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Developing Adobe Flash-Based Interactive Instructional Media to Improve Students' Competencies

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Abstract

Misconceptions are often experienced by the students of senior high school. Especially on the learning material of circulatory system. The aim of this study is to develop Biology instructional media in the form of Adobe Flash-based interactive instructional media on the learning material of Circulatory System which the content is designed to improve the students' competencies. The development of this instructional media uses the RnD method with the Borg and Gall development model. There are 3 validators consisting of 2 Biology material experts and 1 instructional media expert who will test and validate the media that is developed. The study to test the effectiveness of the media is a before-after experimental design. The validation of media done by material and media experts shows the result that is categorized as very good, and the result of statistical test with paired sample t-test shows a significance value of 0.00 < 0.05. This means that there is a significant difference in the average score of students from before and after using Adobe Flash-based interactive instructional media to improve students' competencies. Thus, the Adobe Flash-Based Interactive instructional media can improve the competencies of students.

1. INTRODUCTION

Education is an important aspect to produce quality human resources (HR) and can compete in this era of globalization. In the area of education in this era of globalization, there are often innovations from various aspects that aim to improve the quality of education both in term of curriculum, learning strategies, lesson plans, and instructional media.

Learning activities must be well-planned so that students become active and motivated in participating the learning activities. Moreover, the learning objectives and the materials that the teacher conveys can be achieved. Education must run interactively, be fun, and motivate students to take part in learning activities in accordance with the national standards as stated in PP No. 32 of 2013 article 9.

In learning activities, a teacher can use tools to help him or her in delivering learning material so that students can understand the material presented by the teacher which is called as instructional media (Kustandi & Sutjipto, 2016). Instructional media are divided into several types such as audio, visual, and audio-visual instructional media. Moreover, teaching and learning activities are closely related to the use of media because instructional media are tools used by teachers in delivering learning material so that the material and learning objectives can be achieved. (Ramdhani & Muhammadiyah, 2015).

Interactive instructional media is a tool that can motivate students to be active in learning activities (Arsyad, 2015). Smaldino, Lowther, & Russel (2011: 201) states that instructional media is a tool used by teachers to provide and receive feedback for students so that they do interaction with the media. Moreover, interactive instructional media is a learning tool that has multimedia elements so that students can interact with the instructional media and focus on instructional media (Herman Dwi Surjono, 2017: 41).

In this era of globalization, students must be able to develop with the advanced technological developments. Somehow, students are required to have skills to compete in the working world. Bidarra, Figueiredo, & Natálio (2015) states that educators have an important role in providing facilities and familiarizing students with the use of technology in teaching and learning activities such as the use of technology-based instructional media.

Based on the result of observation in March, academic year 2018/2019 even semester at SMAN 1 Pangkalan, it is found that the instructional media was not used effectively. However, the learning process was carried out without the use of any media to support the teaching and learning activities. The material of circulatory system is an abstract material that is difficult to deliver to the students without the use of instructional media. Somehow, learning activities that take advantage of technology at SMAN 1 Pangkalan have been using the Microsoft Powerpoint application as a medium for the learning process. Then, it results a problem that makes the researchers want to utilize and maximize the use of media in order to support, help the better learning activities, facilitate, and attract the students' learning interest.

Based on the above problems, the instructional media used are not interactive and the material taught by teachers is quite difficult if it does not use visual instructional media. The problems above can be overcome with the use of computer-based instructional media because it is able to display material visually, variatively, and interactively. Then, computer-assisted instructional media is developed to be Adobe Flash-based interactive media. According to Susilana (2008), interactive instructional media can trigger motivation and effectiveness in the]students' competencies. Moreover, susilana (2008) states that the development of interactive instructional media is necessary because interactive instructional media has several advantages. There are: 1) improving students' creativity, 2) the material presented is visually formed on abstract matters, 3) minimizing the use of range and time in learning activities, 4) triggering stimulus and response to the students, 5) improving students' learning motivation because of their interest in the use of instructional media, and 6) developing students' thinking skills by visualizing the learning materials. Then, Adobe Flash-based instructional media is an instructional media that displays material in audio visual in the form of video, which is packaged with the use of computer control. Therefore, students can interact with the instructional media (Nourmaningrum, 2014). Moreover, various kinds of effects displayed on the media can arouse students' curiosity and increase students' interest (Arsyad, 2015).

The interactive instructional media used is designed by using the Adobe Flash Professional CS6 program. This due to this program has a special design to make animation and interesting bitmaps for making interactive and dynamic instructional media (Ditama, 2015). Yuliawati (2017) explains that Adobe Flash is a flexible and easy program for making animation. Some new programs that can be made by using Adobe Flash are games, company profiles, e-cards movie, and interactive animation. Then, this Adobe Flash-based instructional media is expected to trigger positive response from students in the learning activities. According to Kusuma (2012) the positive response is an assessment for students during the learning activities which includes learning approaches and learning strategies, the other factors that bring a positive atmosphere in the learning activities, and the result obtained in the learning activities. Based on this explanation, it is necessary to develop Adobe Flash-based instructional media in which it can facilitate the characteristics of students and involve them generally in the learning activities. Besides, it is also able to help the teacher and facilitate the teaching and learning process.

2. RESEARCH METHODS

The research model used is the research and development model or commonly known as R&D. The research and development steps in this study are adapted from Borg & Gall (2003) model which the steps consist of: Preliminary Research and Information Gathering, Planning, Initial Product Development, Validation by Experts, First Revision, Initial Trial, Second Revision, Field Test, Final Product Revision, and Dissemination (Figure 1). In this study, the effectiveness test is carried out at the initial trial stage and it is not carried out until the field test.

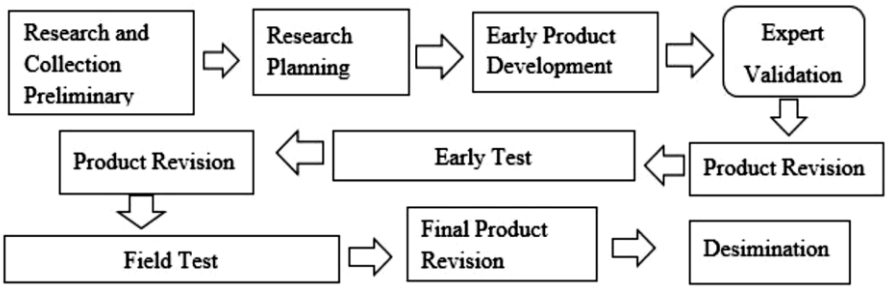

Figure 1. The steps of Borg & Gall Model

The following are the stages carried out in this study shown in Figure 2 with the research and development steps by Borg & Gall (2003).

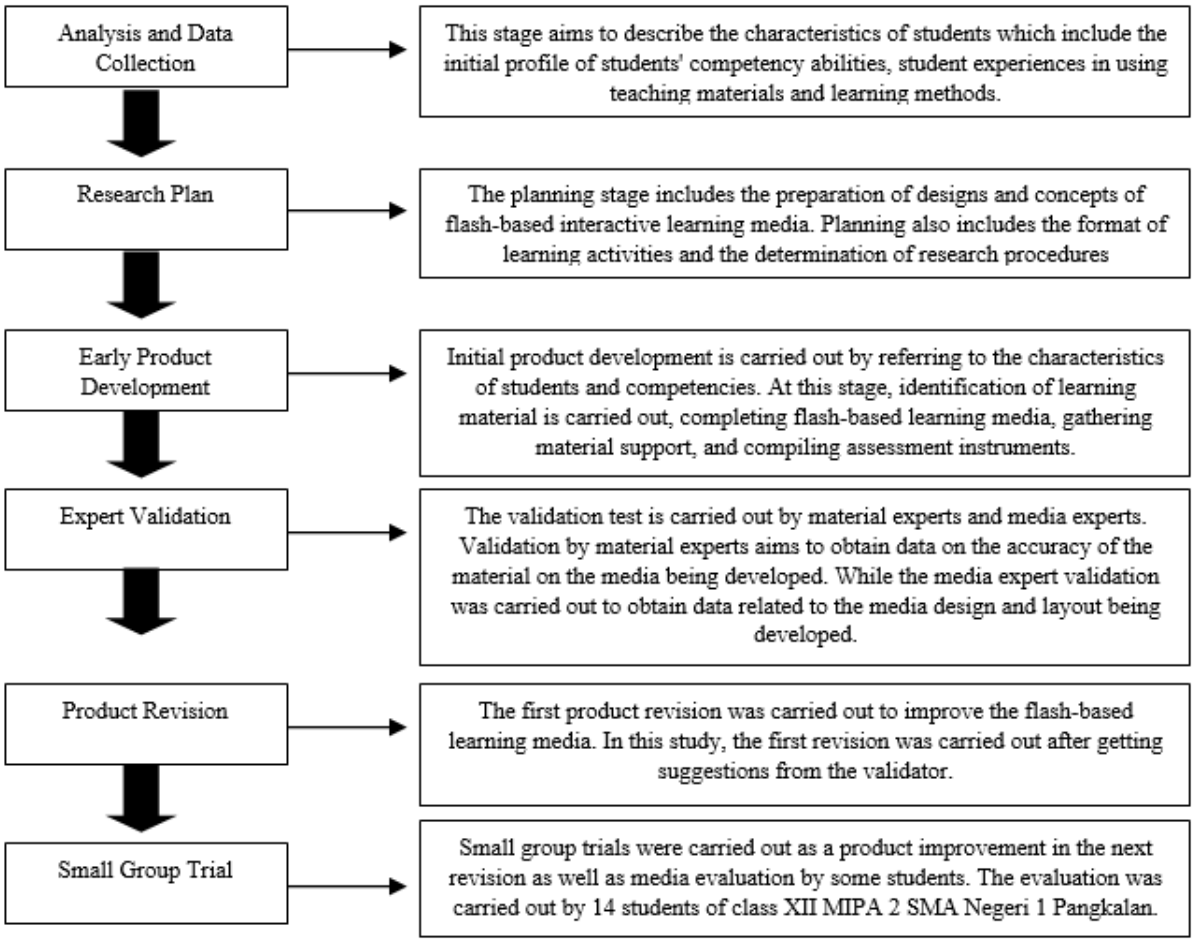

Figure 2. The Schematic of Research Procedure

The data technique of collecting data is carried out by means of test, questionnaire, and interview. The test is carried out to assess the competence aspects of students with the test instruments that has been tested and valid (Table 1). Then, the questionnaire is used to obtain data in the form of responses or expert assessments of the product that is developed. Moreove, the interview is carried out to obtain some information on the initial data collection.

Table 1. The Students' Competencies Instrument

Indicator of students' competencies	The question indicator
Explaining the definition and types of blood circulation in	Explain the definition of closed blood circulation Explain the definition of opened blood circulation

humans.	
Describing the structure and function of the circulatory apparatus in humans	Mention parts of the heart
	Describe the connection between structure and function parts of the heart
	Describe the characteristics of the blood vessels
Describing some kinds of blood circulation in humans.	Explain the definition of small blood circulation.
	Explain the definition of the large blood vessels.
	Explain the definition of blood in humans
	Explain the function of blood
Describing the components of blood in humans.	Explain the cause of why the colour of human blood is red.
	Use knowledge about blood in everyday life.
	Mention the blood cells that function in the blood clotting process.
Describing the classification of blood types in humans	Know the founder of the ABO blood type system in humans
	Explain the basis for determining the blood type in humans
	Mention the blood type which roles as the universal recipient.
	Explain the consequences of error in blood donation.
Describing various disorders and diseases in human blood circulation that often occur in Indonesia.	Explain the characteristics of Anemia.
	Mention hereditary diseases that causes blood to be difficult in clotting
	Mention abnormalities in white blood cells.

In the Validation test, there are 3 validators consisting of 1 material expert validator and 2 media expert validators to validate the media developed. The 2 media experts are biology teacher and technology and information teacher at SMPN 1 Rumpin. While 1 material expert is biology teacher at SMPN 1 Rumpin. Moreover, the conclusion of media feasibility referring to Widoyoko in Priyambodo (2012). See table 2.

Table 2. Criteria for the Validity of Learning Devices.

No	Score	Validity Criteria
1	85,01-100,00 %	Great
2	70,01-85,00 %	Good Enough
3	50,01-70,00 %	Low
4	01,00-50,00 %	None

The feasibility of Adobe Flash-based instructional media is obtained from the assessment of the media experts by using questionnaires. Moreover, the validity data of instructional media is analyzed by using the following formula by (Arikunto in Zakiyah, 2015).

$$P = \frac{\sum x}{\sum xi} x\ 100\%$$

Which:
P = feasibility percentage
X = the answer of Score Validator (real score)
Xi = Highest Answer (expected score)

The effectiveness test is carried out on students of senior high school class XI science at SMAN 1 Pangkalan Karawang with the sample of 14 students. In this activity, a pre-test and a post-test are carried out to be compared (Gall & Borg, 2003). Besides, Simple random sampling (SRS) is a technique used in determining the sample. In the trial class, there are 14 students. Then, the effectiveness test is carried out with 3 types. There are the t test to get the pre-post score, the Paired Sample t-test, and the N-gain test to show the improvement of the students' competencies.

There is one class that is chosen as an experimental class. Somehow, the pre-test and post-test scores are the scores that are used as parameters (Borg & Gall, 2003). Prior to these 2 tests, there are tests, namely validity test and reliability test toward the exercises that will be tested to the students. Then, after the trial, there are 15 valid items out of the 20 that are tested. These items have represented each indicator that is made.

Hypothesis

There are 2 hypothesis in this study which are:
Ho: There is no significance difference between the score of post-test and pre-test.
Ho: There is no significance difference between the gain score of treatment class.

3. RESULTS AND DISCUSSION

Initial Data Collection

The result of an interview with the biology teacher of SMAN 1 Pangkalan Karawang on November 2, 2020 are shown below.

1. Learning models used in learning biology include Discovery Learning, discussion, and teacher presentations by using power point program.
2. The form of the daily test that is usually done is the multiple choice test, and essays. Meanwhile, the daily assignments that are usually done are exercises and independent practicum.
3. Media or applications that are usually used during online learning in the Covid-19 pandemic are Google classrooms, Whatsapp group, and sometimes using video conference via Google meet or Zoom.
4. Most of the Students' competencies can be classified as good enough. However, some others are still classified as low
5. All students already have personal smartphones.

Validation by Experts

Adobe Flash-based interactive instructional media is validated by the two experts. They are media expert and material expert. The result of the validity by the media expert is presented in the Table 3 below.

Table 3. The Result of Validation by the Media Expert.

No	Assesment Aspects	Maximum score	Obtained score	Percentage of achivement	Notes
1	**The quality of instructional media design** (9 indicators of scoring)	36	29	80%	- Add the video sources to the media
2	**The Attractiveness of Instructional media** (5 indicators of scoring)	20	17	85%	- Add many more materials so that it is much clearer.
3	**The suitability of Instructional media with the Curriculum** (4 indicators of scoring)	16	13	81%	- Give colors to the background that is in contrast and clear.
	Average			**83%**	**Good enough**

The validation result by the media experts shows that the assessment on all indicators is in the Good enough category with the average score reaching 83% of the total / maximum score. This means that the developed Adobe Flash-based Interactive instructional media is suitable to be used as learning media. Then, the details of the quality aspects of media design include 9 indicators related to the appearance of Adobe Flash-based interactive instructional media, such as instructions for using the instructional media, the feature buttons that are easy and attractive to use, the font types, and others. Meanwhile, the attractiveness aspects of the instructional media include 5 indicators. There are the clarity of the quality of the background sound / music used, the animation and video used, the appearance and layout used, and others. Moreover, the suitability aspects of instructional media with the curriculum include 4 indicators which are used as the assessment. They are the suitability of the media with the competence and curriculum, the systematic of material presentation can achieve the competency, the suitability of basic competencies and indicators with the material, and the suitability between pictures, videos and animation with material. The scores obtained on each of these indicators are ranged from 3 to 4. The smallest percentage is obtained on the aspect of the quality of instructional media design on Adobe Flash-based interactive instructional media. Therefore, the advice given by the media expert regarding the improvement of interactive instructional media is around these indicators that are shown in the Table 3.

Material Validation

Validation by the material expert is done by two material experts. There are 11 aspects that are scored as shown below:

Table 4. The Result of Validation by the Material Expert.

No	Assesment Aspects	Scores	Notes
1	The suitability of material in the media with the Basic Competencies and Core Competencies in the 2013 Curriculum in the material of circulatory system	3,5	
2	The truth of the concept	4	- The material must be seriously deepened and clarified - Add the material about diseases and disorders to the material of circulatory system.
3	The description of the material	3	
4	The level of students' motivation to study	3,5	
5	The ease to understand	3,5	
6	The clarity to understand	3,5	
7	The presentation of material in a systematic, coherent, and clear way.	3,5	
8	Able to understand the difficult material without direct observation	3,5	
9	Media can help the uniformity of observation or learning perception	2,5	
10	The use of language that is easy to understand	4	
	Average	**79%**	**Very Good**

After the validation test is done by the material expert, it is found that all indicators belong to the very good category with the average score of 79%. This means that the development of the instructional media is very suitable to use by teachers to deliver learning materials since it is in accordance with the basic competencies and the learning indicators. The indicators in each of these aspects contain the suitability of all components of instructional media with the basic competencies, the learning indicators of having creative thinking skills, the goals, and the accuracy in selecting learning strategies to improve students' competencies. Moreover, the score for each indicator ranges between 3 and 4. Specifically, the notes given for the improvement of Instructional media are shown in the Table 4.

Then, after the validation there are several notes and comments given by the validator. Then the researchers do the correction. Next, the researchers test the effectiveness of interactive instructional media related to improving students' competencies.

In the expert validation test, the score is categorized as good so that the instructional media developed is valid and can be used as well. Moreover, the T test through the pre-test and post-test can be seen in the table 5 below:

The pre-test and post-test of the students' competencies

Table 5. The test result of Students' Competences

Data	Pre-test	Post-test
Sample	14	14
Maximum score	80	93
Minimum score	20	73
Average score	50	82

The data about the students' cognitive competence in the circulatory system material before learning (pre-test) by using Adobe Flash-based interactive instructional media shows the average score that is lower than the average total score after the students are taught (post-test) by using Adobe Flash-based interactive instructional media. Thus, it can be seen from the average score of both two tests, there is an improvement from the pre-test to post-test by 32 points. It is shown in the table 5 above.

Furthermore, in order to test whether the hypothesis that Adobe Flash-based interactive instructional media can improve the students' competencies in cognitive domain, the statistical test of paired sample t-test is carried out. This is due to the fact that in this study, there are only two interrelated data samples taking from the research subjects with the same average. Somehow, prior to test the hypothesis, it is necessary to test the normality of the pre-test and post-test data as a criterion of doing the statistical test of paired sample t-test.

Table 6. The Test Result of Normality

Class	Asymp. Sig (2 tailed)	Notes
Pre-test	0,200	Normal
Post-test	0,041	Normal

Then, the result of the normality test is presented in the Table 6 above. Based on the result, it is obtained that the data is normally distributed with a significance of more than 0.05. In other words, the researchers can test the hypothesis by using the paired sample t-test.

Table 7. The Result of Paired Sample t-test

Class	t-count	Asymp. Sig (2 tailed)	Notes
Pretest - Posttest	6,89	0,00	Different average

Table 8. The Result of N-gain

Class	Average	Category
Pretest – Posttest trial	59,8	Effective enough

In the T test, the result shows an improvement of students' competencies in the cognitive domain in the circulatory system material with a t-count value of 6.89. Somehow, it is gained after the students are taught by using Adobe Flash-based interactive instructional media. Therefore, the Ho is rejected.

The media validation score increases after the expert validation test and the effectiveness test is carried out in the trial class. Therefore, it becomes an indicator that the instructional media is well developed in accordance with the revision that has been made. Moreover, the revision is made during the expert test with several improvements such as the revision of exercises on the media, the display of the main menu, the color contrast so that they are different, and the elimination of ineffective displays in the media.

Then, the validation is carried out by 3 people who are experts in their fields. They are 1 expert in the field of media and 2 experts in the field of Biology material especially in the circulatory system material. In this study, there is the one and only expert in the field of media because this study is more focused on the material delivered through the development of Adobe Flash-based interactive instructional media. Moreover, the instructional media developed must have a good category and it is suitable to be used as learning media (Kurniasih & Ngadirin, 2013).

During the learning activities, instructional media is one of the important things that must be included in the lesson plan made by the teacher (Golitsyna, 2017). Moreover, the development of instructional media must be done with the test of it namely an effectiveness test. The test is done as an evidence that the instructional media developed is in the category of good and it roles as the assessment reinforcement. Then, after the assessment by experts and students are compleely done, the comparison between pre-test and post-test scores is done to determine the effectiveness of the use of the instructional media developed. Moreover, the result obtained is that Ho is rejected. Therefore, the use of Adobe Flash-based interactive instructional media is to improve the students' competencies (Dehkordi, 2011). Besides, the learning outcome in this study is the students' competencies in the cognitive domain in the circulatory system material.

The effectiveness test of the development of Adobe Flash-based interactive instructional media results that the developed media is very effective to use in learning activities. Therefore, it eases the teacher to deliver the material about circulatory system that belongs to one of the difficult materials. Besides, the use of instructional media that is not appropriate can cause difficulties for students in understanding the material. Moreover, the use of Adobe Flash-based interactive instructional media that has been tested for its effectiveness can help the teacher to deliver the material about circulatory system. As a result, there is an improvement in the students' learning outcomes since they get a valid and an effective instructional media (Evans, 2014). The use of this instructional media can improve students' competencies, especially in the material of circulatory system because the context in the media has been modified in accordance with its competencies that allow students to understand complex materials and effective learning (Merry, Skingsley, Mitchell, & Orsmond, 2015).

The students' competenes from the pre-test and post-test show a significant improvement in every aspect (Table 10). This shows that the use of Adobe Flash-based interactive instructional media that is developed is effective to improve students' competencies.

Table 10. The Average of Students' Competencies Aspect Improvement.

Indicator of competency	Average score		N-Gain	Category
	Pre-test	Post-test		
Explaining the definition and types of blood circulation in humans	8	13,5	2,8	High
Describing the structure and function of circulatory organs in humans	8	13	2,5	High
Describing various kinds of blood circulation in humans	6,3	8	0,5	Moderate
Describing the components of blood in humans	6,5	12	1,6	High
Describing the blood types in humans	4,3	14	1,7	High
Describing	7,5	12,5	2,0	High

various disorders and diseases in human blood circulation that often occur in Indonesia

Based on the data in table 10, there is significance in all aspects in terms of the N-gain score which is categorized as high. However, there is one aspect that is classified as moderate which describes the types of blood circulation in humans. In learning activities with Adobe Flash-based interactive instructional media that is developed, the competencies of students in each indicator has been improved. However, the improvement of the students' competencies cannot be done once. Therefore, it is necessary to use the interactive instructional media in every learning activity so that the competency indicators of the students continue to improve as well.

Teacher is the facilitator of learning activities in the classroom so that students are indeed required to be active in the learning process or what is commonly called student center. However, it does not mean that a teacher does not have a role at all. Besides, the use of Adobe Flash-based interactive instructional media is a means and proof of teacher's role. Changes in the learning activities can be done by the teachers by utilizing innovative media (Perovic, 2014). However, teachers in this case still do not use Adobe Flash-based interactive instructional media or others. In other words, it can be a consideration for teachers to increase the use of instructional media such as Adobe Flash or other instructional media in all biology materials. (Christ, Arya, & Chiu, 2017).

The development of interactive instructional media is expected to be a solution for the difficulties of educators or teachers when carrying out teaching and learning activities, especially on the material of circulatory system. The use of interactive media is expected to help in improving the students' competencies in learning biology. Moreover, the learning method that is used when using this media is student center which means that the students play role in active learning. (Uzun, 2012).

4. CONCLUSIONS

This study describes some steps started from design, development, and field test of the effectiveness of Adobe Flash-based interactive instructional media. This instructional media is developed in order to improve the students' competencies especially in the cognitive domain and it is used as a learning tool in learning activities. This media component consists of the main menu, content of material, video shows, and evaluation. Based on the evaluation and test by the media expert, it can be said that the Adobe Flash-based interactive instructional media is suitable and feasible to use. It can be seen from the result of the pre-test and post-test after learning using the developed media. Then, the N-gain score in this study shows the use of the Adobe Flash-based interactive instructional media is effective. Moreover, the t score shows the difference in the average and the improvement in the students' competencies after using the developed Adobe Flash-based interactive instructional media.

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