The Development of Adobe FlashMedia Assisted Learning Instrument To Train Student's Process Science Skill

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Abstract

This study aims to describe the development of feasible Adobe Flash-based learning media with optical instrument materials to train students' processing science skills. This is a developmental research with a 4D model and on the subjects of this research were Grade X students in Kartika Wijaya Surabaya Senior High School academic year 2016/2017 with a developmental testing using one group pretest-posttest design. The data obtained were quantitatively and qualitatively analyzed. The results of the analysis showed that learning media with supporting tools in the form of the syllabus, lesson plan, worksheet, and process science skills assessment were feasible to be used. Learning media along with supporting tools that have been developed for a jigsaw-type cooperative learning model can train the students' process science skills. The students' process science skills were improved with the average N-gain score of 0.74 in the first replication and 0.88 in the second replication, they were categorized as a high category. The conclusion of this research was that Adobe Flash-based Physics learning media with materials of optical instrument could be used in the learning process and to train students' process science skill.

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Introduction

Education has a role in providing skills, as a source of knowledge, as well as a means to train tough mentality and discipline [1]. Education provides a great hope for the nation in solving all problems either problems in politics, economics, or even education itself. Stakeholders in education are not only the government, but all elements of the society, starting from family, school, and society.

Education in schools is to educate students to become educated individuals and have good personalities. In school education, students are taught about science and knowledge, how to behave well, work together in a group, express opinions in front of class, lead groups, and socialize among friends. In the ASEAN Economic Community era, an individual is required to have extensive knowledge, a good attitude, and be able to cooperate with others [1]. One of the science disciplines that is taught in school education is Physics.

Physics is a subject that is based on natural phenomena that happen in daily life. It has a huge role to support science and technology. Physics is important to be taught because it gives knowledge to students and it also be used to train the students' science process skill. Science process skill is a set of basic learning tools which serves to make the foundation of each individual in self-development [2]. In order to train the science process skills, some types of media and team work based learning method are used [3].

Learning media is a tool, method, and technique used in order to have a more effective communication and interaction between teachers and students in the process of teaching and learning in school [4]. One learning media that can make learning process become more

attractive is computer. Computer is potential to be a learning tool because it has some advantages such its capacity to show moving objects with sound, thus computer media is more attractive. Computer is also able to run programs which are designed to stimulate some experiments that are difficult to be practiced by students. One software that can be used to make a computer based learning media is Adobe Flash. One of the advantages of the Adobe flash software compared to other similar software programs is that the size of the final project file format is relatively smaller than others. It makes the final project file has a good quality however it does not require a high specification hardware.

Learning materials which are appropriate to be developed using a computer based media are Physics materials which are abstract and microscopic [5] With regard to this, one appropriate material to be developed in computer-based media is optical instrument because in optical instrument experiment, mostly students can only observe final images without observing the rays that construct the images. With the computer based media, students can be able to observe the ray's construction in an optical instrument when an image is formed.

The use of computer based learning media in Physics is expected to be able to train the students' critical thinking skills. It is because Adobe Flash based learning media can improve students' learning motivation [6] and through computer based media students can explore Physics in a unique way due to experiment simulations. It can be a media to train science process skills [7]. This is in corresponding with the results of research from Saputra, Nur and Purnomo who concluded that computer-based learning media can train process skills [8]. Similarly, the results of research from Hutagalung concluded that the use of computer media can improve science process skills and students' critical thinking skills [9]. The result of Finkelstein, et. al

concluded that the process skills of students who study and conduct experiments using computer simulation are better able to use the principles contained in the concept of Physics [10]. Perdiansyah, Supriaty, dan Astra concluded that the use of computer-based Physics learning makes it easier for students to understand the material provided [11].

By using computer based media, students are expected to develop their curiosity through experiment simulation so that their science process skills can be developed. Science process skills are necessary to be developed in learning process because the 21st century demands human resources with high quality so that can compete in global era.

Based on that background, researchers do this present research study titled "The development of adobe media assisted learning instrument to train student's science process skill".

1. Research Methods

In this study, research and development (R&D) methods were used because we want to develop Adobe Flash-based physics learning media on the instructional materials of optical instrument to train science process skills. The developed learning media was also complimented with syllabi, lesson plans, students' worksheets, and THB so that teachers could be helped in critical thinking skills training on students. This R&D research was based on the 4D model that consisted of four steps, i.e. define, design, develop, and disseminate. In this study, the researchers did not get through the disseminate step due to the limited time. The procedure to develop the Adobe Flash-based learning media and the supporting learning tools are explained in Figure 1.

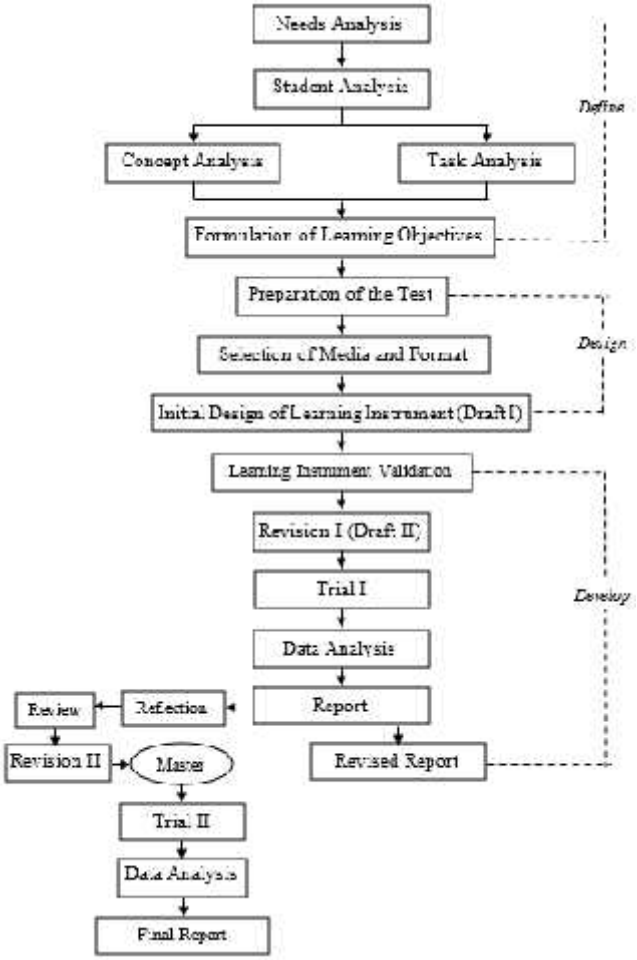

Figure 1 The procedure to develop the learning media tools based on 4D model

DEFINE

The defining stage aimed to define learning conditions. This stage consisted of five activity steps, namely: needs analysis, student analysis, task analysis, concept analysis, and learning objectives formulation.

Needs Analysis

The purpose of needs analysis was a preliminary study to determine the series of learning media development activities and supporting devices. The ultimate goal of needs analysis was to identify learning objectives that were in accordance with the learning syllabus. The curriculum used was the 2013 Curriculum (K-13), and it was expected that in Physics learning in the X-MIA class optical instrument material could train students' science process skills. The development of learning tools assisted by Adobe Flash media was expected to meet the needs of students and in accordance with the 2013 curriculum.

Student Analysis

Based on the stages of Piaget's cognitive development [12] children starting at the age of 11 were already in the formal operational stage, so students were expected to think abstractly, reason logically, and draw conclusions from available information

Task Analysis

Task analysis was the basis for compiling learning objectives. Based on the selected material, namely optical devices, task analysis includes:

Content Structure Analysis

The content structure consists of core competencies and basic competencies taken from Permendikbud No. 24 of 2016 concerning core competencies and basic competencies.

Procedural Analysis

This analysis has the purpose of identifying the stages of completing tasks by analyzing learning objectives. Procedural analysis

can be seen in Figure 2 for worksheets about spells, microscopes and binoculars

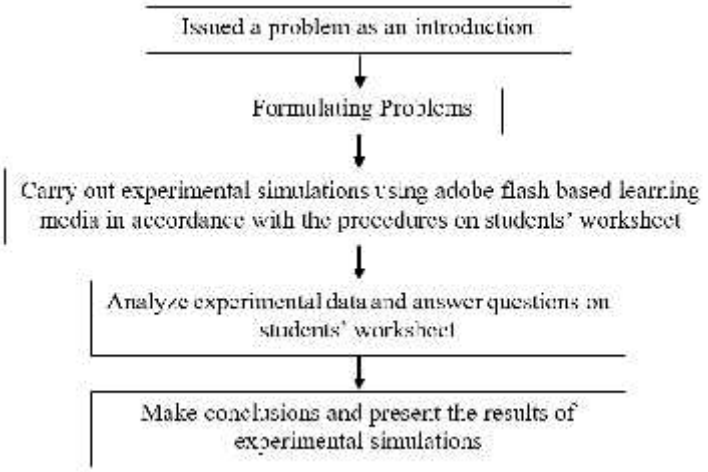

Figure 2: Analysis Procedure Diagram for Lup, Microscopes, Binoculars

Concept Analysis

Concept analysis was used to identify the main concepts to be taught, systematically compile and detail relevant concepts.

Formulation of Learning Objectives

The results of the analysis adjusted to core competencies and basic competencies in the optical instrument material could be used as a reference for learning to be applied to students. Learning objectives were a reference in the preparation of tests, media selection, method selection and design of learning tools

DESIGN

The design phase was to design learning media along with supporting devices. At this stage the design carried out was the preparation of tests, media selection and format selection

Preparation of the Test

The test is an evaluation measuring tool that aims to determine the change in learning ability in students after the teaching and learning activities take place. The compiled tests were based on learning objectives, with the aim to find out changes in students' science process skills after the teaching and learning activities took place using the developed learning media. The test used were in the form of pretest and posttest

Selection of Media and Format

Media selection was done to determine the media in accordance with the learning material presented, for this study, the selected media was Adobe Flash learning media equipped with LKS.

Initial Design of Learning Instrument (Draft I)

The initial design aimed to design learning media and supporting devices that were done before conducting the trial. The learning tool assisted by Adobe Flash media produced at the initial design stage was still in the form of a draft consisting of Adobe Flash based learning media, syllabus, lesson plan, LKS, implementation of learning activities, student activities, process and student response skills, and device validation

DEVELOP

This stage produced a revised learning tool based on expert input

Learning Instrument Validation

The validation of learning media and supporting tools aimed to obtain advice from experts through learning media validation activities and supporting devices that had been produced at the planning stage. This stage aimed to obtain an assessment from the experts used to describe the validity of learning media and supporting devices. The results of the validation then produced draft II, according to the advice from the validator.

Trials

Trial of instructional media along with its supporting device was done by using one group pre-test post-test design [13] that was one group observed/measured not only at the end of treatment (posttest) but also before (posttest) which can be described as follows:

U_1	X	U_2

with

U_1 = Pretest to know the science process skill of students before the learning takes place.

X = Provision of treatment by using learning media and its supporting devices

U_2 = Posttest to know the science process skills of students after the learning takes place.

Data Collection

In this research, the data collection process conducted was used to obtain data about the validity, practicality and effectiveness of instructional media and its supporting devices, validity of instructional media, syllabus, lesson plan, and student worksheet, and test of science

process skills obtained from the instrument validation instrument learning sheet. Implementation and constraints during the learning process were obtained from the observation sheet. Science process skills were derived from pretest and posttest results. Student responses were obtained from the student response questionnaire instrument

Data Analysis

Data validation of instructional media along with its supporting device was obtained from the calculation of average assessment by two validators on the developed media and its supporting devices. Interpretation of data validation results could be seen in table 1

Table 1. Criteria Categorization of Learning Device Validation

Interval Score	Assessment Category	**Explanation**
$3.6 \leq P \leq 4$	Very valid	Can be used without revision
$2.6 \leq P \leq 3.5$	Valid	Can be used with a few revision
$1.6 \leq P \leq 2.5$	Less valid	Can be used with many revisions
$1 \leq P \leq 1.5$	not valid	Can't be used

[14]

Practical data of instructional media along with its supporting device was obtained from the data of Lesson Plan implementation which was the calculation of average assessment by two observers who made observations during the learning process takes place. Interpretation of data results of the implementation of Lesson Plan can be seen in table 2

Table 2. Criteria for Categorization of the Implementation of Learning Devices

Interval Score	Assessment Category
$3.6 \leq P \leq 4$	Very good
$2.6 \leq P \leq 3.5$	Good
$1.6 \leq P \leq 2.5$	Poor
$1 \leq P \leq 1.5$	Very Poor

Adapted from [14]

Analysis of learning implementation constraints was analyzed by qualitative descriptive analysis that the observers and researchers provided a record of the constraints that occured in the implementation of teaching and learning activities in the classroom and the solution of the constraints.

The data of learning media effectiveness along with its tools were obtained from questionnaire analysis to know the student's response to instructional media developed. The questionnaire used Likert scale. The questionnaire answers were analyzed using frequency distribution by calculating the mean ideal and standard deviation.

$$\text{Mean Ideal} = \frac{(\text{Jav} \times \text{nt}) + (\text{Jav} \times \text{nr})}{2} \quad (1)$$

$$\text{SD Ideal} = \frac{(\text{Jav} \times \text{nt}) - (\text{Jav} \times \text{nr})}{6} \quad (2)$$

With

Jav = the number of valid item

nt = highest score

nr = lowest score

The results are categorized as shown in Table 3.

Table 3. Criteria of Students' Response Questionnaire Data

Interval Score			Category
	X >	(M + 1.8 SD)	Excellent
(M + 0.6 SD)	< X ≤	(M + 1.8 SD)	Good
(M – 0.6 SD)	< X ≤	(M + 0.6 SD)	Fair
(M – 1.8 SD)	< X ≤	(M – 0.6 SD)	Poor
	X ≤	(M – 1.8 SD)	Very Poor

[15]

Analysis of students' science process skills was obtained based on pre-test and post-test results. N-gain analysis was used to show the difference between students' science process skills before the learning process and after the learning process. The equation to calculate the gain score (g) was

$$g = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}} \quad (3)$$

The interpretation of gain value (g) is as shown in Table 4.

Table 4. The criteria of Normalized Gain

N-Gain Score			Criteria of Normalized Gain
	g	> 0.7	High
0.3 <	g	≤ 0.7	Medium
	g	≤ 0.3	Low

[16]

2. Results and Discussion

3.1. Validation Result of Media and Its Supporting Learning Tools

In this study the researcher used Adobe Flash based learning media to train students' process science skills. The media was validated by three experts. The average score from the three validators is 3.51, meaning that the learning media can be categorized as valid and showed that the developed media can be used to the next research step.

The supporting learning tool set that had been developed included syllabi, lesson plan, students' worksheet, and evaluation set of critical thinking skills. The syllabus developed by researchers was in accordance with the principles of relevance, systematic, consistency, adequate, actual and contextual, flexibility and comprehensive[17]. In this study, the syllabus was developed based on jigsaw type cooperative learning model. The syllabi were validated by two experts. The average score from the two validators was 3.56 which means that the syllabi were categorized as valid. It indicates that the syllabi can be used for the next research step.

Preparation of lesson plan was done in a systematic and detailed that contains Core Competencies, Basic Competencies, Indicators, Learning Objectives, Methods, Materials, Media, and Learning Steps. The development of lesson plan conducted by researchers was in accordance with the principles of lesson plan development by adjusting the content of the syllabus. The lesson plan developed by the researchers consisted of 2 meetings and it was validated by two experts. The two validators gave an average score of 3.38, which means that the lesson plan was valid and the lesson plan could be used for the next research step.

Worksheet is a learning tool that complement or supporting the implementation of lesson plan. The worksheet developed by the

researchers were said to be valid based on the validation results by experts, so that it could later be used in the teaching and learning activities. The students' worksheets developed by the researchers were used to train the students' critical thinking skills provided by using jigsaw type cooperative learning model. The students' worksheet was also validated by two experts. The average score from two validators was 3.74. It means that the worksheet was valid to be used for the following research steps.

The science process skills test is a collection of questions used to measure the students' critical thinking skills in solving optical device problems. In this research, the researcher provided a subjective test in the form of description test which aimed to measure the extent of science process skill seen from the student's answer. This test was used to obtain data about the students' science process skills. The validations of science process skills assessed two aspects, namely content validation and language validation and writing. The average pretest validation score provided by the two validators was 3.4 for content validation and 3.2 for validation of language and writing and included in valid category, whereas the mean posttest validation score provided by the validator was 3.3 for content validation and 3.1 for validation language and writing and were included in a valid category. It means that the science process skill evaluation set is valid and can be used for the following research steps.

3.2. Practicality Result of Media and Its Supporting Learning Tools

Implementation of lesson plan included 3 parts of the implementation of teaching and learning activities, classroom atmosphere and time management. The data on the implementation of lesson plan at the time of learning using jigsaw type cooperative

learning model to train students' critical skills in replication class I and replication II was obtained from the average observation by two observers.

For replication class I, the result was 3.75 for meetings 1 and 3.64 for meeting 2 and was included in the very good category, while for replication class II, the obtained value was 3.75 for meeting 1 and 3.64 for meeting 2 and was included in very good category. The implementation of all the components in the lesson plan shows that the Adobe Flash-based learning media and supporting tools developed showed that the learning activities using Adobe Flash based learning media and its supporting devices with jigsaw type cooperative learning method took place very well.

3.3. The Use of Media and Its Supporting Learning Tools Set in the Learning Activity

A trial was conducted to 53 students of SMA Kartika Wijaya class X MIA. In the testing phase, the students were asked to provide written input on the media developed through a given questionnaire.

The data obtained from the experiment was summarized and a frequency distribution was obtained so that the following results were obtained.

$$\text{Mean Ideal} = \frac{(\text{Jav} \times \text{nt}) + (\text{Jav} \times \text{nr})}{2}$$

$$= \frac{(10 \times 4) + (10 \times 1)}{2}$$

$$= 25$$

$$\text{SD Ideal} = \frac{(\text{Jav} \times \text{nt}) - (\text{Jav} \times \text{nr})}{6}$$

$$= \frac{(10 \times 4) - (10 \times 1)}{6}$$

$$= 5$$

The result of student response analysis toward instructional media is summarized in Table 5.

Table 5. Summary of distribution of questionnaire scores on media developed against 53 high school students Kartika Wijaya Class X

Category	Score Interval	Frequency	Percentage
Excellent	X > 34	31	58.49%
Good	28 < X ≤ 34	22	41.51%
Fair	22 < X ≤ 28		
Poor	16 < X ≤ 22		
Very Poor	X ≤ 16		
Total		**53**	**100%**

The students' response to the developed learning media showed that 58.49% of the students stated that this learning media was excellent while 41.51% of students said that this media was good. Overall, the students agreed that this learning media was good but based on the students' comments, some of them said that small revisions were still needed to improve the legibility of menu and font.

In addition to feedback on the media developed, the students were also given a questionnaire to find out the students' responses to learning using the jigsaw type cooperative learning model that had been implemented.

The data obtained from the experiment was summarized and a frequency distribution was obtained so that the following results were obtained

$$\text{Mean Ideal} = \frac{(\text{Jav} \times \text{nt}) + (\text{Jav} \times \text{nr})}{2}$$
$$= \frac{(8 \times 4) + (8 \times 1)}{2}$$
$$= 20$$

$$\text{SD Ideal} = \frac{(\text{Jav} \times \text{nt}) - (\text{Jav} \times \text{nr})}{6}$$
$$= \frac{(8 \times 4) - (8 \times 1)}{6}$$
$$= 4$$

the results of the student response analysis of the learning are summarized in Table 6.

Table 6. Summary of distribution of questionnaire scores on the lesson learned on 53 high school students Kartika Wijaya Class X

Category	Score Interval	Frequency	Percentage
Excellent	X > 27.2	29	54.72%
Good	22.4 < X ≤ 27.2	24	45.28%
Fair	17.6 < X ≤ 22.4		
Poor	12.8 < X ≤ 17.6		
Very Poor	X ≤ 12.8		
Total		**53**	**100%**

The result of n-gain analysis for students' pretest and posttest values in replication class I showed that there were 5 students who had moderate gain, while 21 other students had high n-gain. The average of gain score (g) was 0.74 and categorized as high criteria N-gain, while, for replication class II showed that there were 3 students who had moderate gain, while 24 other students had high n-gain. The average of gain score (g) was 0.87 and categorized as high criteria N-gain. This

average of N-gain score also showed that science process skill improved relatively well. It could be interpreted that the developed adobe flash based learning media could train science process skills with good result because the media had a complete content and satisfied the necessity on the optical instrument material such as animation and simulation. This result was also in agreement with the previous research which showed that the use of computer-based learning media could improve reasoning [18]and students' science process skills [19].

3. Conclusion

The adobe flash-based physics learning media on the material of optical instrument with its supporting learning tools set is feasible to train the science process skills in the learning process because it fulfils the validity, practicality, and effectively criteria. Teaching optical instrument is recommended to use jigsaw-based learning media that have been developed because they have met eligibility requirements and can help to train students' science process skill.

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