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Development of Adobe Flash Media Integrated Into HOTS on Circulation System (*AF-HOTS Bicycle Media*)

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ABSTRACT
This study is aimed to develop biology's learning media in the form of Adobe Flash based on HOTS for eleventh graders of senior high school. This study employs research and development (R & D) as method developed by Thiagarajan with a four D model that is modified with three stages, viz: define, design, and development. Products have been developed then validated by experts in their fields and have been revised. Based on the results of media validation conducted by experts, the validation value is 3.03, meanwhile the materials validation by the expert is 3.42, further the language validation by the expert is 3.03. Validation results obtained from media experts, materials, languages and teachers considered to prove that biology's learning media developed are valid for used in the learning process and for HOTS questions there were some suggestions from experts to add the number of questions to help students get used to HOTS questions

Key words: Biology's learning media; adobe flash; HOTS.

1. INTRODUCTION

Learning is an interaction conducted by teachers and students as well as students with teachers to exchange information and experience a change [1]. Biology learning aimed to understand a concept then students could connected one concept to another, so that it helps solve problems in everyday life [2]. In fact, students are often lacking in understanding biological concepts, it makes the inability of students to interpret in learning process [3]. Basically, the learning process must have an influence towards students' knowledge and attitudes for effevtive learning. Effective learning means interaction between students and learning objects in order to train how the process / stages to develop potential, skills, personality, able to study concepts and not be separated from the learning media used by teachers in process of learning [4]. The use of media in the learning process is preferred because it facilitates the delivery of material from teacher to student [5]

Biology's learning media trusted to stimulate students' thoughts, feelings, and attract the attention of bored students [6]. Stated that a function of using media is to provide the detail illustrations of objects which difficult to directly observe and help students to construct complicated concepts so it will be easy to understand for them. Scientific reasoning can be obtained by providing investigative tasks that are enhanced by technology or modeling media learning media [7].

A learning media can be used in learning process is multimedia, because multimedia is a combination of text, video, graphics, audio and animation in a device such as a computer. Learning media could attract students' attention and provide information that can be visualized by students are flash animation media. The use of Adobe Flash learning media in deliver materials combined with text, images and sound shows increased achievement, mastery of concepts, students' problem solving abilities, [8]. According to research conducted by learning using flash animation made the materials more detail and enhancement the learning outcomes.

A biological material did not provide direct learning experience was circulation materials, so that it requires learning media. Based on competencies in Curriculum 2013, the scope of the circulatory system is: the structure and function of cells making up blood tissue, circulatory organs, circulatory system mechanisms and circulatory system abnormalities [9]. The results of the teacher and student interviews showed that the teacher has been difficulty in giving a concrete picture, then students have not been understand yet the concepts and results of daily tests on circulation materials which are still under the minimum completeness criteria. [10] showed that students have lack of understanding in sub-chapter of workings in circulatory organs, and less to relate the concept of interconnected circulatory systems. Development of students' thinking skills based on meaningful learning experiences are able to overcome problems that arise in the learning process [11]
These obstacles could inhibit students in learning process and integrating new knowledges. Learning curriculum 2013 students are required to master Higher Order Thingking Skills (HOTS) [12].

The use of Adobe Flash as multimedia applications could used to overcome difficulties in learning the circulation system because Adobe Flash has advantages including be able to display detail illustrations, attractive display design with

animations, consistent image resulution and provide attractive features [13]. The use of flash media which combines animation, sound, and graphics made students more understanding about abstract materials then it could enhance students' learning outcomes [14].

The situation of learning through use of flash media could create conducive and effective learning. Difficulties experienced by students due to lack of understanding the concept or the possibility of learning strategies which were not related so that it was less effective in enhancing students' abilities to think, such as higher order thinking skills or commonly called HOTS [15]. HOTS is part of abilities to think critically and creatively, which not just memorizes but be able to convey information has known [16]. According to there were several aspects showed the capability to think highly is the abilities to solve problems, think critically and creatively. Student with HOTS ability be able to distinguish fact and opinion information, identify information from various sources and summarize information that has been analyzed [17]. In Bloom's taxonomy modification Anderson and Krathwohl such as: memory, understanding, application , analysis, evaluation and creating. The last three categories include the ability to think higher, namely: (1) analysis is the capability to connect between one concept and another to gain understanding of the concept, (2) evaluation is the ability to assess based on certain criteria, (3) creating an ability to implement a concept in a product.

The development Biology's learning media at 36 Senior High School is based on Adobe flash because school has adequate computer laboratorie's but the use of biology learning has not been carried out optimally. In line of this background to overcome the problem, the researcher intends to develop biology learning media on circulation material with adobe flash based on HOTS questions to improve student learning outcomes at 36 Senior High School Jakarta. Good approach in learning at class and for evaluation is by using HOTS [18]. The purpose of this research are: (1) to produce biology learning media products with Adobe flash based on HOTS questions. (2) to find out the influence of biology learning media with adobe flash. Submission of materials in the class of teachers should use media that is in accordance with the material and infrastructure [19].

Adobe Flash is software that can be produced presentations, games, films, interactive CDs, and learning CDs, as well as for create a website that is interactive, interesting and dynamic [20]. Adobe Flash CS3 complete website with a variety of animations, sounds, interactive animations, etc. so that the user while enjoying Explanation they can see animated images, read explanation in the form of text. Adobe Flash CS3 is the latest version of its predecessor is Macromedia Flash Professional8.

Higher Order Thinking Skills is a participant's thought process students in higher cognitive levels developed from various cognitive concepts and methods and learning taxonomies such as methods problem solving, bloom taxonomy, and the taxonomy of learning, teaching, and assessment [21]. These higher order thinking skills include at depth of problem-solving ability, creative thinking ability, critical thinking, the ability to reason, and the ability to take decision. According to King, higher order thinking skills are included critical, logical, reflective, metacognitive, and creative thinking. Students who have HOTS can develop cognitive processes in solving problems [22].

The circulatory system or cardiovascular system is an organ system that functions to move substances to and from cells. This system also helps stabilize body temperature and pH (part of homeostasis). There are two types of circulatory systems: the open circulatory system, and the closed circulatory system. the circulatory system, which is also part of the performance of the heart and the network of blood vessels (cardiovascular system) is formed. This system guarantees the survival of organisms, supported by the metabolism of every cell in the body and maintains the chemical and physiological properties of body fluids.

2. METHODOLOGY

Research and development employs in this study to develop products in the form of flash animation learning media based on hots question in circulation materials. Research and development procedures applied using the Thiagarajan four D. model [23]. The Thiagarajan four D model consists of four stages i.e. define, design, development, and disseminate. The procedures of Thiagarajan model are as follows.

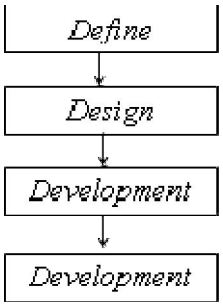

Figure 1: The procedures of Thiagarajan model

In the define stage, an analysis of the character of students is conducted, analyzing the tasks, and analyzing the concept with the aim of determining the objectives to be achieved in flash animation learning media. The second stage is design, namely by designing flash animation media. The next stage is development, which is to test students. The fourth stage is Disseminate, the media that have been developed are then used by other students and disseminated. However, this research is only carried out until the development stage, because this research is the initial research to conduct further research.

The steps contained in this study begin with the stages of defining namely conducting initial analysis, curriculum analysis, student characteristics, analysis of the material being taught, learning media that students have used, and learning objectives. Define phase aims to provide an overview of what kind of media to be made.

The second step is to design. Before learning media is made, first make a storyboad or flash learning media storyline, then the learning media design is done. The last stage is development. The learning media that have become later are validated to see the feasibility of the learning media. Validation is carried out by validators who are experts in their

fields. It consists of validator, media expert, material expert validator, language expert validator, and teacher.

The research sample is eleventh graders of 36 senior high school in East Jakarta. The instrument used for data collection was a validation sheet by media experts, material experts, teachers, and students. Enhancing students' learning outcomes in concept of circulation using the design of experimental and control class to find out the comparison [24]. Data collected by using a questionnaire and test techniques. Determine the percentage of validity score calculated by the following formula [25].

$$JK_{(r)} = \frac{\sum X_E^2}{k} - \frac{(\sum X_E)^2}{(k \times N)}$$

Explanation:
$Jk_{(r)}$ = average of the results of the assessment of the validator
K = number of criteria
N = number of validators assessing
Xt = total validator score

Data analysis techniques using a Likert Scale. Using the validity level criteria can be seen in Table 1 [26].

Table 1: Validity Criteria Criteria validation value

Validation Value	Criteria
1,00-1,99	Not valid
2,00-2,99	Less valid
3,00-3,49	Valid
3,50-40	Very valid

Media design

The media begins at the stage of making storyboard designs to create a picture of flash learning media. then proceed with making flash media on respiration material based on respiration concepts. pembutan flash learning media using the Adobe Flash CS3 application.

Expert validation

In this research development must be validated by experts. Expert validation is carried out from material expert validators, media experts, and linguists who are experts in their fields. Validation is done aimed at making the media suitable for use. Media validation is done by looking at various aspects. media that have been validated by experts and then made revisions to the media then it can only be concluded that the media is feasible or not used by students.

3. RESULT AND DISCUSSION

The results of the product developed in this research and development are adobe flash learning media products based on hots questions on the circulation system material in the XI MIPA class. Development research conducted with the Thiagarajan model that has been modified only until the Development stage. The steps undertaken in this research development are: Define, Design, and Development, without being carried out until the Disseminate step because this research is a preliminary study to conduct further research.

The steps taken in developing Adobe Flash learning media starting from, (1) define, (2) design, and (3) development. Define Phase, at this stage an analysis of the characteristics of students, initial analysis, analysis of materials, analysis of learning media that have been learned, and formulating learning objectives. The defining phase is carried out aimed at establishing learning requirements. Initial analysis was carried out observations by conducting interviews with biology teachers at the school. Based on observations, it is known the teacher states that students have difficulty in answering hots questions. Development of thought and finding patterns have not been trained in learners. Learning by using interesting learning media has the potential to trigger high-level thinking in students [27].

Design Phase, at this stage the design of instructional media and materials used for learning activities are carried out. Product design begins with making storyboards then proceed with making flash media. The menu format contained in Adobe Flash learning media contains the title, learning objectives, flash material, indicators, and hots questions. The purpose of the menu format is displayed to describe and provide a path to the learning media that have been created.

Development phase, is the stage of developing adobe flash learning media which is used as a suitable medium for teachers when teaching class. Learning media which have become validated by experts in their fields. Adobe Flash learning media based on hots is said to be appropriate to be used by students if it has fulfilled several aspects of the level of validity assessed by the validator. The following are the results of validation by media experts.

Table 2: Media Expert Validation Data

NO	ASPECT	Indicator	Average
1.	Learning Design	Clarity of learning objectives	3.0
		Relevance of learning objectives with basic comptences	3.0
		Material depth	3.0
		Systematic/logic flow	3.0
2.	Visual communication	Communication	3.0
		Simple and alluring	3.0
		Visual	3.0
		Audio	3.0
		Animation	3.0
		Navigation	3.5
		Pots	3.0
		Image	3.0
Total			3.03

The learning media validation was carried out by two learning media validators. Based on the results of the validation obtained from the results of the validation carried out by media experts an assessment was made on aspects of the learning design in which there were items about how about the suitability of the media and the appearance of the Adobe Flash media. Learning media that have a display that is not confusing and easy to use by students is the main thing in improving understanding of the material [28].

The average obtained from the results of expert validation consisting of various indicator items obtained 3.00 which means valid. The next evaluation criteria, which are aspects of visual communication, contain the appropriateness of the use of writing, pictures, audio, image layout, type and size of writing. The advantages possessed by Adobe Flash are the ability to combine animated letters and images to attract students' attention [29]. Based on the results of media validation from experts stated that the visual communication aspects are valid with an average result of 3.03. There are a number of notes from media experts namely the use of writing must be increased in font size so that it is easier to read by students.

Tabel 3: Material Expert Validation Data

Aspect	Indicator	Average	Information
Learning design	The suitability of the material with the curriculum	3.00	Valid
	The suitability of the material with the media	3.00	Valid
	Language and spelling accuracy	3.50	Valid
	Clarity of description	3.00	Valid
Quality of content	Material Weight	3.50	Valid
	Systematic presentation of material	3.00	Valid
	Video supports material	4.00	Very valid
	Material compatibility with competence	3.00	Valid
Total		3.42	Valid

Material validation was carried out by two validators to assess the feasibility of the circulation system material contained in the adobe flash learning media based on hots problems. There are several aspects that are assessed to determine the feasibility of the material on Adobe Flash learning media.

There are points about the feasibility of the material, the suitability of the material, the clarity of the material description on Adobe Flash media, and so forth. Based on the results of the overall material validation the scope of the circulation system material in the adobe flash learning media is valid. There is a note from the material validator that is, by adding more items adobe flah learning media so that students are trained and accustomed to working on hots, besides that the circulation system material must be made more detailed and the use of animation must be more varied. As research conducted by explains that using varied animation will make it easier for students to describe difficult material that will be more easily understood by students [30]. Clarity of material presented to the media makes the media valid for use [31]. The next validation that is assessed is the validation of the validation expert as follows.

Tabel 4: Language Validity Data

Aspect	Indicator	Average	Information
Word difficulty level	Word level on flash media	3.00	Valid
Linguistc	The accuracy of using discussion or spelling on flash media	3.00	Valid
Article	The accuracy of fonts and font colors on flash media	3.00	Valid
	Total	**3.00**	**Valid**

Based on the results of the validation carried out by the validator linguists and teachers obtained valid with a total average value of 3.03 with valid criteria. The language aspect is an important aspect because it is assessed as a determinant of the quality of the media because it will provide information to the recipient [32]. Submission of media by using language that is correct and in accordance with the rules of biology can improve students 'understanding of the material and increase students' understanding in answering hots questions [33]. The role of language is very important when the teacher conveys the material and gives an understanding of the material being taught.

Tabel 5: Teacher Validity Data

Aspect	Indicator	Average	Information
Ease aspect	Flash learning media is easy to use	3.00	Valid
Effectivity aspect	The use of flash learning media is used effectively	3.50	Very valid
Errors aspect	Flash learning media can avoid mistakes	3.50	Very valid
Statisfact aspect	Flash learning media can provide satisfaction to the user	2.50	Less valid
Data pull aspect	Flash learning media can attract students' attention	3.50	Very valid
Total		**3.06**	**Valid**

Flash learning media, there are a number of suggestions given by language validators about scientific terms and explanations to be more clarified in their mention, so that students are not mistaken and wrong understanding about what is conveyed in the flash media pronounce a term that clearly makes students not mistaken and confused [34]. Some things that are conveyed by the teacher to be used as suggestions such as the need to add a play and stop button on the developed flash media and the questions presented are more varied. Next is the indicator table about hots.

Tabel 6: Indicator HOTS

Problem indicator	Cognitive level	Question distribution
Determine blood type	C6	1
Explain the circulatory system of various	C6	2
Analyzing the causes/diseases that occur in the circulatory system	C5	3
Explain and give arguments for abnormalities in the circulatory system.	C4	4
Make an analysis of the circulatory system.	C4	5
Correlating the state of social status with abnormalities of the circulatory system.	C4	6
Overcoming overcoming problem preventing from clotting.	C6	7
Summing up cardiovascular disease abnormalities.	C5	8
Summing up the consequences of inserting a wire or stent into a vein in surgical angioplasty.	C5	9
Examine the structure of different arteries and veins.	C4	10

Based on the results of validation with the teacher, the teacher gives suggestions on the matter of hots that are presented too little. Hots problems found on flash media can be added again so that students become trained in answering hots questions. In their research mentioned that students will more easily solve problems if they are solved in solving hots [34]. Developing students' thinking can be a provision for students [35-36]. The following below is a table about hots.

4. CONSLUSION

Research and development has been carried out in the form of flash media products based on hots. Based on the findings obtained, the flash media developed are valid by experts consisting of media experts, materials, languages, and teachers. Implementation in the use of flash media can be a positive response by biology teachers, because in the media there are questions about hots that can train students in trouble answering about the hots. thus this research and development is carried out as a step and initial research to conduct further studies that can be tested on students and can be disseminated.

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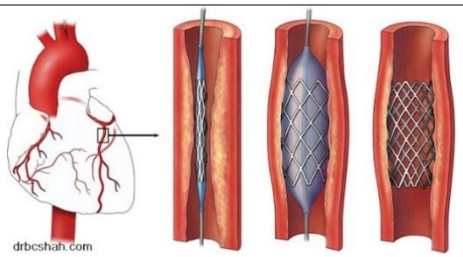
Appendix 1

Circulatory Hots Question

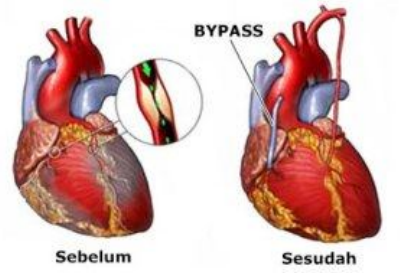
No	HOTS Questions
1	Awan is a eleventh graders of high school who wants to donate blood to his mother who must immediately get a blood donor. But the clouds do not yet know their blood type. Imgin clouds do a blood type test. What should the clouds do?
2	Irza is a eleventh graders of high school. Irza got an assignment to do the practicum given by biology teacher about the circulatory system. The animal that Irza used in the lab was tadpoles. How should Irza carry out this task?
3	During biology learning, Yani suddenly felt her body go limp. Then Yani asked for permission to go to the hospital. After being examined by a doctor it turns out that in Yani's blood the production of white blood cells is excessive so that the amount in the blood exceeds the normal limit. Excessive blood cells not only eat bacteria but also eat red blood cells so the body experiences severe blood shortages. According to the doctor's analysis, this disease is called anemia. Is it true that the analysis from the doctor? What do you think and give the reason?
4	When practicing biology, Luwi was affected by a razor when dissecting fish. Then there was a lot of blood coming out from Luwi's hand. Strangely the blood that came out continuously and would not stop. According to biology teacher Luwi suffers from hermophilia. Is it true what Luwi biology teacher said and gave your reasons?
5	Mr. Bambang is checking for blood pressure at the Puskesmas. It turns out that Bambang's systole pressure is greater than 140 mmHg and diastolic pressure is more than 99 mmHG. In your opinion, what is the abnormality experienced by Mr. Bambang's body and give reasons?
6	The number of anemia sufferers among junior high school students in Kab. Karawang is fairly high. As part of the pilot project, out of 215 students in Karawang 1 Junior High School who were examined for hemoglobin levels, 34 of them tested positive for anemia. 50 percent of anemia sufferers come from poor families. Based on one of the news taglines above, how is it related to a student who comes from a poor family with a person's low Hb?
7	Before the 1930s, blood transfusions were generally taken from certain donors. Usually from one of the patient's relatives and the blood is "still warm". But today, there are many blood banks that provide stored blood. Given that blood is easy to clot, what is the process of storing blood so that the stored blood does not clot.
8	Ministry of Health Research and Development (Balitbangkes) Ministry of Health released data on 10 diseases that are the most common cause of death in Indonesia from the 2014 survey of events.  Identify why in Indonesia cardiovascular disease is ranked in the top 10 diseases that cause death in Indonesia?

9



In your opinion, will inserting a wire or stent in a vein in an angioplasty surgery have another potentially harmful effect?
Menurut pendapatmu, apakah memasukkan kawat atau stent didalam saluran pembuluh darah pada bedah angioplasty itu akan menimbulkan efek lain yang dapat membahayakan ?

10 Heart attacks occur when the arteries that supply blood to the heart harden and become blocked (coronary heart disease). One of the healing technologies of heart attack is by passarteri surgery (CABG), which is to transplant new blood vessels in the form of healthy arteries or veins.



If a new vein is removed from the vein to replace the blocked coronary artery, what will happen considering that the structures of the arteries and veins are different?