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Developing Interactive Learning Multimedia for Blood Circulatory System Materials for Elementary School Students

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***Abstract*—The purpose of this research was to produce interactive learning multimedia on human circulatory system materials for grade 5 elementary school students. This research was a research and development study which refers to Borg and Gall's steps collaborated with the Hannafin & Peck model. The research stages included the planning, design and development stages. The research subjects used in this study included two validators, namely learning media experts and learning material experts, 35 elementary school students in grade 5. The results achieved in the development of interactive learning multimedia showed that the developed interactive learning multimedia was valid based on the assessment of learning material experts and learning media experts. The trials carried out were initial trials, main field trials, operational field trials. The test results showed that the interactive multimedia learning material circulatory system produced is suitable for use in learning activities and according to user needs.**

Keywords—development; multimedia learning; circulatory; elementary school

I. INTRODUCTION

The development of science and technology has encouraged the creation of innovations in the use of technology products in the field of education. In accordance with the 2013 curriculum, everything must be integrated with information and communication technology. The teacher has a role to be able to develop skills in the use of technology in making representative learning media because learning media is one of the components of learning resources that are important in learning activities [1]. Learning media serves as a communication tool used to channel messages and can stimulate students' thoughts, feelings, and abilities so that it can encourage an effective and efficient learning process [2]. Various forms and types of learning media used by teachers can be a source of knowledge for students. In this case, the teacher must have the skills to choose and use the media properly so that it can make it easier for students to understand the subject matter, which can then affect student learning outcomes. In addition, teachers must be able to always innovate so that students can get a meaningful learning process through an attractively packaged learning process. This is conducted to achieve learning objectives, namely by organizing learning, conveying learning content by arranging interactions between learning resources used and learners so that they can function optimally [3].

Based on the results of observations made in grade 5, Muhammadiyah Karangkajen Elementary School Yogyakarta, when the learning process of the circulatory system materials took place, some students found it difficult to absorb the material presented by the teacher. The difficulty of these students is because the material in the circulatory system includes abstract material. Circulatory organs, functions, and how they work cannot be brought to the presence of students so that students cannot observe directly. Students experience difficulties in this material due to the inability to reconstruct the circulatory system material that involves oxygen, the function of the lungs, the number of blood vessels, and its circulation [4].

In addition, based on interviews with class teachers, student learning difficulties were also indicated by the daily test scores of students on science material which obtained a class average below the Minimum Completion Criteria of 75, namely 74.00 out of 35 students, the data obtained showed that there were 16 or 46% students who have not reached the standard value of the Minimum Completeness Criteria. Students also admit that it is difficult to ask them to sequence the circulatory process of human blood and explain the functions of the circulatory organs. The lack of variations in the media used by the teacher and the media that students can use in learning the human circulatory system material causes students to have difficulty understanding learning. Therefore a media is needed to help explain the material of the human circulatory system to students.

The learning media often used by teachers in the Natural Science learning process are textbooks, Student Worksheets, and Microsoft PowerPoint with simple presentations. However, the use of power points was still not optimal, because even though it was equipped with pictures, most of them only moved the writing from the book to be read and copied by the

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students after the teacher had explained it orally. The media used is less practical and less attractive. In addition, teachers still use conventional methods, but there are still many students who do not pay attention when students are asked to answer questions, some students do not focus on learning and do not pay attention to explanations from the teacher, even some students are cool with their own world or chatting with their next door friends.

Learning that is carried out conventionally results in students learning ineffective and unmotivated so that students do not understand the material provided so that teachers must use other learning methods and even more attractive learning media to increase student learning motivation [5]. So, the material that studies the circulatory system really needs help and a variety of learning media that supports conveying information.

One good solution is to implement interactive learning media in the form of interactive learning multimedia. Interactive learning multimedia is multimedia equipped with a controller that can be operated by the user so that users can choose what they want for the next process [5]. Multimedia learning can combine all combinations of text, photos, graphics, sound, animation, and video that are digitally manipulated [6]. Multimedia has several characteristics, namely: diversity, interactive, integration of several components, and real time [7]. The element of interactivity in the use of multimedia aims so that students who act as users can exercise full control during use in the learning process so that it makes it easier for students to understand the content of the material presented [8].

In addition, multimedia used in learning environments can help teachers increase understanding, knowledge, and encourage them to use multimedia in teaching-learning situations. The interactive features of multimedia also help students learn and remember better. Investigations show that people learn faster and develop more effectively when they are in a multimedia environment [9]. The use of multimedia in learning can also help teachers explain difficult concepts, can generate student motivation for learning because of an attractive presentation and is more efficient in terms of time [10].

Interactive multimedia is a medium that is easy to store and flexible, can bring objects or learning materials that are difficult to obtain or dangerous into the learning environment, and can display objects that are too large to the class and display objects that cannot be seen directly [11]. Multimedia learning can be used to help explain human blood circulation material because multimedia learning can help attract students' attention, help explain difficult concepts such as human blood circulation, and can help display circulatory organs and their processes.

Based on the explanation above, the use of technology in the learning process is of course very helpful for teachers in solving the concrete problems that are happening, especially problems in the learning process with the human blood circulation system material. Therefore, researchers are very interested in developing learning media in the form of interactive multimedia learning material on the human circulatory system in grade 5 elementary school students.

II. METHODS

This study used a Research and Development (R&D) research design. The development carried out adopts the Borg & Gall model [12]. Then for the development of materials and media used refers to the model Hannafin & Peck [13]. The choice of Hannafin and Peck's model is based on the consideration that this model is oriented towards learning products.

The procedure in this study adopted a research and development model from Borg & Gall that was collaborated with the Hannafin & Peck model. In this model, which only goes through 9 out of 10 research and development steps which include research and information gathering, planning, developing initial products collaborating with the development or implementation stages of Hannafin & Peck, conducting initial field trials, revising major products, conducting main field trials, operational product revisions, conduct operational field trials, and final product revisions. This development research only assesses the feasibility of the product being developed, not to assess the effectiveness of interactive learning multimedia products human circulatory system material.

The subjects of this study were 5th grade students of SD Muhammadiyah Karangkajen Yogyakarta. The number of students who were the research subjects was 35 students. The procedure in this study adopted a research and development model. Data collection techniques in this study were observation, interviews and questionnaires. Researchers used observation techniques towards learning in class 5, interviews with teachers and question and answer with several grade 5 students of Muhammadiyah Karangkajen Elementary School to explore information about problems and obstacles experienced by students during the learning and learning process.

Meanwhile, questionnaires were used to collect data in the form of quantitative and qualitative data. Quantitative data, namely in the form of assessment scores from questionnaires/ questionnaires and qualitative data in the form of suggestions and responses from material experts and media experts as well as students after assessing interactive learning multimedia products on the human circulatory system material.

In this study, there were three types of questionnaires used, namely material validation questionnaires, media validation questionnaires, and student response questionnaires. The materials validation questionnaire was used to get an assessment from material experts regarding the suitability of the material contained in the developed multimedia and used as a basis for revising the material. Media validation questionnaires were used to obtain revised assessments and suggestions regarding multimedia quality from media experts. Meanwhile, the student response questionnaire was used to determine the response or assessment of students to multimedia during implementation trials.

The data analysis technique used in processing the data obtained in this study used quantitative descriptive data

analysis [14]. The data analyzed in the form of data obtained from the results of material validation, media validation, and student response questionnaires. Assessment data from material experts and media experts on interactive learning multimedia uses a Likert scale, namely by using four categories consisting of very poor, not good, good, and very good. To calculate the average score for all aspects of the assessment with the following formula

$$\overline{X} = \frac{\sum x}{n}$$

Explanation: $\overline{X}$ = average score of each aspect

$\sum x$ = total score

n = number of respondents

Furthermore, the data were analyzed descriptively and quantitatively with the mean and categorization technique, as for the assessment data from material experts and media experts on interactive learning multimedia using a Likert scale with a scale of 4. On this scale, the product developed is said to be feasible if the assessment given is at least three or in the good category. The Likert scale score and assessment criteria according to Widoyoko are as follows [11].

TABLE I. PRODUCT ASSESSMENT CRITERIA

Score	Interval	Category	Conversion
4	$3{,}25 \leqslant \overline{x} \leqslant 4$	Very Good	Proper to Use
3	$2{,}5 \leqslant \overline{x} < 3{,}25$	Good	
2	$1{,}75 \leqslant \overline{x} < 2{,}5$	Not Good	Not Feasible
1	$1 \leqslant \overline{x} < 1{,}75$	Very Poor	

If the resulting data analysis has met the conversion. Category "proper to use" or gets a range score $2{,}5 \leqslant \overline{x} < 3{,}25$ or $3{,}25 \leqslant \overline{x} < 4{,}00$ obtained from material experts and media experts, interactive learning multimedia can be used and is feasible for product testing. Assessment data from student trials using the Guttman scale ranging from 0 to 1 with the product eligibility criteria as follows.

TABLE II. PRODUCT ASSESSMENT CRITERIA

Score	Interval	Category	Conversion
1	$0{,}5 < x \leqslant 1$	Agree	Proper to Use
0	$0 < x \leqslant 0{,}5$	Disagree	Not Feasible

If the analysis of the resulting student response data shows the conversion of the "feasible" category or obtains a score with a range of values $0{,}5 < x \leqslant 1$ then interactive multimedia learning is feasible and can be used.

III. RESULT AND DISCUSSION

The results of the study were based on a series of activities at the time of the initial research, which concluded that the development of interactive multimedia learning material on the human blood circulatory system was an alternative learning media for grade 5 students of Muhammadiyah Karangkajen Elementary School. The results of the initial development of multimedia learning were in accordance with the characteristics contained in multimedia learning, such as the availability of interactivity and feedback processes, and are able to provide freedom to users in choosing topics for learning with systematic control [15].

The process of developing multimedia interactive learning material for the human circulatory system begins with the stages of research and information gathering. At the initial information collection stage, the researcher conducted an analysis by observation, interviewing class teachers, and grade 5 students of Muhammadiyah Karangkajen Elementary School. Based on observations and interviews, several problems were found, namely the suboptimal media used by the teacher to explain the material on the human circulatory system, so that students had difficulty understanding the materials. The interesting and interactive media used by students to study the circulatory system material are still not available in schools. The results of interviews with students showed that students expect variations in the learning media used, students were more enthusiastic about receiving lessons if they used something new and interesting, students already had basic computer operating skills. However, the use of computers to run multimedia learning programs in learning and learning activities was still not optimal.

After the initial research and information collection stages have been carried out, then the second stage is development planning. At the planning stage, the steps taken to consist of: 1) Analyzing the Learning Implementation Plan, which contains material on the human circulatory system. 2) Determining the multimedia concept in the form and determining the content of the material by adjusting basic competencies, indicators, and learning objectives. 3) Determining and preparing the tools to be used in the development process. 4) Making a flowchart to describe the sequence of operations of a multimedia program. 5) Make a storyboard to provide a complete explanation, what is contained in each flow in the flowchart. 6) Collect material and materials for interactive learning multimedia products that are developed according to the material needed.

Then the study proceeded with the initial product development stage. In developing this initial product, the researcher collaborated with the third phase of the Hannafin and Peck model (1988), namely development or implementation. Multimedia development was based on compiled material, flowcharts, and storyboards. Production or creation of multimedia programs are assembled using software *Adobe Flash CS6*, *Corel Draw X7*, and *Adobe Premiere*. The stages carried out in production consist of:

1) Making multimedia components in the form of text, images, animation, video, audio, buttons, and interactivity.

a) *Selection (Heading 4):* Highlight all author and affiliation lines.

b) *Change number of columns:* Select the Columns icon from the MS Word Standard toolbar and then select “1 Column” from the selection palette.

c) *Deletion:* Delete the author and affiliation lines for the second affiliation.

2) Making a multimedia display according to the storyboard. The display made consisted of several main pages such as.

a) a title page containing multimedia titles, target users, logos, and buttons to start using multimedia.

b) Help page containing instructions regarding the keys in multimedia.

c) Learning objectives page containing basic competencies and indicators from multimedia.

d) The material menu page is containing a selection button for the material you want to study.

e) The content page containing material on the circulatory system.

f) Simulation page, there are 3 simulations, namely 1) user simulation can draw human circulatory organs according to the available image, 2) user simulations can point the cursor to find the correct blood flow, and 3) simulations users could match information on the blood circulation image by drop and drag it precisely on the column provided.

g) The question practice page, which contained 10 multiple choice questions, each of which has immediate feedback in the form of a pop-up when it was wrong or correct in answering the questions, and when it had finished answering all the questions, a score will appear from the user's answers.

h) Games page, which contained 2 games, namely blood hop and puzzle games. But before starting this game, the user must do practice questions with a minimum score of 7, and then the game can be played.

i) The developer profile page contained information about media developer profiles, supervisors, media experts, and material experts.

j) Multimedia program exit page, on this page there was a choice of "yes" or "no". If you choose "yes" then the user will exit the multimedia learning program and if you choose "no" then the user can still continue the multimedia learning program

3) Writing script code so that the animation button and text in multimedia can be executed according to the design.

After the multimedia was completed, the researcher double-checked by trialing the multimedia to see the overall function of buttons, animation, and text so that there were no errors in operation. Furthermore, packaging was carried out by publishing multimedia, namely storing multimedia in .exe form so that it is ready for use on a computer.

A series of product development stages had been carried out, then the researcher carried out the product trial stage. At this stage, interactive learning multimedia was produced, which was then validated by material experts and media experts to get an assessment of the feasibility of learning multimedia that has been developed. Validation of material experts and media experts was carried out using a multimedia learning assessment questionnaire that had been developed and had received validation from the supervisor.

Validation of the material aspects of the human circulatory system in interactive multimedia learning was carried out by a material expert, namely Dr. Pratiwi Puji Astuti, M.Pd. as a lecturer in the Elementary School Teacher Education study program. Validation of this material is in order to produce multimedia products that are feasible in terms of the correctness of content and material in interactive multimedia learning. Material validation was carried out in two stages before the media was implemented to students. The following is the first stage material validator assessment of the material contained in interactive multimedia learning.

TABLE III. AVERAGE SCORE OF FIRST STAGE MATERIAL EXPERT VALIDATION RESULTS

No	Rated Aspect	Average Score	Category
1	Learning Aspects	3,61	Very Good
2	Material Aspects	3,62	Very Good
	Total	7,32	
	Average	3,61	Very Good

The assessment data from material experts was obtained through an instrument sheet with a Likert scale assessment. The results of the first stage validation of the product from material experts gave a score on the learning aspect with an average of 3.61 which was in the very good category, and in the material aspect, the score was obtained with an average of 3.62 which was in the very good category. Overall, the first stage material expert's assessment of interactive multimedia learning material circulatory system obtained a total score of 7.32 with an average score of 3.61, which is in the very good category and is feasible to use with revisions according to suggestions and input.

There are several improvements that need to be made, namely adjusting the sequence of learning objectives, reinforcing images in the heart chamber material that is not yet clearly visible, improving the information on images of circulatory circulation, emphasizing how the heart works, and clarifying blood circulation charts. These suggestions and input become a guide in implementing the revision of multimedia learning. After improving the material in multimedia, it is followed by a second stage material validation assessment. The following is presented the second stage material validator assessment of the material contained in interactive multimedia learning.

TABLE IV. MEAN SCORE OF THE SECOND STAGE OF MATERIAL EXPERT VALIDATION RESULTS

No	Rated Aspect	Average Score	Category
1	Learning Aspects	3,84	Very Good
2	Material Aspects	3,87	Very Good
	Total	7,71	
	Average	3,85	Very Good

The results of the second stage validation of multimedia products from material experts gave a score on the learning aspect with an average of 3.84, including the very good

category, and in the materials aspect obtaining a score of 3.87 in the very good category. Overall, the second stage material expert's assessment of interactive multimedia learning on circulatory system material obtained a total score of 7.71, with an average score of 3.85, which was categorized as very good and worthy of being tested.

In addition to obtain an assessment from the material aspect, interactive multimedia learning on the circulatory system material also received an assessment from the media aspect. Validation of the media aspect was carried out by a learning media expert, namely Mrs. Dian Wahyuningsing, M.Pd. as a lecturer in Educational Technology. Validation of this media was to produce a viable product in terms of the suitability of the existing learning media components in interactive learning multimedia products. Media validation was carried out in two stages before the media was implemented to students. In the following, the first stage media validator assessment of media aspects in interactive learning multimedia is presented

TABLE V. AVERAGE SCORE OF FIRST STAGE MEDIA EXPERT VALIDATION RESULTS

No	Rated Aspect	Average Score	Category
1	Display Aspects	3,23	Good
2	Programming Aspects	3,50	Very Good
	Total	6,73	
	Average	3,36	Very Good

The assessment data from media experts ware also obtained through an instrument sheet with a Likert scale assessment. The results of the first stage validation of the product from the media expert gave a score on the display aspect with an average of 3.23 which was in the good category, and in the programming aspect, the score was obtained with an average of 3.50 which was in the very good category. Overall, the first stage media expert assessment on interactive multimedia learning circulatory system material obtained a total score of 6.73 with an average score of 3.36, which is in the very good category and is feasible to use with revisions according to suggestions and input.

There are several improvements that need to be made, namely improving the appearance of the material and more equipped with clearer and more attractive images, emphasizing the interactive elements in the simulation part, the time limitation on puzzle games, and adding audio volume to the video on how the heart works. These suggestions and input become a guide in implementing the revision of multimedia learning. After improving the media components in multimedia, it is followed by a second stage media validation assessment. The following is presented the second stage media validator assessment of aspects in interactive learning multimedia.

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TABLE VI. MEAN SCORE OF SECOND STAGE MEDIA EXPERT VALIDATION RESULTS

No	Rated Aspect	Average Score	Category
1	Display Aspects	3,53	Very Good
2	Programming Aspects	3,50	Very Good
	Total	7,03	
	Average	3,51	Very Good

The results of the second stage validation of multimedia products from media experts gave a score on the display aspect with an average of 3.53, including a very good category, and in the programming aspect, the score was 3.50 in the very good category. Overall, the second stage media expert assessment on interactive learning multimedia circulatory system material obtained a total score of 7.03 with an average score of 3.51, which was in the very good category, and there were no more revisions from experts so that interactive multimedia learning material circulatory system was feasible. To be tested on students.

After going through the material validation and media validation stages. The learning multimedia developed is said to be feasible to be tested. Furthermore, the researchers conducted product trials. This product trial stage aims to determine the response of grade 5 elementary school students to interactive multimedia learning circulatory system material. Assessment data from initial field trials, main field trials, operational field trials using a Guttman scale ranging from 0 to 1.

The results of the initial field trial involving 5 grade 5 students of Muhammadiyah Karangkajen Elementary School obtained an average of 0.98 into the feasible category. From the results of the initial field trial, a student made a comment, namely that the writing size of the four heart chambers was small. After the initial field trial, the researchers revised the multimedia product.

Furthermore, the results of the main field trial of interactive learning multimedia products involving 10 grade 5 students of Muhammadiyah Karangkajen Elementary School obtained an average of 1 in the feasible category. From field trials, there are

no deficiencies in this learning multimedia product, so that there is no multimedia learning section that must be revised.

After that, the researchers conducted operational field trials of interactive learning multimedia products involving 20 grade 5 students of Muhammadiyah Karangkajen Elementary School. The results of operational field trials obtained an average of 1 in the feasible category. The responses were given by students from the implementation of operational field trials, namely: 1) students find it easier to learn the material of the human circulatory system because these learning multimedia provides a more concrete learning experience. 2) Students are more enthusiastic and happy to learn using interactive multimedia learning because this learning multimedia is equipped with various aspects including text, audio, video, images, and animation. Overall, the results obtained from this study state that interactive multimedia learning on circulatory system material is suitable for use by grade 5 elementary school students. Then the research and development activities based on the Borg & Gall model development steps have been completed.

The development research that has been carried out has resulted in a product in the form of interactive learning multimedia suitable for use for grade 5 elementary school students on the material of the human circulatory system. The research process was carried out using the Borg & Gall's development model and collaborated with the Hannafin & Peck's model. There are 10 steps in the research method and development of the Borg & Gall's model, but researchers only do it up to step 9, which includes research and information gathering, planning, product draft development, initial field trials, major product revisions, main field trials revisions, operational products, operational field trials, and final product revisions. Meanwhile, material and media development adopted the Hannafin & Peck model from the development or implementation phase.

The first stage is research and information gathering. In this stage, the researcher conducted interviews with teachers and students to find out the problems and conditions experienced in the learning process. The problems in the learning process in grade 5 Muhammadiyah Karangkajen Elementary School, namely that some students had difficulty absorbing the materials, especially the human blood circulation system, the lack of variation in the delivery of the materials, and the availability of learning media is still minimal. The media that the teacher used were textbooks, student worksheets, and simple Microsoft PowerPoint. Therefore, teachers and students need alternative learning media that can be used as presentation media in the classroom as well as independent learning media.

After the problems are found, one solution that can overcome these problems is to develop media in the form of interactive learning multimedia. Interactive learning multimedia can be a solution because interactive multimedia can help students to be more active in learning, where multimedia learning provides freedom for students to be able to learn independently [16]. Interactive multimedia also has several advantages compared to other media including multimedia that is more interactive and innovative, motivates student learning, and learning objectives can be achieved.

In addition, interactive multimedia learning can combine various combinations of graphics, text, sound, video, and animation [17]. This merger is a mutually supportive unit, capable of visualizing abstract learning material, facilitating student interactivity with existing teaching material sources on the computer, is a medium that is easy to store and flexible, can bring objects or learning materials that are difficult to obtain or dangerous into the environment learning, and can display objects that are too large a class and display objects that can not be seen directly. Based on this, developed interactive multimedia can support the learning process in the human circulatory system material.

Furthermore, the second stage is design development. The stages are carried out in multimedia design, namely analyzing the Learning Implementation Plan which contains material for the human blood circulation system, determining multimedia concepts in the form and determining the content of the material by adjusting basic competencies, indicators and learning objectives, making flowcharts and storyboards, collecting materials and materials for interactive learning multimedia products developed according to the material needed.

After the planning is complete, it is followed by a third stage that collaborated with the Hannafin & Peck model, namely the development or implementation stage. This multimedia development involves software *Adobe Flash CS6*, *Corel Draw X7*, and *Adobe Premiere.* The multimedia development is based on the preparation of material, flowcharts, storyboards. The initial interactive multimedia product has been made and then validated by material experts and media experts, first the multimedia is assessed by the supervisor for improvement and research approval. With the approval of the supervisor, interactive multimedia learning is validated by material experts and media experts.

The material validation was carried out in 2 stages. The first stage of validation obtained an assessment with an average score of 3.61, which was categorized as very good and feasible for use with revisions according to suggestions and input. As for the suggestions and input from material experts, namely adjusting the sequence of learning objectives, reinforcing images in the heart chamber material that is not yet clear, improving the information on images of circulatory circulation, emphasizing how the heart works, and clarifying the blood circulation chart. These suggestions and input become a guide in implementing the revision of multimedia learning. After the revision of multimedia, the second material validation stage is carried out. In this second stage of material validation, the developed multimedia obtained an average score of 3.85, including a very good category and included in the feasible category. So that in this stage of validation, material experts stated that multimedia no longer needed improvement and could be tested on users or students.

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suggestions and input from media experts, namely improving the appearance of the material and more equipped with clearer and more interesting images, emphasizing the interactive elements in the simulation part, the time limitation on puzzle games, and adding audio volume to the video of how the heart works. After the revision of multimedia, a second media validation stage is carried out. In this second stage of media validation, the developed multimedia obtained an average score of 3.51, including the very good category. So that all multimedia criteria have been met and no longer need improvement because media experts state that the product being developed is feasible to be tested on users or students. The results achieved in the development of interactive learning multimedia show that the developed interactive learning multimedia is valid based on the assessment of learning material experts and learning media experts.

Furthermore, it is implemented by testing the fifth grade elementary school students. The testing phase for students includes the initial field trial stage, the main field trial stage, the operational field trial stage. At the trial stage, each student gave an assessment according to the available questionnaire with 10 assessment indicators. Based on the results of the initial field trials involving 5 subjects, this interactive multimedia learning obtained an assessment in the proper category. The suggestion from a student is that the display of the material on the four heart chambers is small in size. After the initial field trials, the researchers revised the product.

After the initial field trial, continued at the main field trial stage involving 10 subjects, this interactive learning multimedia obtained an assessment in the proper category and without revision. Data from the results of the main field trials do not indicate that there are components that need to be revised from users or students so that it is continued at the next stage, namely operational field trials. This operational field trial phase involved 20 subjects, and this interactive learning multimedia obtained an assessment with a decent category and without revision. After the trial was carried out, students were given a response questionnaire to interactive multimedia learning. The responses given by students stated that students liked and were happy because it was easy to understand the material presented with multimedia learning, increased enthusiasm for learning, and did not experience difficulties in its use.

From these results, it can be said that interactive learning multimedia can be used as an alternative media for learning material on the human circulatory system. In addition, the teacher also gives a positive response, namely the teacher agrees to the existence of interactive learning multimedia, because multimedia learning is indispensable and needed as a companion to textbooks as well as learning media in the classroom and greatly helps teachers in delivering circulatory system material, adding to variations in learning media, and able to give full control to students when using multimedia in the learning process.

In this regard, the development of multimedia cannot be separated from the underlying learning theory. Learning theories provide a basis for building a systematic mindset in learning so that the resulting development products can be applied in learning optimally [18]. The theories that underlie this interactive learning multimedia are behavioristic learning theory and cognitive learning theory. The implications that can be given by behavioristic theory in the development of interactive learning multimedia, namely multimedia being able to apply the stimulus-response concept, develop stimuli provided in the form of simulations and practice questions, provide reinforcement by providing scores or values on students' answers which can be seen directly by way of interactive. Meanwhile, the implications that can be given by cognitive theory in the development of multimedia interactive learning are being able to direct students attention, being able to present learning material in the form of images or with varied text and displays so that students' understanding of a more in-depth concept can be stored in memory in a relatively long time, and provide additional cues in order to recall the capabilities obtained through exercises that can be operated interactively.

The interactive learning multimedia products developed certainly have advantages and disadvantages. The advantage of this multimedia is that students can operate multimedia learning well, which means students can repeat the subject matter and the freedom for students to choose which material to study. There is a circulation simulation menu that is packaged into several forms, namely drawing blood circulation, finding blood circulation instructions, and drop-drag questions to find out how far students understand the material presented. There is feedback at the end of the question exercise, after successfully obtaining the predetermined value students can open the games menu in the form of jump games and puzzle games to absorb students' attention into the active learning process. In addition, of course, there are pictures and animations that attract attention and arouse student motivation and interest in learning.

This interactive multimedia program is easy to use, so students can learn independently. Although designed for independent or small group learning both at school and at home, this developed multimedia can also be used as a medium for teacher presentations in the classroom. While the shortcomings of interactive learning multimedia developed are a limited exploration of material offerings because it is only the subject of the human circulatory system in multimedia, the multimedia learning format developed can only be operated using a computer or laptop because researchers have not developed it for the Android platform.

IV. CONCLUSION

Based on the results of the research and discussion, the following conclusions can be made. Multimedia interactive learning material for human circulatory systems is declared suitable for use for grade 5 elementary school students. This feasibility is based on the assessment of material experts and media experts with the results of product validation that has been carried out, as well as the assessment is given by students through a series of trials consisting of initial field trials, main field trials, and operational field trials.

The final results of product validation from materials experts using a Likert scale obtains an average overall score of 3.85 including the very good category, so that it is included in the feasible criteria, and the final validation results from media experts using a Likert scale get an average overall score of 3, 51 is in the very good category, so it falls into the proper criteria. Meanwhile, the results of the initial field trials of the main field trials, this operational field trial used the Guttman scale. The results of the initial field trials obtained an average score of 0.98 into the feasible category. The results of the main field trials of interactive learning multimedia products obtained an average score of 1 in the feasible category, and the results of operational field trials obtained an average score of 1 in the feasible category. From these results, it can be said that interactive multimedia learning material on human circulatory systems can be used for the learning process and become an alternative learning media for material on human circulatory systems in grade 5 elementary school.

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