017 odd semester of the academic year 2017/2018. Simultaneously, the research trial site was conducted at SMP Negeri 1 Kalasan, located on Jalan Raya Jogja-Solo, Sleman, Yogyakarta. The procedure for developing interactive learning multimedia based on Adobe Flash refers to the development model according to Reiser and Mollenda (Supriatna and Mulyadi, 2009: 15) with five stages or development procedures, namely analysis, design, development, implementation, implementation, and evaluation as in Figure 1.

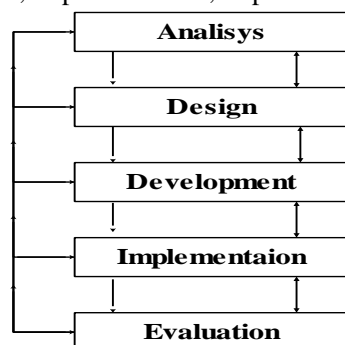


Figure 1. ADDIE Illustration According to Mollenda (2003: 2)

The instrument used in this study was a questionnaire. The questionnaire used in the data collection process was a questionnaire for media experts, a material expert for two-variable linear equation systems, and a questionnaire for student responses. The validation questionnaire was given to 2 experts, namely 1) Dra. Sumargiyani, M.Pd., who is a lecturer in the Linear Program in the Mathematics Education Study Program at Ahmad Dahlan University, 2) Ervin Tamta Lirawati, M.Pd., who is a mathematics teacher at SMP Negeri 1 Kalasan. This questionnaire is used to determine the feasibility of learning media viewed from the learning media's material aspects. Using this instrument, assessment, criticism, and suggestions can be obtained as evaluation material to improve learning media.

The validation questionnaire was given to 2 experts, namely 1) Syariful Fahmi, M.Pd., a lecturer in Multimedia Learning in the Mathematics Education Study Program at Ahmad Dahlan University, 2) Bachtiar Yuliardi, S.Pd. Who is the organizer of the IT Services Center at SMP Negeri 1 Kalasan. This questionnaire is used to determine the feasibility of learning media viewed from the audio and visual aspects of learning media. Using this instrument, assessment, criticism, and suggestions can be obtained as evaluation material to improve learning media.

The student response questionnaire was filled in by all students who used instructional media to identify deficiencies in the developed instructional media product. This questionnaire contains students' responses to aspects of the quality of media display, aspects of language, and learning aspects. The results of this instrument are used for evaluation materials in order to improve the learning media.

Data validation results from material experts and media experts for learning media products developed in qualitative and quantitative data. Qualitative data in the form of criticism and suggestions raised by media experts and material experts will improve the learning media. Simultaneously, quantitative data obtained from the assessment of material experts and media experts will be analyzed descriptively. The criteria for expert judgment scores use a rating scale with four interval as in Table 1.

Table 1. Rules for Scoring

Score	Criteria
4	Very good
3	Well
2	Not good
1	Very less

From the data collected, we calculate the average using the formula:

$$K = \frac{F}{N \times I \times R} \dots (1)$$

Information:

K: Percentage of eligibility

F: The total number of respondents' answers

N: The highest score in the questionnaire

I: Number of questions in the questionnaire

R: Number of respondents

(Palelupu dan Cholik, 2014:4)

After knowing the results of calculating the feasibility percentage, then interpreted according to the following table 2.

Table 2. Criteria for Interpretation of Feasibility Assessment Validators

Percentage	Criteria
$80\% < K \leq 100$	Very good
$60\% < K \leq 80\%$	Well
$40\% < K \leq 60\%$	Enough
$20\% < K \leq 40\%$	Bad
$K \geq 20\%$	Very bad

(Riduwan, 2012: 22)

Learning media is feasible to use if all aspects of the questionnaire get a percentage of more than or equal to 61% with good and perfect criteria.

Data from students' assessment of learning media obtained through questionnaires were analyzed descriptively with percentages. Calculations for obtaining percentages also use the equation formula (1). After knowing the calculation of the feasibility percentage, then interpreted according to the following table 3.

Table 3. Interpretation Table Student Response

Percentage	Criteria
$80\% < K \leq 100$	Very interesting
$60\% < K \leq 80\%$	Interesting
$40\% < K \leq 60\%$	Enough
$20\% < K \leq 40\%$	Less attractive
$K \geq 20\%$	Very unattractive

(Riduwan, 2012: 22)

Learning media is feasible to use if all aspects of the questionnaire get a percentage of more than or equal to 61% with interesting or exciting criteria.

The feasibility of instructional media is determined by calculating the average percentage of scores obtained from material experts' validation and media experts and student responses. The validator's average percentage score is then matched with table 4 of the following learning media eligibility criteria.

Table 4. Interpretation of Learning Media Feasibility

Percentage	Criteria
$80\% < K \leq 100$	Very decent
$60\% < K \leq 80\%$	Worthy
$40\% < K \leq 60\%$	Enough
$20\% < K \leq 40\%$	Inadequate
$K \geq 20\%$	Very Inadequate

(Riduwan, 2012: 22)

Overall, learning media is feasible to use if all aspects of the questionnaire get a percentage of more than or equal to 61% with feasible or very feasible criteria.

RESEARCH AND DISCUSSION

This research has successfully developed adobe flash-based interactive learning multimedia on SPLDV material as a learning source for eighth-grade students of junior high school. This study uses the ADDIE.

Activities carried out at the analysis stage are divided into three, namely situation analysis, material analysis, and technology analysis. Situation analysis is performed to determine the school's condition used as the research object by observing some needed things, such as classrooms, computer laboratories, multimedia rooms, and mathematics teachers. The results obtained from the analysis are: (1) There are several classrooms and multimedia rooms with LCD projectors. (2) The laboratory is only used for ICT lessons, not yet used for other subjects, including mathematics. (3) Learning media in interactive learning multimedia has not been widely used in learning mathematics in schools. (4) Mathematics lessons, especially the material system of two-variable linear equations, require learning media as an innovation in instructional media.

In analyzing the material, the researcher chooses the developed teaching material. The selection of material developed is done by consulting with a mathematics teacher in class VIII of SMP Negeri 1 Kalasan. The material chosen is a two-variable linear equation system. This material requires a direct visualization in the learning process to facilitate students in understanding the material.

Technical analysis was carried out to find the software suitable for researchers' ability and develop learning media. In this study, researchers used Adobe Flash CS6 combined with graphics software such as Adobe illustrator and wonder share quiz creators to develop learning media.

The next stage is the design stage. At this stage, the activity carried out is to create a navigation structure and storyboard as in Figure 2.

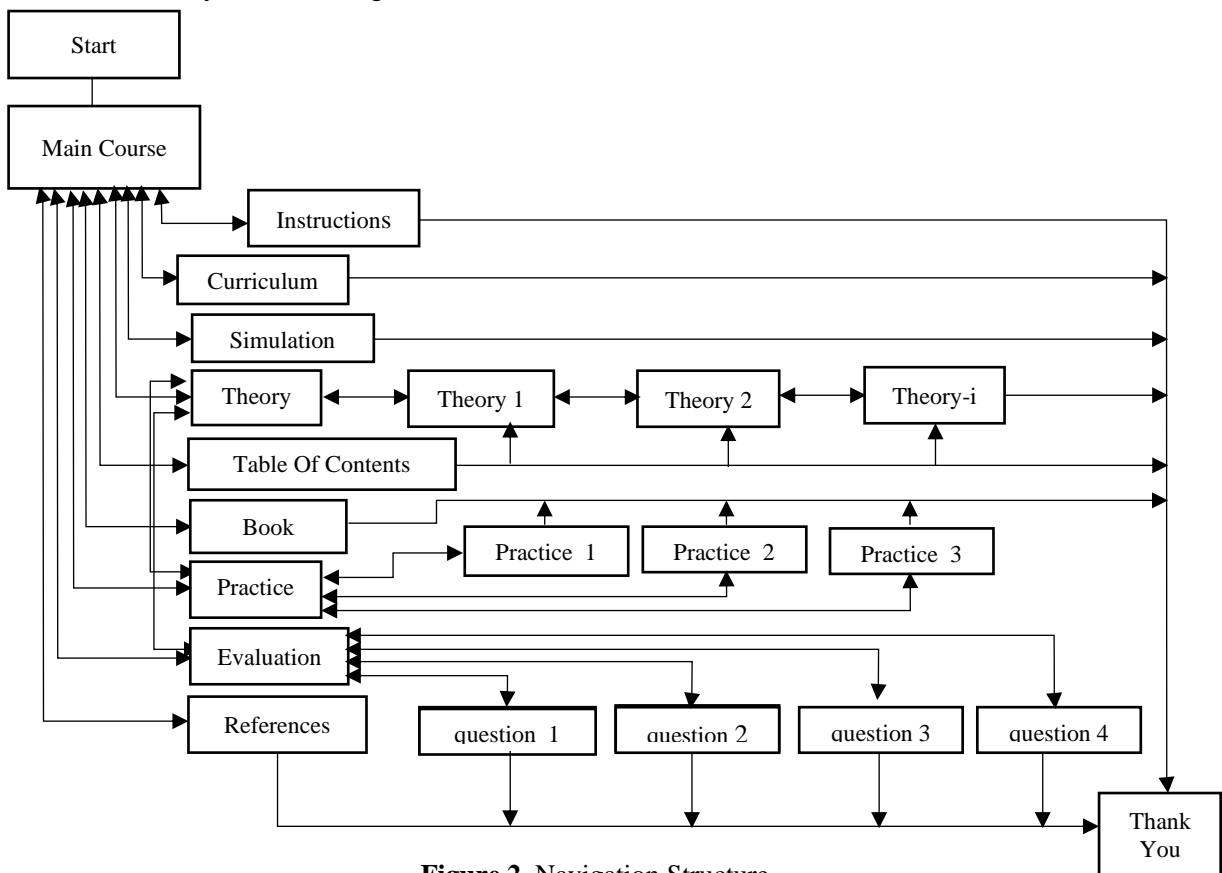


Figure 2. Navigation Structure

After creating a navigation structure, the next step is to create a storyboard, a brief description of the learning media's storyline.

Table 5. Storyboard

Visual	
<p>Intro contains:</p> <ol style="list-style-type: none"> 1. Title of learning media. 2. Animation of the transition. 3. Start button to start media usage. 	<p>The main menu page contains:</p> <ol style="list-style-type: none"> 1. Clock Display. 2. Menu buttons: Instructions, Curriculum, Simulations, Materials, Exercises, Evaluations, Table of contents, Books, and References. 3. Title of Learning Media. 4. Introduction to SPLDV material. 5. Mute sound button



The instructions contain:

1. Clock display.
2. Instructions on the function of the menu button and directions for using instructional media.
3. The button returns to the main menu page.

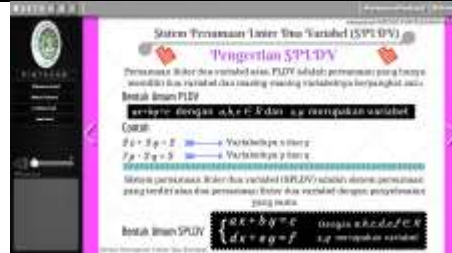


The curriculum contains

1. Clock display
2. Core competencies, basic competencies, indicators of achievement, and learning goals.
3. The button returns to the main menu page.



When the simulation button is clicked, an application will appear to simulate the completion of the SPLDV graph method.



Material contains:

1. Clock display.
2. Navigation menu: main menu, training, and evaluation.
3. SPLDV material.
4. Examples of questions and Learning Videos
5. Reverse and continue buttons to control scenes.



Learning video display




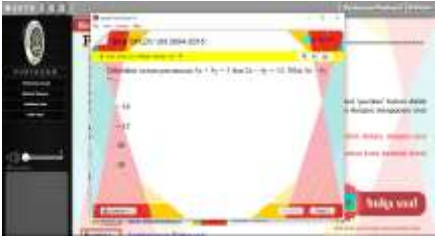




The practice questions contain:

1. Clock display.
2. Navigation menu: main menu, material, and evaluation.
3. 3 exercise package buttons.
4. Back and forward buttons to control the



The evaluation contains:

1. Clock display.
2. Navigation menu: main menu, material, and practice questions.
3. 4 question package buttons.
4. Back and forward buttons to control the

<p>scene.</p>  <p>The display in the practice questions contains:</p> <ol style="list-style-type: none"> 1. Instructions for working on the questions 2. Questions and discussion 	<p>scene.</p>  <p>Display in the problem package</p>
 <p>Table of contents contains:</p> <ol style="list-style-type: none"> 1. Clock display. 2. Button to sub material in SPLDV material. 3. The button returns to the main menu. 	 <p>The book contains instructions for use and buttons that connect learning multimedia with BSE books.</p>
 <p>Reference contains:</p> <ol style="list-style-type: none"> 1. Clock display 2. Developer profile. 3. Library resources and software used to develop learning media. 	 <p>Outro display contains expressions of thanks.</p>

Then the development phase is carried out. At this stage, the material is merged into a learning medium created at the design stage. Making animated images on learning media is done by using Adobe Flash CS6 software. The scenes are broken down into several frames. The animation is made with the shape tween and classic tween animation methods. A button or button to go between pages in learning media is made by giving programming language or action script 2.0. Learning media completed at the design stage are converted or published into a format (.exe) and burned onto a CD. The learning media is ready for the next stage, namely the stage where the learning media is given to the SPLDV material expert validator and the media expert to determine the developed learning media's feasibility results.

The validation of learning media involves two material experts and two instructional media experts. The testing steps are as follows: (1) Determine and approach learning media experts, namely two media experts and 2 SPLDV material experts. (2) Explain the purpose and objectives of testing this learning media. (3) Provide learning media that have been created. (4) Provide learning media assessment questionnaire sheets. (5) Collecting data and analyzing data. (6) Revision of learning media (if any). (7) Completed (continue the trial phase in limited classes).

After validating and learning media have been stated with good minimum quality, the learning media are tested in a limited class consisting of 10 students of SMP Negeri 1 Kalasan who have

different abilities. The testing steps are as follows: (1) Prepare and explain the test's purpose to students. (2) Present the developed learning media. (3) After all, learning materials have been used by students. Researchers provide questionnaire responses to student assessments of the learning media used. (4) Collecting data and analyzing data. (5) Revision of learning media (if any). (6) Completed (continued the application of learning media in large classes).

The implementation phase is the testing phase of learning media in large classes. Large class trials are the final trials in the process of developing learning media. The trial was conducted on 31 students of SMP Negeri 1 Kalasan. The researcher presented this learning media in the learning process. After completing the learning media, researchers distributed student response questionnaires to determine students' responses to the learning process.

The final stage of the ADDIE learning system design model is evaluation. Evaluation can be defined as a process carried out by someone to assess something; in this case, the learning media's quality. The assessment was given several parts: the quality of instructional media based on material aspects, the quality of instructional media based on media appearance, and students' responses to learning media. The assessment is used as a reference in determining whether or not the mathematics learning media developed is appropriate.

Data Analysis is a follow-up evaluation step in the ADDIE development model. The data obtained is divided into three parts: assessments from experts, student responses, and the overall quality of learning media. The results of the assessment of learning media from various aspects are explained as follows.

The feasibility of the learning material was assessed by two material experts, namely Ahmad Dahlan University lecturer and mathematics teacher at SMP Negeri 1 Kalasan. The results of the eligibility questionnaire calculations by material experts can be seen in Table 6.

Table 6. Results of the Questionnaire Calculation of Material Expertise

No	Assessment	Percentage of eligibility	Qualitative Category
1	Expert Material 1	93,33%	Very Good
2	Expert Material 2	93,33%	Very Good
Average percentage		93,33%	Very Good

Based on Table 6, it can be seen that the average percentage of eligibility for the results of the expert judgment of the material is 93.33%. These results indicate that the learning media developed were seen in terms of the excellent category's material.

The feasibility of instructional media based on media aspects was assessed by two media experts, namely Ahmad Dahlan University lecturer and IT Center supervisor teacher at SMP Negeri 1 Kalasan. The results of the eligibility questionnaire calculations by media experts can be seen in Table 7.

Table 7. Results of the Questioning Questionnaire for Feasibility of Media Experts

No	Assessment	Percentage of eligibility	Qualitative Category
1	Expert Material 1	93,42%	Very Good
2	Expert Material 2	96,05%	Very Good
Average percentage		94,73%	Very Good

Based on Table 7, it can be seen that the average percentage of eligibility for the results of the assessment of media experts is 94.73%. These results indicate that the developed learning media in terms of media included in the excellent category.

Students' responses to the learning media developed were known based on the questionnaire's results and filled out by students of SMP Negeri 1 Kalasan during limited trials and large class trials. The results of the questionnaire calculation of student responses to learning media can be seen in Table 8.

Table 8. Results of Calculation of Student Response Questionnaire

No	Trial sample	Percentage of response	Qualitative Category
1	Limited trial	86,87%	Very interesting
2	Large class trials	85,84%	Very interesting

Based on Table 8, the percentage of student responses in the trial is limited to 86.87%. The learning media developed are included in the exciting criteria. The calculation of the percentage of student responses in extensive class tests is 85.84%. So the learning media developed are included in the exciting criteria.

The determination of the quality of mathematics learning media is based on the assessment of two material experts, two media experts, ten students in a limited trial, and 31 students in a large class trial at SMP Negeri 1 Kalasan. The data obtained were analyzed to determine the quality of the learning media.

The data was obtained from experts and students' assessment in quantitative data based on the data analysis techniques used. The quantitative data generated are then analyzed for each assessment instrument. The final score obtained is converted to a qualitative level of product eligibility using ideal assessment criteria. Based on the ideal assessment criteria obtained by the quality of mathematics learning media from each assessment. The combined calculation of the material expert questionnaire, media expert, and student responses to learning media can be seen in Table 9.

Table 9. Combined Calculating Results for the Eligibility of Learning Media

No	Aspect	Average percentage score	Qualitative Category
1	Material	93,33 %	Very good
2	Media	94,73 %	Very good
3	Student Response (limited trial)	86,87%	Very interesting
4	Student Responses (large class trials)	85,84%	Very interesting
Total average percentage		90,19%	Very decent

The average percentage of the final score obtained for learning media that has been developed is 90.19%. This learning media is declared very feasible as an alternative source of mathematics learning media on the subject matter of SPLDV for VIII grade junior high school students.

CONCLUSION

The learning media developed in this research is interactive learning multimedia developed using Adobe Flash CS6 software with a system of two-variable linear equations for eighth-grade students. This learning media was developed following the ADDIE development procedure, which went through 5 stages of development: the analysis, design, development, implementation (trial), and evaluation stages to measure learning media feasibility.

The results of research on the development of interactive learning multimedia based on Adobe Flash based on the quality of each aspect of learning media in terms of material experts in the excellent category with an average percentage score of 93.33%, in terms of media experts in the excellent category with an average percentage score of 94, 73%, and student responses in the category are very interesting with an average percentage score of 85.84%. Based on this assessment, the adobe flash-based interactive learning multimedia is very feasible in the learning process.

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