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Learning the circulatory system through the learning management system-Moodle: How to develop teaching materials oriented towards scientific literacy?

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ABSTRACT

Teaching materials are one of the important factors that determine the success of the learning process. The research objective was to develop a circulation system teaching material based on Moodle's LMS which is oriented towards increasing students' scientific literacy. The development model used was 4D (Define, Design, Develop, and Disseminate), to the stage of feasibility testing (develop). The subjects in this study were validators of media experts, material experts, language experts, teachers and students. The data collection technique was carried out using a questionnaire to measure the validity of the open material. The results showed that the circulation system teaching materials based on the LMS-Moodle, which were oriented towards increasing scientific literacy, had an average score of 3.50 (very valid) from a maximum value of 4.00 from all aspects. Based on the results of the research, it is shown that the teaching materials of the circulation system based on the Moodle LMS which were developed to increase scientific literacy are very valid to be used as learning media for the circulation system in schools and are expected to improve students' scientific literacy.

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INTRODUCTION

Skills in the 21st century are the main focus of education today, especially science education (Nisrina et al., 2020). Science education is responsible for achieving scientific literacy of the nation's children, so the quality of science education needs to be improved (Aqil, 2017). One of the skills that is very crucial to pay attention to so that students are able to apply science appropriately is skills in scientific literacy (Anisa et al., 2020). Deming et al. (2012) stated that scientific literacy skills are one of the main needs of students in this era of development in the 21st century.

Scientific literacy is defined as the capacity to use scientific knowledge, identify questions, and draw conclusions based on facts (Rusilowati et al., 2016). For almost 20 years since its release by PISA, the science literacy of students in Indonesia has not increased significantly (Fuadi et al., 2020). In 2012 the science literacy of Indonesian students was at the level of 64 out of 65 participating countries with a score of 382 (Fuadi et al., 2020). The score is far below compared to the international average score set by PISA, which is 500 (Hasasiyah et al., 2020). In PISA 2015 students' science literacy scores increased slightly from 382 in 2012 to 403 in 2015 but this did not make Indonesia position higher than Thailand, Vietnam, and Singapore (Fuadi et al., 2020). The description of the results of the PISA study sufficiently shows the low literacy achievements of Indonesian students. Based on the results of the PISA study, it shows that the average student in Indonesia has low science literacy skills when compared to the international average which reaches a score of 500 (Fitriani et al., 2014). Students' scientific literacy needs to be improved through the science (science) teaching materials used.

One of the science materials studied in grade 8 is the circulation system. The circulatory system material is one of the materials that is classified as complex, because it is divided into sub-sub materials that are complicated in understanding (Porsche et al., 2019). This material studies the components of the circulatory system along with their function and structure, disease disorders in the circulatory system, as well as the application of technology to the circulatory system material. The coverage of material about the circulation system is broad and there are many terms that are not commonly heard by students, making it difficult for students to understand some of the concepts. Based on previous research from Musfiroh (2012), students experience difficulties in learning the circulation system due to various conditions. First, the concepts in this material are considered by students to be difficult because these concepts are difficult to relate to one another and the material only requires reading the material and memorizing it, thus creating concepts with short-term memory. Apart from that, traditional and behavioristic educational models and methods make students feel difficult and also influence the level of difficulty of students in understanding concepts.

Alhajri (2016) argued that the rapid development and use of technology does pose its own challenges in the world of education so that many researchers are trying to develop technology-based learning. This condition really requires the adaptability of fast and creative teachers (Mamahit, 2021). Systems and processes in learning by utilizing an application and technology are referred to as Learning Management System (LMS) or also Course Management System (CMS) (Darmawan, 2015). Application Learning Management System (LMS) has a big role in streamlining communication, interaction between teachers and students, and the use of teaching materials. One of Learning Management System (LMS) which is widely used is LMS Moodle (Firman et al., 2021). LMS Moodle itself is an application that can be used to develop science learning systems and processes using digital devices such as laptops, computers, and other gadgets (Azis, 2017). Via app Moodle, shaped teaching materials soft files can be changed in shape with an object-oriented model so that students can learn independently and dynamically (Copriady et al., 2020).

Various studies have been carried out in developing teaching materials for online learning through Moodle on natural science and biology materials, such as on ecosystem materials, material on the body's defense system, human anatomy and physiology (Azis, 2017) and movement system material (Nuriyanti, 2013). Most of these previous studies used the ADDIE

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research development model with the results of this previous research showing that learning media e-learning LMS-based is very useful in improving the quality of learning on this particular material. However, there has been no development of teaching materials for online learning through Moodle on circulation system material using the 4-D model (Ekantini & Wilujeng, 2018). The priority of this research is that it requires teaching materials on circulation system material that are oriented towards increasing students' scientific literacy. Circulation system teaching materials through Moodle it is hoped that it will facilitate online learning and be oriented towards improving students' scientific literacy skills. Through a based learning Moodle and the selection of appropriate teaching materials is expected to increase understanding of science which in turn can increase students' scientific literacy and create more efficient and effective implementation of learning activities.

METHODS

This research was conducted from April 2021 to February 2022. The subjects in this study were media expert validators, subject matter expert validators, linguists, students, and teachers. The method used in this research is the research and development method (Research and Development). The research and development model used is the 4D model (Define, Design, Develop, Disseminate), to the stage of feasibility testing (Develop). The 4D model is suitable for developing products in the form of teaching materials (Hidayati et al., 2019). The research was carried out to the stage development because dissemination takes a long time while this research is limited to a predetermined time. Thus, the disseminate stage was omitted in this study. The steps in this study can be seen in the illustration (Figure 1).

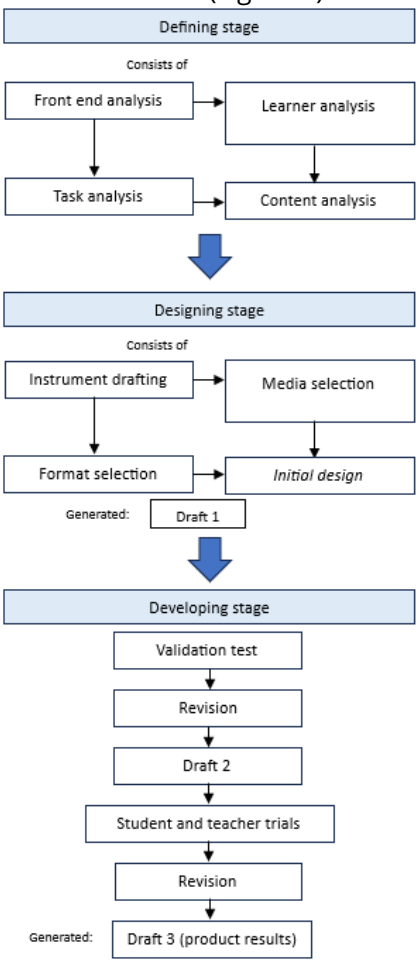

Figure 1. The 4-D model research stage (Ekantini & Wilujeng, 2018)

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Development steps taken in developing LMS-based circulation system teaching materials Moodle, can be described as follows.

1. **Define (definition)**
   At this definition stage several things are carried out, namely frontend analysis (front-end analysis), student analysis (learner analysis), task analysis (task analysis), concept analysis (concept analysis), and goal analysis (specifying instructional objectives) (Rochmad, 2012). The five preliminary analysis activities were carried out by observing the school directly and distributing initial questionnaires to 31 students and 2 science teachers to obtain the required information. The questionnaire was used because it was considered relatively economical, having the same items for all research subjects
2. **Design (design)**
   This design stage aims to design learning tools. The design stage divided into four steps that must be carried out at this stage, namely: instrument preparation, media selection, format selection and initial design. The instruments prepared at the initial stage of design are in the form of LMS teaching material assessment tools in the form of assessment questionnaires by expert validators and science teachers, as well as student response questionnaires. Furthermore, the media chosen to be developed is in the form of teaching materials-module module form electronic learning integrated into the LMS Moodle designed to achieve learning objectives. Teaching materials are developed using Canva and then built using PDF and JPG formats (Alamsyah et al., 2023). The PDF and JPG formats were chosen because they are commonly used and easy to open on various devices such as smartphones, laptops, and computers. At this stage it is also create storyboards and the end result of the design is in the form of the initial design called draft 1.
3. **Develop (development stage)**
   This stage aims to produce LMS teaching materials Moodle which was validated by experts, and several improvements were made to produce-module which is valid and meets the requirements. This stage consists of the following activities, namely expert appraisal (expert judgment) and developmental testing (development test). Expert appraisal is a technique for assessing the feasibility or validating the feasibility of the product design being developed. In this step, an evaluation is carried out by an expert validator in the field. The suggestions, comments and input provided are used to improve the learning materials and designs that have been prepared. Furthermore, developmental testing is a product design trial activity on real target subjects. The experimental design was carried out in small groups. The number of trials is 60 students for small group trials. During this trial, response data, reactions or comments from the target users of the product are sought. The test results are then used to improve the product. This is followed by the revision stage. The revision aims to perfect and complete the LMS teaching material products Moodle developed in order to meet the appropriate and effective criteria for use in learning.

The research instrument consisted of a feasibility validation questionnaire for research subjects, namely media expert validators, material expert validators, linguists, students, and teachers. The following is an explanation of the instruments used: (1) a preliminary analysis questionnaire in the form of a statement questionnaire given to teachers and students to analyze initial problems and analyze the needs of teaching materials. Making student needs analysis instruments refers to the needs analysis guide from BNSP scale (Suryanda et al., 2019); (2) questionnaire validating the suitability of teaching materials by media experts in the form of a media suitability test assessment questionnaire based on the quality and completeness of the features and general appearance of the teaching materials; (3) questionnaire validating the suitability of teaching materials by material experts in the form of a questionnaire assessing material suitability tests based on the truth/accuracy and suitability of the circulation system material concept; (4) a questionnaire validating the suitability of teaching materials by a language

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expert in the form of a questionnaire assessing the suitability test of circulation system teaching materials from the language aspect; and (5) student and teacher test questionnaires in the form of response questionnaires to find out responses from students regarding LMS-based circulation system teaching materials Moodle. The making of the feasibility validation instrument for media experts, material experts, and linguists, testing students and science teachers with the instrument grid refers to the guidelines from BNSP scale (Suryanda et al., 2018).

The results of the validity scores of the due diligence instruments by experts, the science teacher trials, and the small group trials of students were analyzed using descriptive analysis techniques. The percentage of data obtained was then converted based on the BSNP scale (Suryanda et al., 2018).

Table 1. Due diligence assessment scale based on BNSP

Criteria	Score
Strongly agree	4
Agree	3
Don't agree	2
Strongly disagree	1

Assess the quality of appropriateness of LMS-based circulation system teaching materials Moodle obtained based on the overall average value or can be obtained using the following formula:

$$Score = \frac{Scores\ obtained}{Number\ of\ questions}$$

After the quality value is obtained, the feasibility results of the Moodle LMS-based circulation system teaching materials can be determined based on the interpretation of the feasibility test value adapted from Ratumanan & Laurens (in Firdausi & Wulandari, 2021). The interpretation table of feasibility test values can be seen in (Table 2).

Table 2. Interpretation of feasibility test scores

Category Intervals	Criteria	Description
$3{,}25 \leq x \leq 4{,}00$	Very Valid	Can be used without revision
$2{,}50 \leq x < 3{,}25$	Valid	Can be used with few revisions
$1{,}75 \leq x < 2{,}50$	Less Valid	Can be used with many revisions
$1{,}00 \leq x < 1{,}75$	Invalid	Not yet usable and need revisions

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RESULT AND DISCUSSION

The results of the feasibility test by media experts received a final score of 3.28 out of 4.00 which is included in the very valid category. The scores for each component of the media expert's assessment can be seen in Figure 2.

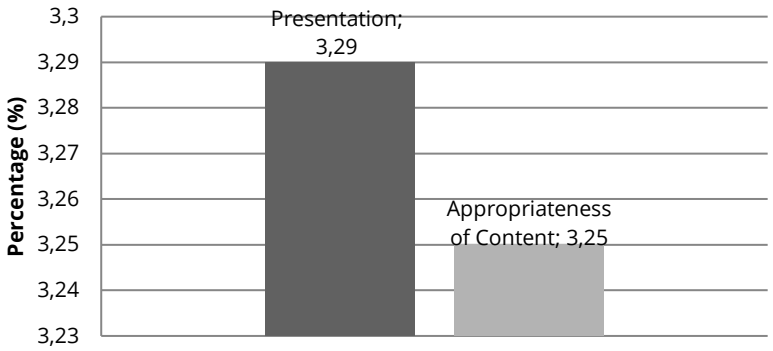

Figure 2. Media expert due diligence results

The results of the due diligence by the material expert got a final score of 3.62 out of 4.00 (Very Valid). The score for each component of the material expert's assessment can be seen in Figure 3.

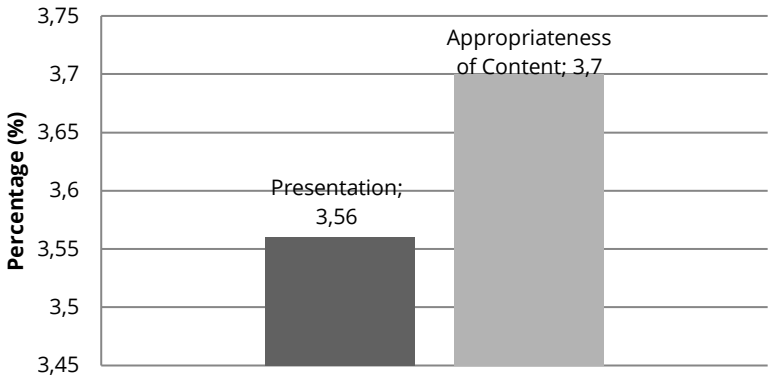

Figure 3. Material expert feasibility test results

Furthermore, the results of the due diligence by linguists received a final score with an average of 3.50 (Very Valid). As for the results of the trial, the science teacher obtained a final score of 3.78 and was included in the very valid category. The scores for each component of the science teacher assessment can be seen in Figure 4.

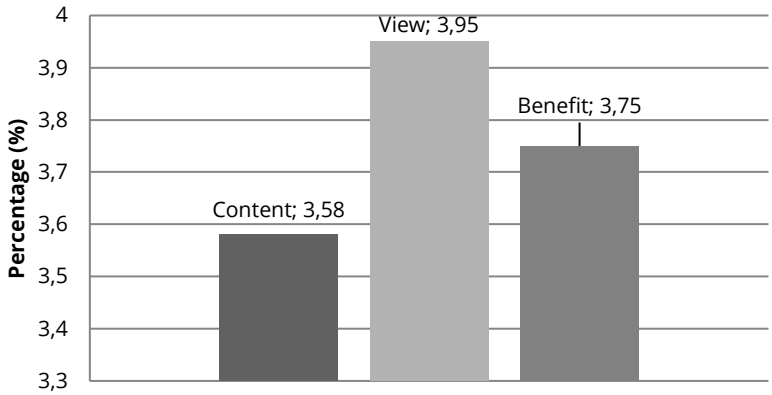

Figure 4. Results of trials on science teachers

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The test results on students with a total of 60 student respondents got a final score of 3.35 (very valid). The scores for each component of the student trial assessment can be seen in Figure 5.

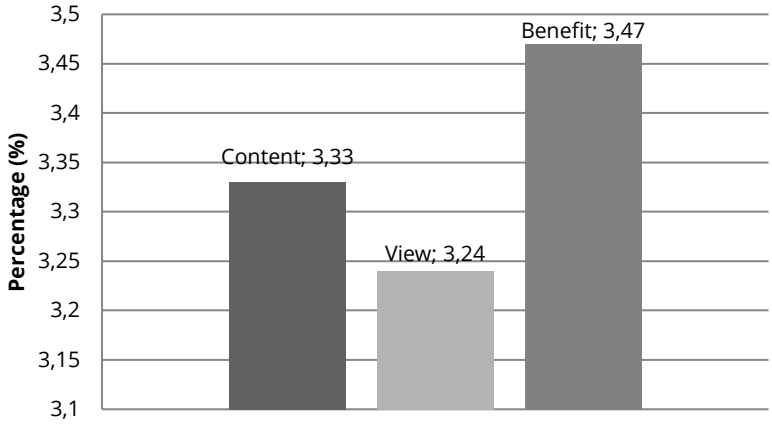

Figure 5. Results of trials on science teachers

Product development for LMS-based circulation system teaching materials Moodle, oriented towards increasing scientific literacy. Because in its development, the circulation system teaching materials were created to include balanced aspects of scientific literacy. The score for assessing the content of scientific literacy aspects in the circulatory system teaching materials obtained an average for all aspects of 3.59 with a very valid category. There are 4 components of scientific literacy aspects included, namely (a) Science as the body (a body of knowledge), (b) Science as a way to investigate (way of investigating), (c) Science as a way of thinking (way of thinking), (d) interactions between science, technology and society (interaction of science, technology, and society) (Rusilowati, 2016). The content of each component of the scientific literacy aspect can be seen in Figure 6.

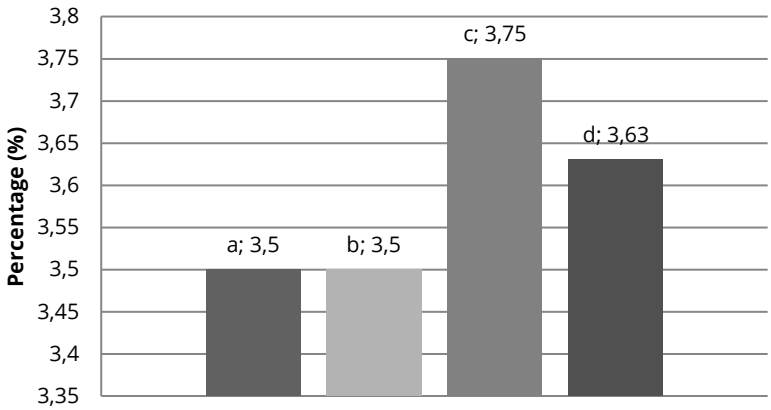

Figure 6. The results of the assessment of the content of scientific literacy aspects: (a) science as a body, (b) science as a way to investigate, (c) science as a way of thinking, (d) the interaction between science, technology and society

The average value obtained based on the overall assessment that has been carried out is 3.50 with a very valid category. Overall assessment of circulatory system teaching materials through Moodle can be seen in (Figure 7).

Development of LMS-based circulation system teaching materials Moodle which is oriented towards increasing scientific literacy is carried out using the 4-D development research model. The discussion of the results of this research and development is discussed based on each stage that has been carried out, which includes stages Define (definition), Design (design), Develop (development).

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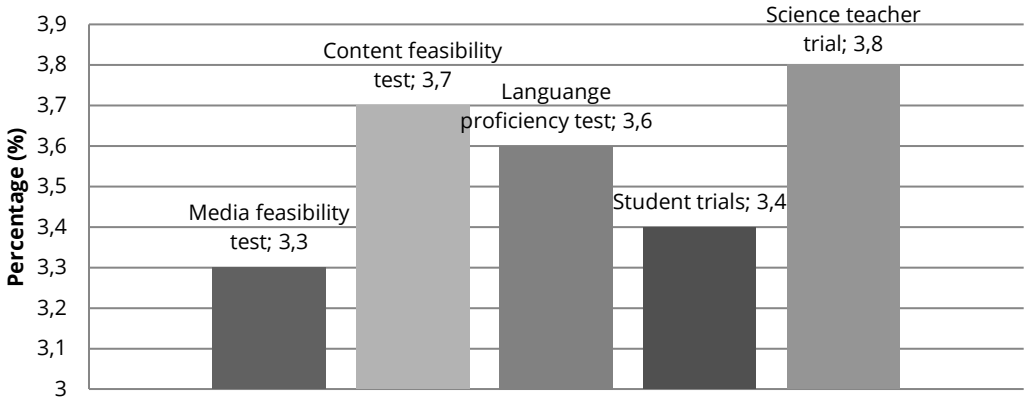

Figure 7. Graph of overall product ratings

The first stage carried out is stage define (definition). In other models, this stage is often called needs analysis. At the needs analysis stage, observations were made on students and science teachers who aimed to find out the problems that existed in the learning that was carried out at school, especially in the circulation system material. Data collection was carried out by distributing questionnaires at SMP IT Ulil Albab Bekasi to 31 respondents. The questionnaire is intended for students who have previously received circulatory system material. The results of student observations that have been carried out can be seen in (Figure 8) and (Figure 9).

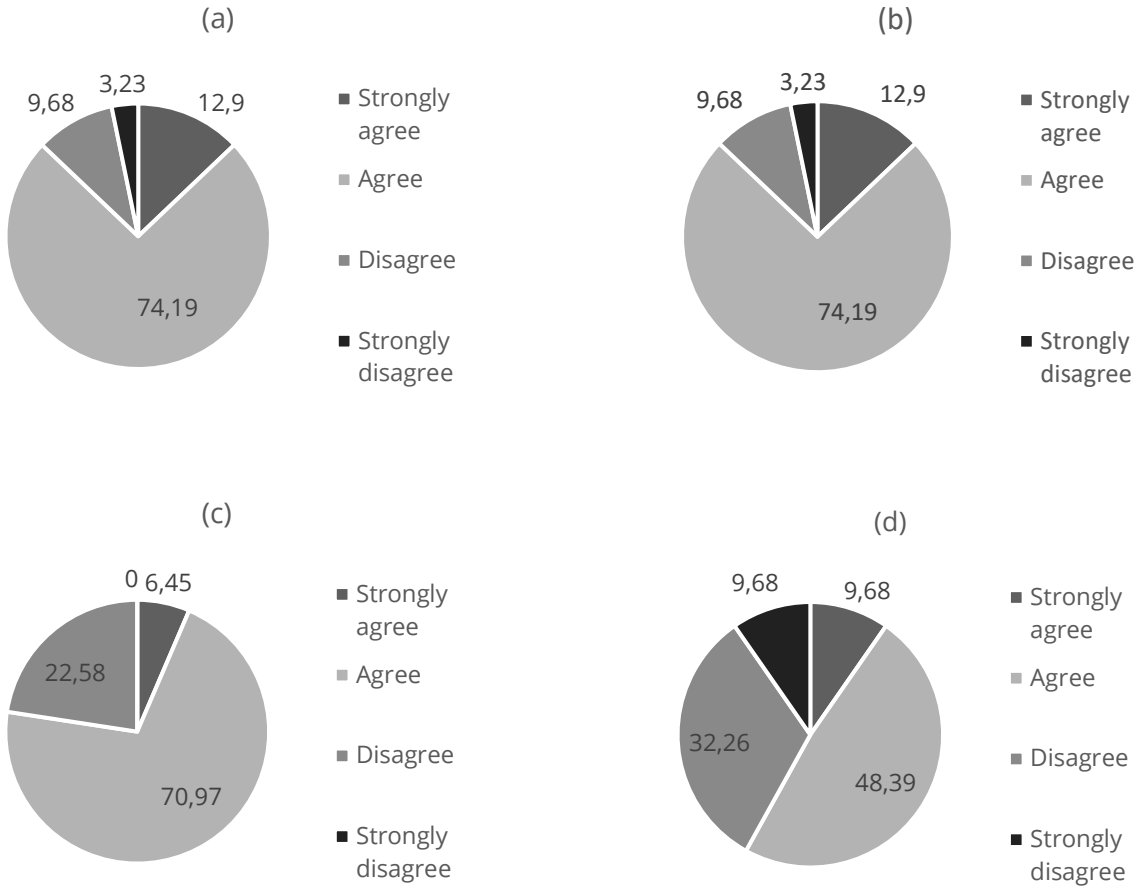

Figure 8. Students' perceptions regarding (a) Circulatory system material which is abstract and complicated; (b) The topic of circulation system components, structure and function contains new terms; (c) The circulation system material is classified as complex and has complicated sub-materials; (d) Use of circulation system teaching materials via LMS Moodle

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Based on Figure 8 (a), it can be seen that 23 of the total 31 students (74.19%) agreed and (12.90%) strongly agreed that the circulation system material is one of the materials that is complicated and abstract. It is known that 1 student (3.23%) said that he strongly agreed and 3 other students (9.68%) said that he did not agree with this opinion. Based on Figure 8 (b) it is known that topics on circulation system material such as material on the components of the circulation system, along with their structure and function, types of disturbances in the circulation system, contain new terms which are considered to be poorly understood. Regarding this matter, 23 students (74.19%) said they agreed and 3 students (9.68%) said they strongly agreed, while there were 4 students (12.90%) who said they did not agree and other students (3, 23%) strongly disagree.

In addition, the circulation system material is also considered difficult and quite complex because it is divided into sub-materials that are complicated to understand. This can be known based on Figure 8 (c) which shows that 22 students (70.97%) said they agreed about this, 2 students (6.45%) said they strongly agreed, 7 students (22.58%) disagreed, and no one said very strongly agree. Furthermore, based on Figure 8 (d) regarding the use of teaching materials regarding circulation systems through LMS Moodle It can be seen that 15 students (48.50%) said they agreed, 3 students (9.68%) said they strongly agreed, 10 students (32.26%) said they disagreed and 3 other students (9.68%) said strongly disagree.

In addition, based on the results of observations it can also be seen that the majority of students need science learning media that has an attractive visual appearance, can be used anytime and anywhere, contains the latest information, and has many features that can support the science learning process, especially in material circulation system. The observation results also show that the majority of students agree if LMS-based circulation system material is held Moodle which contains aspects of scientific literacy while also being able to improve scientific literacy skills.

Figure 9. Perceptions regarding learning media (a) The science learning media used in schools is not yet varied (b) Science teaching materials are needed that have an attractive visual appearance and can be used anywhere and anytime

Based on Figure 9 (a) it can be seen that 17 out of a total of 31 students (54.84%) agreed and (16.13%) strongly agreed that the science learning media used in schools did not vary. And the remaining 9 students (29.03%) said they did not agree. Based on figure 9 (b) the majority of students are interested in science teaching materials which have an attractive visual appearance and can be used anywhere and anytime. This was followed by the percentage of students who agreed, 19 students (61.29%) and 9 students (29.03%) said they strongly agreed. The remaining 3 students only (9.68%) disagreed and no one chose strongly disagree.

If seen from the existing facilities and infrastructure at the school, they are sufficient, especially if you develop a technology-based learning media, because at the school itself the students have used an LMS device in the form of E-learning Moodle, SMP IT Ulil Albab for online learning for 1.5 years. LMS provides flexibility for users to be able to create and manage learning

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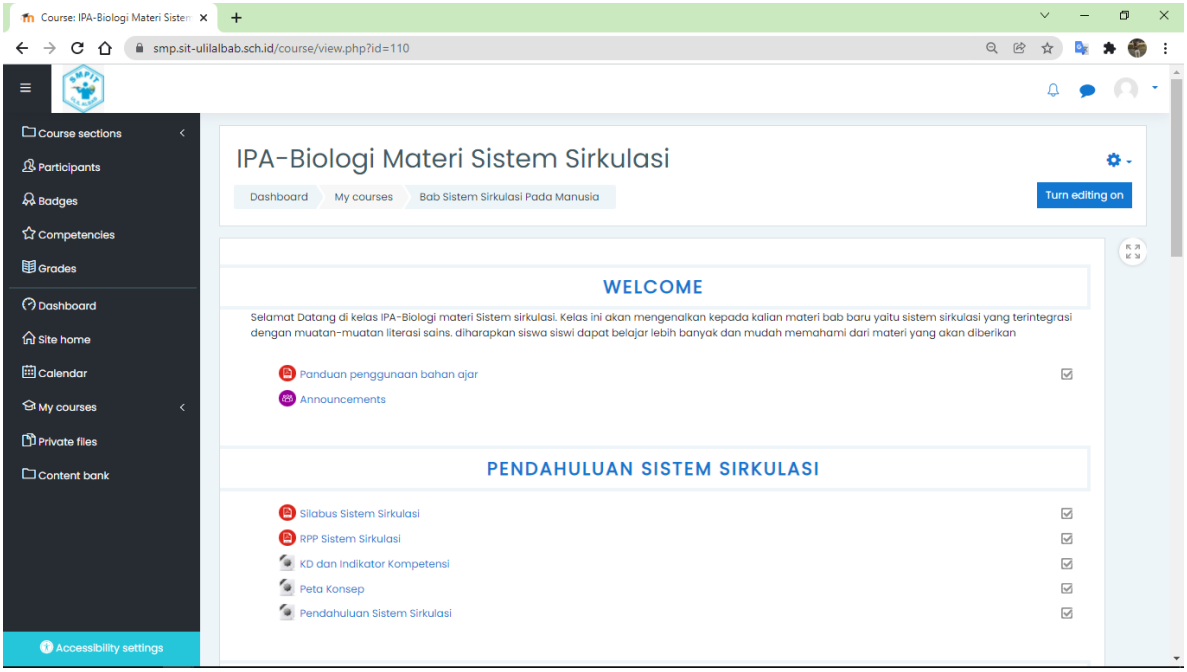
in accordance with the aims and objectives of learning (Simanullang & Rajaguguk, 2020). Judging from the condition of schools that are familiar with LMS, it makes it easy for researchers to develop learning using LMS technology-based teaching materials Moodle which is feasible and practical to use.

At stage define or the initial needs analysis stage is also carried out by observing science teachers. The observation of science teachers was carried out by distributing questionnaires to science teachers who teach at IT Ulil Albab Bekasi Middle School. Based on the results of observations that have been made, science teachers are of the opinion that learning media is very necessary to help understand the circulation system material. Apart from that, the science teacher also believes that learning circulation system material at the school has used the help of effective learning media such as textbooks and PowerPoint. The role of learning media in the learning process in schools is considered very important, however, according to the science teacher's opinion, the circulation system learning media used at SMP IT Ulil Albab Bekasi is not yet varied and does not use learning media that contains balanced components of scientific literacy aspects. Apart from that, based on the results of observations it can be seen that science teachers at SMP IT Ulil Albab Bekasi usually teach by combining the use of Google Classroom, PPT and LMS Moodle as eLearning from school. LMS facilities that are already adequate for implementing online learning should be further maximized in the science learning process, especially circulation system material. Observation results also show that science teachers at SMP IT Ulil Albab Bekasi support the development of teaching materials regarding circulation systems through LMS Moodle which is oriented towards increasing students' scientific literacy.

Based on the results of the analysis at stage define, then a set of teaching materials on circulation system material oriented towards increasing scientific literacy was developed. The next stage is Design (planning). The final result of the design stage is the production of draft product 1 of teaching materials for circulation system material which has been integrated into the LMS Moodle. Circulation system material class display design and display Moodle when accessing circulation system teaching materials can be seen in (Figure 10).



(a)

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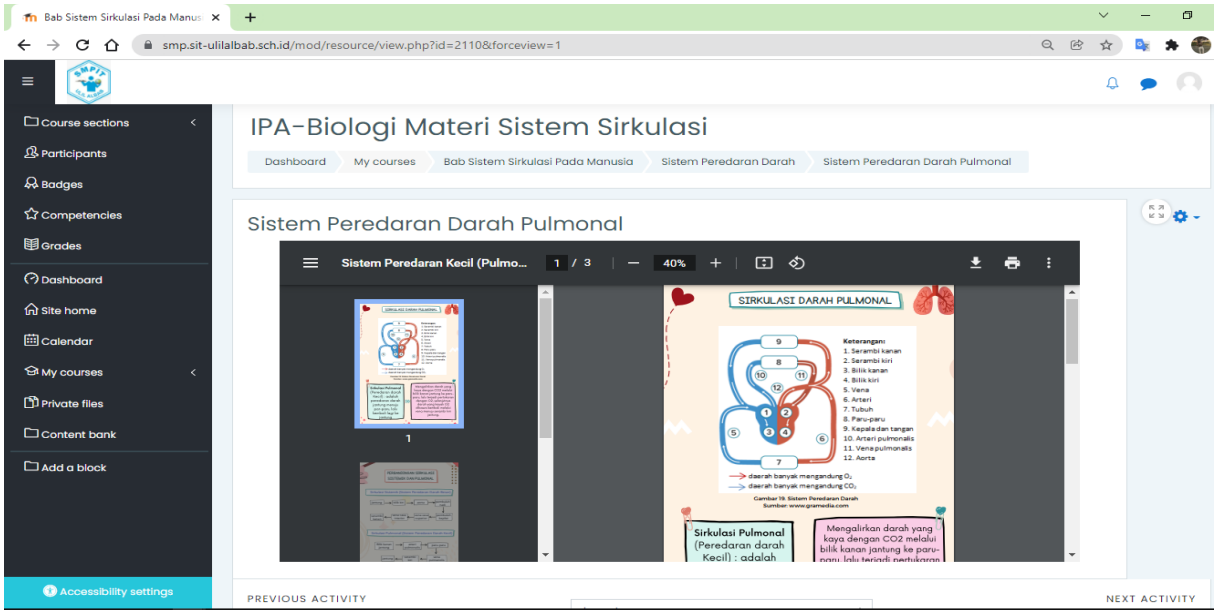

(b)

Figure 10. (a) This is the circulation system class homepage on the LMS Moodle (b) Show view moodle when accessing teaching material files for circulatory system materials.

Based on Figure 10 (a), it shows the design of the circulation system class homepage display in the LMS Moodle which presents guidelines for the use of teaching materials, lesson plans, syllabus, KD and competency indicators, concept maps, lists of sub-materials studied in circulation system materials, files of circulation system teaching materials, and other features such as discussion forums and circulation system material evaluation quizzes. while in Figure 5 (b) shows the display Moodle when accessing circulatory system teaching material files. This file can be viewed directly or downloaded to be accessed without an internet connection anytime and anywhere. The circulation system material and other supporting resources that have been prepared are then arranged in the form of teaching materials using the help of the Canva application and saved in pdf and jpg file formats. The material used in the preparation stage of the teaching materials was adapted from the teacher's handbook and other source books which cover science circulation system material. The circulatory system teaching materials that have been developed can be seen in (Figure 11).

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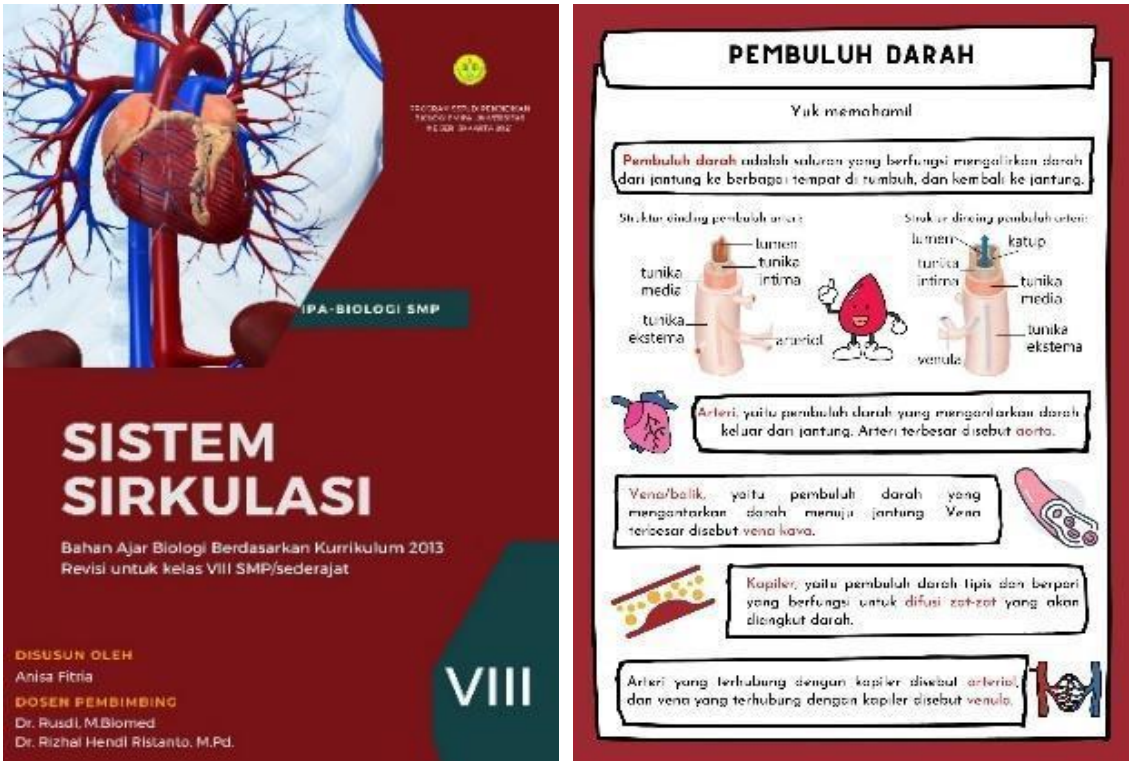

(a) (b)

(c) (d)

Figure 11. (a) Cover of teaching materials on circulation system material; (b) Material pages and supporting images in teaching materials; (c) Teaching materials page accompanied by supporting videos on circulation system material; (d) Student worksheet (LKPD)

Figure 11 (a) shows the cover display of the circulation system teaching material which contains the title of the material, classes, and pictures related to the circulation system. Figure 11 (b) is one of the circulation system teaching material pages which includes material and supporting

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images that explain one of the sub-materials in the circulation system. Figure 11 (c) shows one of the circulation system teaching materials pages which presents supporting videos related to circulation system materials which can be accessed using an internet connection. Meanwhile, Figure 11 (d) is display of one of the LKPD pages on circulation system material to increase student learning activities.

After designing, the next stage is Develop. The results obtained at the development stage are the result of expert validation consisting of: media experts, material experts, and language experts. The feasibility test by media experts got the highest average score with a value of 3.62 which is included in the very valid category. In the material feasibility test, the highest average score was obtained in the aspect of the effectiveness of presentation and the accuracy of the substance of the learning media which received an average value of 4.00. This is because the systematic presentation of the layout of the circulation system material is orderly and neat, the elaboration of the circulation system material is in accordance with the latest developments, also the actual presentation of pictures, illustrations and diagrams.

On the results of the media feasibility test, the average value obtained from the assessment of the media expert validator is 3.28 with a very valid interpretation category. In the media feasibility test, the highest average score was obtained in the attractiveness aspect of interactivity with an average value of 3.50. This shows that the circulation system teaching materials through Moodle LMS which are oriented towards increasing scientific literacy are considered interactive and interesting because there is a unique appearance on each page of the teaching materials as well as a diversity of features that are interesting for students. Image features that do not break when enlarged, the correct layout of images and illustrations, as well as the video and website links included are considered appropriate. Circulation system teaching materials can be accessed easily and can be downloaded for offline learning purposes. Based on the results of the media feasibility test, it can be seen that there are several deficiencies in the teaching materials, this can be seen from the comments.

In the language feasibility test results, the average value obtained from the language expert validator assessment was 3.50 with a very valid interpretation category. Even though overall it has been assessed as very valid, the product is still being revised because there are still corrections from language expert validators.

Furthermore, products that have been validated by expert validators and refined will then be implemented through trial activities (Putri, 2021). In this research, the implementation stage was only carried out as a small group trial on students and science teachers. The small group trial was carried out with the help of 60 respondents who were class IX students at SMP IT Ulil Albab Bekasi. Based on the results of student trials, an average score of 3.35 was obtained, which is classified as very valid. In the student trials, the highest assessment was in the benefits aspect with an average value of 3.47. This is because circulatory system teaching materials are considered to provide benefits for increasing information regarding circulatory system material and increasing students' curiosity regarding the circulation system as well as providing literacy benefits for students.

Furthermore, a trial of the science teacher was carried out with the help of two science teachers showing that the circulation system teaching materials were classified as very valid categories with an average score of 3.78. In the science teacher trials, it can be seen that almost every aspect of the assessment has a very valid category, this shows that the circulation system teaching materials have advantages in almost every aspect of the assessment. The lowest rating results are found in the aspect of system material clarity which gets an average value of 3.00. This is because in the matter of evaluating the circulation system material it is not clear where the level of thinking of the students is placed. However, this was corrected by revising the contents of the quiz feature with evaluation questions that were more in line with the thinking level of junior high school students.

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The circulation system teaching materials developed are oriented towards increasing students' scientific literacy. This is because the development of LMS Moodle-based teaching materials is equipped with various aspects of scientific literacy. Chiappetta et al. (1991) reveals that there are four aspects of scientific literacy namely science as a body of knowledge (a body of knowledge), science as a way to investigate (a way of investigating), science as a way of thinking (a way of thinking) and the interactions between science, technology, and society (interactions between science, technology, and society) (Rusilowati et al., 2016). These four aspects of scientific literacy have been included in the teaching materials developed and distributed in the contents of the teaching materials as well as in the features of the materials created such as features: "let's think!", "let's discuss!", "you need to know!", "come on learn!", "let's understand!", "unique facts!", "about knowledge", "about facts", and "interesting information". As for the results of the assessment of aspects of scientific literacy content by material expert validators obtained an average score of 3.59 from 4 aspects and were included in the very valid category.

Circulation system teaching materials through Moodle that have been developed have advantages and disadvantages as learning media. Based on the results of a series of feasibility tests and trials that have been carried out, the advantages of circulation system teaching materials include having an attractive appearance and various features such as images, illustrations and videos that are varied and presented in an actual manner. Circulation system teaching materials can be downloaded for students to study without requiring an internet connection, the teaching materials have a sequential and neat layout, and the material presented is considered to be in accordance with the discussion of circulation systems studied at school. Teaching materials that are integrated with Moodle LMS also have their own positive benefits for teachers. According to Fatmi et al. (2021) teacher creativity increases every semester which shows a pattern of increasing teacher ability in designing Moodle used in learning. Apart from that, circulation system teaching materials through Moodle are oriented towards improving scientific literacy competencies because they contain balanced scientific literacy components.

The weakness of the circulation system teaching materials through the Moodle LMS is that it requires an internet connection to be able to visit the Moodle LMS website being developed. The display of Moodle on gadgets is not very good when compared to the display when using a laptop or computer, besides that there has not been an effectiveness test related to circulation system teaching materials through the Moodle LMS which can improve students' scientific literacy skills so that this teaching material can only be said to be oriented towards improving students' scientific literacy. These advantages and disadvantages are obtained based on the conversion of judgments from a series of feasibility tests and trials that have previously been carried out.

CONCLUSION

The development of teaching materials for circulation system material based on Moodle LMS which is oriented towards increasing scientific literacy is declared to be very valid. In the media aspect, the Moodle LMS-based circulation system material received an average score of 3.28 (very valid), in the material aspect it received an average score of 3.62 (very valid), and in the language aspect it obtained an average score of 3. 50 (valid). Apart from that, in the small group trial students gave positive responses with an average score of 3.35 (very valid) and in the science teacher trial they obtained an average score of 3.78 (very valid). Moodle LMS-based circulatory system teaching materials have several advantages, including having an attractive appearance, various varied features and the material presented systematically. In addition, the features and content of scientific literacy aspects contained in the Moodle LMS-based circulatory system teaching materials are able to be oriented towards improving students' scientific literacy abilities independently. Effectiveness testing needs to be carried out in the future to see the impact of implementing Moodle LMS-based circulation system teaching materials on circulation system learning in schools.

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