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Development of the Human Circulatory System Module to Support Junior High School Students' Independent Learning

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Abstract: This research is to produce a teaching material product or science learning module about human circulatory system that is suitable to support junior high school students' independent learning by fulfilling eligibility and effectiveness. This research uses the Borg and Gall research model which is modified into 7 stages. This type of research is Research and Development (R & D). Techniques for collecting data used observation, questionnaires for expert and student validation sheets, interviews. Module validity, curriculum validity, material validity were validated by several teachers in science subjects at Junior High School 1 Papar. The research results show that the assessment of material experts with an average score of 3.76 with very good criteria and the assessment of module experts get approximately a score of 3.76 with very good criteria. The results of the assessment in the initial field trials obtained a percentage of 90.23% with the criteria of feasible and the results of the field trials obtained a percentage of 97.79% with the criteria of eligible. Based on the results of the research, it can be concluded that the science module on the subject of the human circulatory system is suitable for use as teaching material or a module that students can use in independent learning and has met its feasibility and effectiveness.

Keywords: Human Circulatory System, Independent Learning, Junior High School, Module

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INTRODUCTION

Education is a three-part process that combines society, the individual, and all aspects of reality, both material and spiritual, where all are factors that together contribute to the formation of nature and destiny, and how society or humans develop in the future (Duschl, 2008). The educational process is an educational activity through the teacher who guides towards achieving educational goals, where the educational process is carried out to determine the quality of the results of achieving educational goals. Development in the field of education as part of national development, it is necessary to achieve improvement and progress in the field of education. In law and regulation Number 20 of 2003 concerning the National Education System it is stated that "The implementation of education is obliged to adhere to several principles, namely education is carried out in a democratic and fair manner and is not discriminatory with uphold human rights. religious values, cultural values, and national pluralism through one systematic unit with an open and multi-meaning system" (UU No. 20, 2003:4-5).

Education can be interpreted as a process of acquiring knowledge and habits that can be seen during the learning process (Chao & Salvendy, 1994). Education plays an important role in everyday life, education cannot be separated from the life of society, family, nation and state. Education has an effect on the progress of a nation. Education cannot run well if it is not balanced with learning. Basically learning is a step in changing behavior and is based on experience. Changes in behavior, for example, are changes in habits, changes in attitudes, knowledge, understanding and skills (Tinto, 1997). In the learning process there are several parties involved, not only involving educators and students. However, modules also play a very important role during the teaching and learning process. Teaching material modules are learning materials used in teaching that are arranged systematically in accordance with the teaching principles that the teacher applies to their students (Hidayat et al., 2017). Systematic in question, namely arranged sequentially starting from the opening, filling the material, and closing, this is expected to make it easier for students when learning and make it easier for a teacher when delivering material. The teaching module is specific, which means that the teaching module is designed as optimally as possible in order to achieve success indicators (Sunarno et al., 2016). So it can be concluded that the module is a media or learning tool that is structured in an interesting and methodical way, with the ultimate goal of achieving the desired competency itself.

Preliminary observations made by researchers in 8th grade at Junior High School 1 Papar show that the main forms of learning resources are textbooks and student worksheets. The learning process in class consists of the instructor explaining, then giving practice questions to students to work on (Brusilovsky & Sosnovsky, 2005). Student worksheets is used for practice questions as student training material, while text books are usually used by teachers as instructions for conveying subjects in class. Most students like science material but the grades they produce are still unsatisfactory. Judging from the test results, students only get a score on the Minimum Completeness Criteria Standard, which is 67. One of the reasons or factors for the lack of a maximum score is because students experience difficulties in learning science. Students experience difficulties in learning science because the material is difficult to understand. Mrs. Widya as a 8th grade teacher revealed that students still have a significant knowledge gap when it comes to topics around the Human Circulatory System. Therefore, to master the material in depth, a better understanding of the material is required. To succeed in this endeavor, one cannot rely solely on the explanations given by the instructor. It is necessary to have additional aspects that complement the learning material so that students can use it for independent learning. Because the speed at which each learner absorbs information varies greatly. On the other hand, there are no learning materials that children can use independently while at home in this situation. Most students study at home using only textbooks and worksheets. Educators at Junior High School 1 Papar have not yet developed a learning module that students can use in independent learning at home. Therefore, it is necessary to develop teaching modules in printed form as student learning materials independently.

Modules are one of the most frequently used types of educational material. As a result of this goal, namely that students can learn alone or under the direction of a teacher, teaching modules are designed to be as effective as possible (Salsabila et al., 2022). The introductory section, the main section, and the concluding section are the basic components included in the module. The following is a list of some of the features that teaching modules have: (1) being able to teach alone; (2) self-sufficient; (3) solitary; (4) adaptive; and 5) user (Depdiknas, 2008) -friendliness teaching modules are very much needed in the learning process both for educators and for students. However, it requires an analysis of the needs needed to find out what teaching materials students need in helping the learning process (Setiawan et al., 2017). So, the teaching materials will be developed according to the characteristics of students. If

there are no teaching modules, the teacher will experience difficulties in upgrading teaching effectiveness as well as students will experience difficulties regarding understanding the material presented by the teacher because it is not systematic (Ghavifekr & Rosdy, 2015). So therefore, this module is a media that plays an important role in improving the quality of learning for both teachers and students. This module contains material on the Circulatory System in Humans in 8th grade science subjects.

Several previous studies regarding the development of the human circulatory system module. These studies include a PBL-based circulatory system e-module based on research results to improve students' critical thinking skills and cognitive learning outcomes (Rahmatika et al., 2020), E-module of human circulatory system through levels of inquiry-based to improve students' science literacy (Soraya Raupu et al., 2022), and developing the guided inquiry-based module on the circulatory system to improve student's critical thinking skills (Wulandari et al., 2022). The studies that have been carried out focus on the development of the human circulatory system module which can train students' critical thinking skills and students' scientific literacy so that the human circulatory system module developed is based on inquiry and PBL. Meanwhile, the human circulatory system module that will be developed in this study is the circulatory system module which focuses on independent learning. This module is varied which includes learning material/content, learning methods, interpretation, and evaluation techniques which are arranged in a systematic and riveting manner to achieve the expected indicators of success.

Based on the background above, the researcher will conduct research on the development of the human circulatory system module to support junior high school students' independent learning. This research is to produce a teaching material product or science learning module about human circulatory system that is suitable to support junior high school students' independent learning by fulfilling eligibility and effectiveness.

METHOD

This type of research uses Research and Development (R&D). Research and Development which means research and development. This research is based on a product. The development of this product aims to overcome students' learning problems both inside

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and outside the classroom. Another goal is to develop a learning module in the natural knowledge subject on the material for the Circulatory System in Humans.

According to Borg, W.R & Gall (2003) it is explained that there are 10 steps in conducting development research, namely: (1) research and information collecting; (2) planning; (3) developing preliminary form of product; (4) preliminary field testing; (5) main product revision; (6) main field testing; (7) product revision operations; (8) field testing operations; (9) final product revision; (10) dissemination and implementation. The stages of the development research put forward by Borg and Gall have modifications. This development research was carried out only up to the 7th stage, namely: (1) research and information collecting); (2) planning; (3) develop preliminary form of product; (4) preliminary field testing; (5) main product revision; (6) main field testing; and (7) product revision operations.

This research was conducted at Junior High School 1 Papar in the even semester of 2022/2023. The instruments used include: (1) interviews; (2) observation; (3) documentation; (4) questionnaire or questionnaire; and (5) product validation by experts. The information collected in the context of making the natural sciences module is in the form of qualitative data. During the development of the module, these qualitative data pieces were obtained from notes and contributions made by a number of research subjects. And the resulting module is said to be good if it meets three criteria, namely validation criteria, efficiency and practicality. Therefore, in determining the quality of the modules made there are three types of data that need attention, namely validity, practicality and effectiveness.

The questionnaire given to the module expert is in the form of a test. Interval data was analyzed by calculating the average response based on individual response scores. To determine the average value of agreeing or disagreeing, a table is provided which describes the characteristics of the respondents. The rule for compiling the classification table is to look for the highest score, the lowest score, the number of classes and the interval distance. Based on the data above, it can be compiled in the form of a table of classifications of respondents' attitudes as in **Table 1**.

Table 1. Score clarification

Average Answer Score	Classification
3.30 to 4.0	Very Worth it
2.4 to 3.30	Worthy
1.80 to 2.4	Decent Enough

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1.0 to 1.80	Not worth it

This score clarification is given for module expert validation and student validation. Based on the results of the score classification above, if the product evaluation results get points from 1.0 to 8, then it can be said that the product is "unfit" to be tested, and if the product reaches points from 1.8 to 2.4, it can be said that the product is "enough worth it". The product can be said to be "good enough" for testing. If a product achieves a score of 2.4 to 3.30, it can be said to be "feasible" for testing, and if it gets a score of 3.30 to 4.0, it can be said to be "very feasible" to be tested.

FINDING AND DISCUSSION

Data from Module and Material Validation Results

The product validation results of the human circulatory system module to support junior high school students' independent learning are shown in **Table 2**. The validation results include data from the module validation results and material validation results.

Table 2. Data from module and material validation results

No.	Statement	Expert 1	Expert 2	Expert 3
1	The teaching module achieves or is in accordance with the objectives to be achieved	4	4	4
2	Teaching modules according to student needs	4	4	4
3	Teaching modules make it easy for students to understand learning material	4	4	4
4	Teaching modules are suitable learning resources for students and teachers	4	4	3
5	Components in the Complete module (Core Competencies, Basic Competencies, Indicators, Learning Materials, Benefits, Activity Steps)	4	3	4
6	The material is arranged from simple material to complex material.	4	4	3
7	The teaching module facilitates students in the independent learning process	4	4	4
8	Teaching modules are easy to understand	3	4	4
9	The use of language in the module uses good and correct language	4	4	4
10	Design (pictures/photos, colors, letters, layout) in teaching modules attracts students' attention	3	3	3
11	The content of the teaching module is in accordance with the material	4	4	4
12	The topics in the teaching module are interesting	3	4	3

13	The topics in the teaching module help students understand the material	4	4	4
	Average	3.77	3.84	3.69

The module assessment obtained from the module and material expert, namely the module value from expert 1 was 3.77. The module value obtained from expert 2 is 3.84. Meanwhile, the module value obtained from expert 3 was 3.69.

$$\text{Total Invervals } = \frac{3{,}77+3{,}84+3{,}69}{3} = 3{,}76$$

Results of Assessment of Teaching Modules by Students

Results of assessment of teaching modules by students shown in **Table 3**. The validation results include data from the module validation results and material validation results. These results were obtained based on the student assessment questionnaire.

TabeI 3. Results of the student questionnaire

Number of Students	Module Assessment Score	Quality Classification	Number of Students	Module Assessment Score	Quality Classification
1.	3,1	Worthy	18.	3,7	Very worth it
2.	3, 4	Very Worth it	19	4	Very worth it
3.	3.0	Worthy	20	3,3	Worthy
4.	3, 3	Worthy	21	3,1	Worthy
5.	3, 4	Very Worth it	22	3,8	Very worth it
6.	3, 6	Very Worth it	23	3,1	Worthy
7.	3, 1	Worthy	24	2,8	Worthy
8.	4	Very Worth it	25	4	Very worth it
9.	3.0	Worthy	26	3,4	Very worth it
10.	3.0	Worthy	27	3,5	Very worth it
11.	3,6	Very worth it	28	3,1	Worthy
12.	3,6	Very worth it	29	3,1	Worthy
13.	3,2	Worthy	30	4	Very worth it
14.	4	Very Worth it	31	3,0	Worthy
15.	2,9	Worthy	32	3,5	Very worth it
16.	3,6	Very worth it	33	3,5	Very worth it
17.	3,8	Very worth it	34	2,9	Worthy
	Average			3.39	Very Worth it

Based on the results of the average score, a total of 3.39 was obtained. It can be analyzed based on table 4. The score clarification shows that the teaching module in teaching

science falls into the category of "Very Eligible" to be used as an independent learning module in 8th grade at Junior High School 1 Papar.

1. Research results and data collection

Researchers collect data and research results through interviews and questionnaires to collect data. During the teaching and learning process, this observation was carried out. Interviews were conducted with VIII grade teachers at Junior High School 1 Papar, and students were given a questionnaire to fill out. Some of the results are as follows:

a. Interview results

Result of teacher interview for eighth grade. Interviews were conducted with several 8th grade teachers, regarding the teaching and learning process that takes place in the classroom, as well as the challenges presented by the teaching materials that have been applied. According to the findings of the interviews conducted during the teaching and learning process in the classroom, they always used lecture techniques, and the practice questions they worked on were still sourced from textbooks. The textbooks and student worksheet used in this class are the resources used. The difficulty of students in understanding the content of lessons taught about the human circulatory system is one of the challenges they face during the teaching and learning process (Cheng & Gilbert, 2015; Seah & Silver, 2020). The scores for the science exam taken in odd semesters range from the minimum requirement of 67 points needed for completeness to that score. For this reason, it is necessary to have a teaching strategy or learning module that can be applied independently by students as part of student efforts to increase students' understanding of the circulatory system found in humans to understand the material and not only rely on the teacher in explaining and not relying on packages and student worksheet (Dewi & Primayana, 2019; Rahmawati et al., 2019). Therefore, according to the narrative, a module is needed to develop natural science on the circulatory system in humans.

b. Results of a questionnaire or questionnaire

Filling out the questionnaire 8th grade students of junior high school are given a questionnaire to fill out, the purpose of which is to collect information and determine the needs of student learning materials. The contents of the questionnaire are about the obstacles in the learning process of Natural Sciences and the teaching modules used by students. Based on the results of the questionnaire, it was found that 32 students felt

happy and satisfied with the Natural Sciences subject, while these 2 students considered it normal. Based on the results of interviews with the 2 students, they admitted that they had difficulty learning science because the subjects being studied were difficult to understand. From the results of this survey it can be concluded that students who study at home still use textbooks, some even use worksheets. As a result, the teaching materials used both in class and at home only consist of textbooks and worksheets. Some students use the internet as a means to facilitate learning.

c. Result Observation in Class

Based on the results of observations in class, the teaching method in class still uses the lecture method. When the teacher explains, the teacher sometimes asks questions to students. After the teacher explains the students will be given some questions to measure their level of understanding. In this teaching and learning process, the teaching materials used are textbooks and worksheets or student activity sheets.

It can be concluded that a teaching material is needed that will be utilized by students in the subject of the human circulatory system for the purpose of self-study based on the results of interviews and class observations. The creation of these teaching materials should enable students to learn on their own, and have the potential to increase student understanding and student learning outcomes.

2. Planning Results

The planning activities for the development of the module on the human circulatory system include:

a. Planning and developing ideas for building teaching modules together with class instructors. As a consequence, it is hoped that the science module can be developed into content that students can use independently when discussing material on the human circulatory system.
b. Plan and create content for the creation of human circulatory system modules based on basic competency standards, criteria and indicators in natural science disciplines
c. Collect references and images searched on the internet according to the material of the human circulatory system
d. Prepare equipment and supplies to be used in materials for the circulatory system in humans.

3. Initial Product Development Results

In making the initial product development stage of science teaching materials by going through the process and steps that must be done:

a. Making content formulation in teaching materials, consulted with 8th grade teachers at Junior High School 1 Papar regarding the subject of Natural Sciences material on the Human Circulatory System.
b. Draft a content outline or that will serve as a guide for writing a future module. Outline of Material Content is based on core competency standards, basic competency and indicators for science subjects on the Human Circulatory System.
c. Prepare and make a writing plan
d. After preparing the writing plan, make a teaching material design. The design that needs to be made is the cover of the teaching material and the design of the contents of the teaching material.
e. Review and revise the module.

This was reviewed in order to find out the shortcomings and get some input from experts, including material experts and module experts. This is very important and very necessary to identify weaknesses and get advice from experts. The feasibility of a product is also carried out by asking for consideration from material experts and module experts. In the process of validating the stage I material, it received an average of 3.22 which was included in the "Enough Decent" section, the validator gave suggestions for several things that had to be revised, including the choice of words in the teaching material module and the elaboration of the material that needed to be emphasized. In the process of validating the material for stage II, obtaining an average of around 3.76 and the vaIidator said that the material for the Human Circulatory System was said to be "decent" and good. It can be said that this teaching material can be tested without revising.

4. Initial Trial Results

The results of the initial field trial involved 7 8th grade H students of junior high school. The results of the initial trials were presented at 90.23% and it can be said that the science module on the human circulatory system is said to be "feasible". Many students gave responses indicating that they were interested in learning the module because the content was easy to understand, the display color of the module was attractive, and the language used was

easy to understand. From the results of the preliminary test, it can be concluded that the scientific module received a positive response from students.

5. Results of Initial Field Trial Revision

From the results of the initial field trials, it can be concluded that the science module on the Human Circulatory System is suitable and good for use as independent teaching material by 8th grade H students at Junior High School 1 Papar. Because of that, the researcher did not revise this science teaching material.

6. Field Trials

The trial of natural science teaching materials on the human circulatory system, in this case involved 34 8th grade H students at Junior High School 1 Papar. Based on the results of the field trial, a score of 92 was obtained with a percentage of 93.79% and it can be said that the science module on the Human Circulatory System is "appropriate" for use by grade VIII students at Junior High School 1 Papar.

7. Product Improvement Results Field Test Results

Field trials obtained the result that science teaching materials on the human circulatory system were said to be suitable and good for use as independent teaching materials for 8th grade students at SMPN 1 Papar. Based on these results, there are no revisions for researchers of science teaching material products.

8. Design of Human Circulatory system Module

In making science learning models based on education. Result after data collection and processing, competency standards and basic competency standards are evaluated based on the findings. Researchers make lesson plan after first determining competency standards and basic competency. Lesson plan serves as the foundation on which the scientific curriculum module is built. Researchers utilized *Microsoft Office Word* 2013 software during the process of compiling the Science section on the Human Circulatory System. There are several module materials made by researchers as in **Figure 1** is appereance module cover, **Figure 2** is appereance core competencies, basic competencies, and indicators, **Figure 3** is apperence practice question ini each sub-chapter, and **Figure 4** is content material.

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1) Sample modul

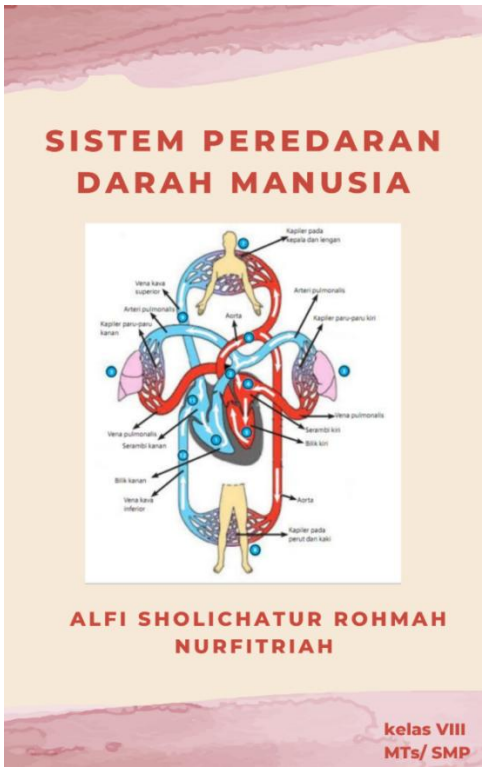


Figure 1. Module Cover

2) Core competencies, basic competencies, and indicators

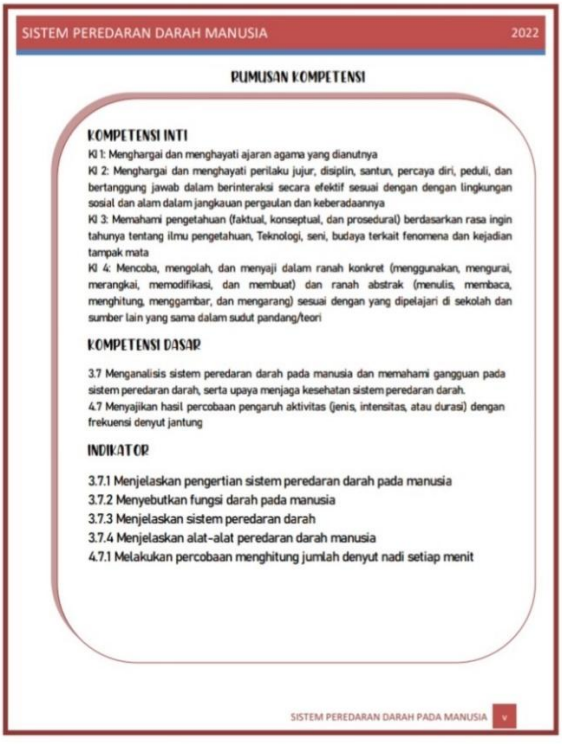


Figure 2 . Core competencies, basic competencies, and indicators

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3) Content and Exercise Questions

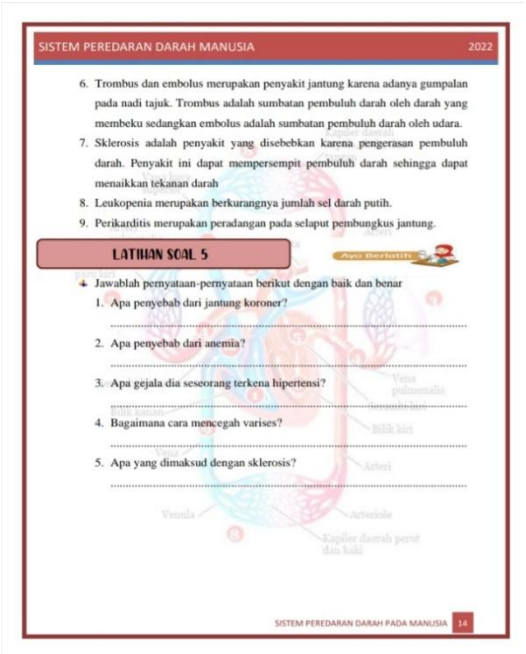


Figure 3. Practice questions in each sub-chapter

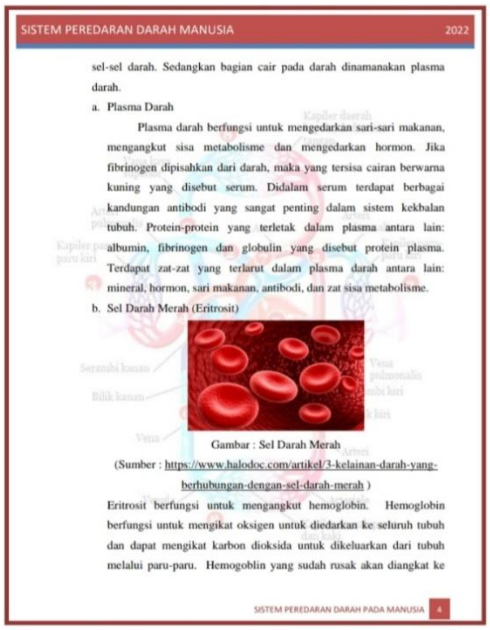


Figure 4. Content material

This module which focuses on the topic of the human circulatory system. This module is a product made by researchers. Modules are programs arranged in a planned manner in the form of various units to support individual participants in achieving learning objectives (Darmaji et al., 2020). Modul is designed to help people achieve their educational goals. This module was developed with the aim of providing VIII grade students of Junior High School 1 Papar with information on the cardiovascular system in the human body. In addition, this research development aims to create a science learning module for the human circulatory system that is suitable for use by VIII grade students of Junior High School. The Science module is structured in order to equip students with independent learning materials that they can use on their own (Handayani, 2018; Inguva et al., 2021).

Evaluation of respondents will be used to construct a questionnaire that will be used to determine the practicality of the product, which will be obtained in accordance with the objectives to be achieved. The data used in the respondent's assessment of the practicality of the product comes from the results of the questionnaire instrument which is based on the findings of the material expert's assessment and VIII grade students of Junior High School 1 Papar who try the product and act as product users. The initial product output of the science

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module must comply with the components of the module, namely as follows: 1) introductory section, 2) main section, and 3) closing section. The basic idea behind the creation of a new module, which is based on the results of the first product of the Science module, is adapted to 1) interests. 2) attention 3) student abilities and 4) student needs.

The feasibility test of research and development products is carried out through tiered testing to obtain evaluation and input so that the resulting scientific module is suitable for use in science education related to the human circulatory system. The product feasibility test consists of several steps, including the first stage of material expert confirmation and the second stage of preliminary testing. Before conducting validation, specialists carry out a review and analysis, then adjustments are made based on their suggestions and input, and finally the product validation and testing phase is carried out.

In the material validation stage, the science teacher who is an expert on the subject matter assesses and also provides advice regarding aspects of the accuracy of the material, aspects of material clarity, linguistic aspects, and aspects of material correctness content material. During the material validation activity, there were two stages that were carried out, in stage I obtaining a fairly decent category, but the validator gave suggestions for several things that had to be revised, including the choice of words in the module and the elaboration of the material that needed to be emphasized. In stage II, it gets the "feasible" category to be tested without revision. And at this stage the validator has not provided any suggestions for improvement so that the material module for natural circulatory system in humans is unrevised.

CONCLUSION

The development of the human circulatory system module to support junior high school students' independent learning has been carried out. This teaching material is said to be appropriate according to the results of the material expert's assessment with an average score of 3.76 which is categorized that this teaching material is "very good" and the assessment of the module expert gets an average score of 3.76 which is categorized that this teaching material " Very good". Based on student responses taken from the results of the questionnaire, it was found that the results in the initial field trial obtained a percentage of 90.23% and the results of the field trial obtained a percentage of 93.79%. Based on the results of the research,

it can be concluded that the science module on the subject of the human circulatory system is suitable for use as teaching material or a module that students can use in independent learning and has met its feasibility and effectiveness. For teachers, it is hoped that this teaching material can be used as an alternative during the learning process that students can use in studying independently. The same for students, it is hoped that students will use this teaching material well and can be used as an alternative in deepening the material independently.

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