DEVELOPMENT OF RESPIRATORY SYSTEM TEACHING MATERIALS THROUGH MOODLE WHICH IS ORIENTED TOWARDS IMPROVING STUDENTS' DIGITAL LITERACY

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Abstract: Digital literacy is very important in the industrial era 4.0 because almost all aspects of life today are influenced by digital technology. As implementers of education, schools can play a role in increasing the digital literacy of the community, one of which is by implementing learning oriented towards increasing the digital literacy of students. To support this, in this study the development of teaching materials oriented to improve the digital literacy competence of students. The development model used in this research is ADDIE which consists of five stages, namely analysis, design, development, implementation and evaluation. Feasibility tests are carried out on three aspects, namely material, media and language carried out by two validators in each aspect. The teaching materials developed were tested on grade XI students of SMAN 23 Jakarta and two biology teachers. The feasibility test of the three aspects showed very valid results with a material aspect value of 3.40, a media aspect of 3.47 and a language aspect of 3.70. Trials on students and biology teachers also showed very valid results with a student trial value of 3.32 and a biology teacher trial value of 3.75. The average value of the overall assessment conducted was 3.53 so that the products developed from this study were considered very valid and suitable for use in schools and were expected to improve students' digital literacy.

Key Words: Teaching materials, Respiratory system, Moodle, Digital Literacy.

THE DEVELOPMENT OF RESPIRATORY SYSTEM LEARNING MATERIAL THROUGH MOODLE THAT ORIENTED TO IMPROVE STUDENTS' DIGITAL LITERACY

Abstract: *Digital literacy is an important skill in the era of industry 4.0 because digital technology is affecting many aspects of life. As an executive institution of the education system, schools have to play a role in the citizens' digital literacy by implementing a learning programme that is oriented towards the improvement of students digital literacy. To support that affair, this research is aimed to develop a respiratory system teaching material that is oriented to improve students' digital literacy. The development model used in this research is the ADDIE model that consists of five stages; analyze, design, develop, implement and evaluate. Teaching material was going through feasibility tests on the concept, media, and language aspects by two validators in each aspect. The test and trial process is executed by the students of SMAN 23 Jakarta and two biology teachers. The results of feasibility tests are the following; 3,40 on concept aspect, 3,47 on media aspect and 3,70 on language aspect that indicates a very valid criterion. The trial test results also shown a very valid criterion with the following values; 3,32 on students' trial test and 3,75 on teachers' trial test. The overall result of the respiratory systems teaching material is 3,53 which is indicating that the product is very feasible to be used as a learning material in schools and expected to improve students digital literacy.*

Keywords: *Teaching material, Respiratory system, Moodle, Digital literacy.*

INTRODUCTION

Digitizing learning is important for schools and teachers in the industrial era 4.0, because the education system in this era has been heavily influenced by digital technology (Putrawangsa &; Hasanah, 2018). E-learning offers convenience and benefits that conventional learning does not provide, such as time efficiency, place efficiency, cost efficiency, and flexibility (Arkorful &; Abaidoo, 2014). In addition, with E-learning applications such as LMS, teachers can also convey information in a wider spectrum such as in the form of images, videos, audio, text and other digital files (Jayawardana &; Gita, 2020). This will be very useful in learning in subjects that have a high level of misconceptions such as in biology subjects of respiratory system material.

Biology is a science that discusses living things, the environment and the interactions that take place between the two (Nisa, Djamahar, &; Evriyani, 2018). Many objects learned in biology learning cannot be observed directly and there are difficult concepts that make learning biology require certain tools and media (Sudarisman, 2015). Respiratory system material is one of the materials in biology lessons that has a fairly high level of misconception among students (Nainggolan &; Yemima, 2017). This is because the objects studied in this material are difficult to observe and many abstract concepts are difficult to master such as the concept of respiratory mechanisms and bioprocesses (Panjaitan, 2020). So certain media are needed to make it easier for students to understand the material. This statement is supported by studies on the use of various media such as animation / graphics (Irwanto, Perwani, Irwani, &; Marliah, 2012), videos (Nirva, Hala &; Junda, 2015), short films such as in research (Ichsan, Rusdi, &; Sartono, 2017), images (Safryadi, 2016), and computer applications (Mukti &; Nurcahyo, 2017) which show positive results on motivation, activeness, independence and learning outcomes of students in learning system material biology breathing. By utilizing digital learning applications such as *Learning Management System (LMS),* teachers can easily convey information through images and videos that can increase student understanding. In addition, learning components such as worksheets and learning evaluations can also be presented easily and effectively through the LMS.

LMS is an application that functions to convey, organize, identify, manage, and conduct assessments in learning activities (Szabo &; Flescher, 2002). LMS applications began to develop in the early 90s and now there are many choices of LMS applications that can be used, one of which is LMS Moodle. Moodle is one of the most widely used *open source* LMS in the world and has proven to be useful for digital learning activities. Moodle's features allow teachers to create fun E-Learning, this application is not only useful for storing and delivering material but also acts as a medium of communication between teachers and students so that learning becomes interactive (Simanullang &; Rajagukguk, 2020). Learning activities supported by features in the Moodle LMS include material storage and delivery activities, online discussions, assignments, polls, evaluations, video/image displays, automatic assessments, glossary features and student administration features (Retnoningsih, 2017). These features can help teachers create interactive and communicative learning as well as help students to be able to learn independently.

Success in the implementation of E-Learning is not only determined by the devices used but also influenced by the level of digital literacy of students. As said by (Irhandayaningsih, 2020), according to him, the effectiveness of interaction, collaboration and learning communication in E-learning is influenced by the level of digital literacy of teachers and students.

Digital literacy is the ability to use information and communication technology to find, understand, analyze, create and disseminate information in digital form (Becker, 2018). Digital literacy is an ability that can be improved by applying technology in everyday life such as in the implementation of E-Learning. This statement is in accordance with the results of research from (Oktavia and Hardinata, 2021) where there is a relationship between the application of information and communication technology in learning to the level of digital literacy of students. In addition, in research (Anuur, 2021) it was found that the digital literacy of students in biology learning can be improved by using digital-based teaching materials. Digital literacy is a competency that needs to be possessed by all circles of society in the

era of the industrial revolution 4.0 to be able to compete in all areas of life (Saputra &; Siddiq, 2020). Sutrisna (2020) stated that digital literacy competency is very necessary to be able to create a society with a critical and creative mindset.

According to (Littlejohn, Beetham &; McGill, 2012) there are 7 important elements to digital literacy. The first is information literacy, namely the ability of digital device users to find, interpret and process information obtained from digital devices to be disseminated to other people and the wider community. The second is media literacy, which is the ability to search and select information in various media so that the information obtained can be ascertained to be true. Third, technological literacy, namely the ability to use technological devices, both services and applications well so that they can be useful for everyday life. Fourth is the ability to understand technology, namely the skills of digital device users in using various components of digital technology so that they can improve their ability to advance various aspects of life. Fifth is communication and collaboration skills which can be interpreted as active participation of digital device users in using digital technology so that its use becomes more effective and efficient. The sixth is privacy management, namely the ability of digital device users to manage identities online. And finally is *digital scholarship*, which can be understood as the ability of digital device users to find and process various information obtained from digital devices to be used as a source or reference in academic fields such as for schoolwork and research purposes.

Based on research conducted by (Kurnia et al, 2017) on the level of digital literacy movement in society. Higher education occupies the first position as a digital literacy driver with a percentage (56.14%), followed by the government (14.34%), community (13.52%), NGOs (5.32%), while schools only contribute (3.68%). The data shows that schools still have not taken a significant role as digital literacy activists in Indonesia. As an institution responsible for educating the younger generation, it is fitting that schools begin to take an important role in improving digital literacy in Indonesia. What schools can do to start promoting digital literacy to students is by implementing E-learning in accordance with the statement by (Hamutoglu, 2019).

Based on the background, problem formulation, and theoretical studies above, it is necessary to develop teaching materials that are oriented to improve students' digital literacy competence as well as being able to act as an electronic learning resource for biology subjects on respiratory system material. The application chosen to deliver the developed teaching materials is LMS Moodle. Teaching materials of the respiratory system through *Moodle* Integrated with the internet and has features that can make it easier for students to manage information, understand material and support various elements of digital literacy so that they can train students' digital literacy.

RESEARCH METHODS

This research is aimed at developing a teaching material product that has been tested for validity and is suitable for use. The development model used is ADDIE (McGriff, 2000) which consists of five stages, namely analysis, design, development, implementation and evaluation, with the subject of research being grade XI students of SMAN 23 Jakarta and two biology teachers. The instruments used for research data collection include student needs analysis instruments, biology teacher interview instruments, media feasibility test instruments, language feasibility test instruments, material feasibility test instruments, biology teacher trial instruments and student trial instruments.
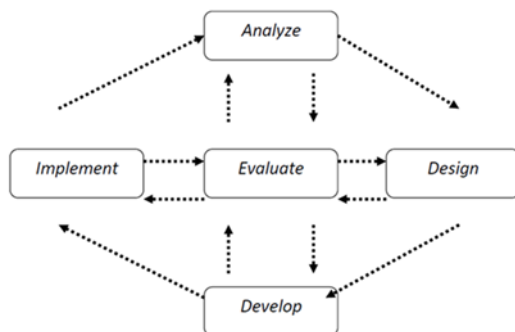
Picture 1. ADDIE development model (Tegeh &; Kirna, 2013)

The research procedure carried out follows the development procedure of the ADDIE model according to (Emzir, 2011):

1. Analysis

At this stage, two activities are carried out, namely curriculum analysis and student needs analysis. This activity is carried out to find out the competence of students, the obstacles faced by students and find out the material that needs to be focused on learning so that the products developed can be adjusted to the needs of students. The results of these two analyses will later be used as guidelines for the next steps in the preparation and development of Moodle LMS-based teaching materials.

2. Design

At this stage, the learning components needed to develop teaching materials are made. At this stage, the preparation of a grid of expert validation instruments and early trial instruments will be used at a later stage.

3. Development

The steps at this stage consist of product development, product validation by experts, product revision and early stage trials. In the product development step, the components of teaching materials that have been prepared at the design stage will be uploaded to the Moodle LMS so that they can be accessed by students and adjustments to the appearance and features of the Moodle LMS are also made. Furthermore, validation of teaching materials on aspects of material, media and language was carried out by two experts in each aspect assessed. Assessments, suggestions and comments provided by validators will be the basis of the next step at this stage, namely product revision. Early stage trials are carried out by students and biology teachers to determine the quality of the products developed before finally the products are used in learning activities at the implementation stage.

4. Implementation

In the ADDIE development model, the implementation stage is carried out by conducting field trials to determine the influence of teaching materials on student learning outcomes (Tegeh, Jampel &; Pudjawan, 2015). However, the procedure in this study was not carried out at the implementation stage because it was limited and focused on the product development stage by carrying out feasibility tests carried out by material, media and language experts and early stage trials carried out by students and biology teachers as in (Ristanto, et al, 2020).

5. Evaluation

There are two forms of evaluation, namely formative and summative evaluation. Formative evaluation is carried out at the end of each stage carried out to evaluate the results obtained from each stage carried out in order to obtain maximum results at each stage. While summative evaluation is the final evaluation carried out after the implementation stage to determine the real influence of the use of teaching materials developed on student learning outcomes (Tegeh, 2015). In this study, summative evaluation was not carried out to determine the influence of teaching materials on student learning outcomes, but only formative evaluation was carried out. Summative evaluation was not carried out because this research did not go through the implementation stage to test the real influence that the product had on teaching materials, so the final evaluation could not be carried out.

Data collection techniques can be seen in the following table.

Table 1. Data collection techniques

Phase	Technique	Instruments	Goal
Analysis	Observation	Questionnaire	Biology students and teachers
Design	No data collection required		
Development	Material validation	Questionnaire	Material expert
	Media validation	Questionnaire	Ahli media
	Language validation	Questionnaire	Linguists
	Trial	Questionnaire	Biology students and teachers
Implementation	No data collection required		
Evaluation	No data collection required		

Data analysis is carried out quantitatively by calculating the assessment of media experts, language and material with the help of prepared instruments, in addition to product trials by biology teachers and students. The feasibility level of the product is obtained from the score of the validation results of media, material and language tests (Sugiyono, 2007). The feasibility value of respiratory system teaching material products through LMS Moodle is calculated using the following formula;

$$Nilai = \frac{Skor\ yang\ diperoleh}{Jumlah\ pertanyaan}$$

With score interpretation criteria based (Ratumanan &; Laurens, 2011) shown by table 3 as follows;

Table 2. Score Interpretation Criteria

Categorical interval	Criterion	Information
3.25 >< 4.00	Sangat valid	Can be used without revision
2.50 >< 3.25	Valid	Can be used but needs a little revision
1.75 >< 2.50	Kurang valid	Can be used but needs a lot of revision
1.00 >< 1.75	Invalid	Cannot be used and needs expert consultation

RESULTS AND DISCUSSION

Result
1. Analysis

The development of teaching materials begins with analyzing the curriculum, analyzing the needs of participants and conducting interviews with biology teachers related to the learning process on respiratory system material.

a) Curriculum Analysis

Curriculum analysis is carried out to determine the basic competencies and learning objectives that are references in compiling teaching material components such as teaching materials and evaluation (Mulyatiningsih, 2016). The core competencies and basic competencies specified in the 2013 curriculum are written in the annex to the decision of the Head of the Research and Development Agency and Bookkeeping No. 18 of 2020. Based on the study conducted on these rules, the subject matter that will be included in the teaching materials of the respiratory system is; sub-matter of the human respiratory system and respiratory mechanisms in humans. Then there will also be a gas exchange sub-chapter that will discuss the gas exchange process that takes place in the alveolus and tissues. As well as sub-chapters of abnormalities in the human respiratory system and the latest technology that can help humans maintain the health of the respiratory system.

b) Learner Needs Analysis

Analysis of student needs to be done to find out the characteristics of students who will use teaching materials (Mulyatiningsih, 2016). Analysis of student needs was carried out by distributing instruments consisting of 15 questions related to respiratory system learning in schools and the use of moodle learning media. The results of the distribution of needs analysis instruments can be seen in the appendix.

c) Biology teacher interview

The next needs analysis was carried out by conducting interviews with biology teachers to find out the opinions of biology teachers on teaching and learning activities on respiratory system material. From the results of the interview, it is known that according to the teacher in order for learning to take place effectively and optimally in increasing the understanding of didi participants, biology learning requires tools that are able to explain abstract concepts or represent the biological objects studied. The teacher agrees that in learning respiratory system material, the use of images and videos will greatly help students' understanding. The answer obtained from biology

teachers is in line with the statement from (Sudarisman, 2015) which says that biology learning requires certain media in its delivery to take place more effectively. The results of the interview can be seen further in the appendix.

2. Design

At this stage, the preparation of the components needed to make teaching materials is carried out and the result of this stage is the formation of a teaching material framework (Kurnia, 2019). The results of the previous stage are used as a basis for compiling the components of the material to be presented, then determining the features to be used, and adjusting the appearance. In addition, at this stage, a grid of feasibility test instruments and trial instruments is also carried out. The components of teaching materials uploaded to the Moodle LMS can be seen in the attachment.

3. Development

This stage consists of developing teaching materials, testing the feasibility of teaching materials, and testing students and biology teachers.

a) Test material qualification

The material feasibility test was conducted to determine the suitability of the material presented by the product to the basic competencies, indicators and learning objectives listed in the 2013 curriculum (Rozalia, 2018). The final score of the material due diligence shows a value of 3.40 and is included in the very valid category.

b) Test media credentials

Media feasibility tests are carried out to determine the feasibility of various graphic elements and features of teaching materials. The graphic elements in question include images, videos, color selection and the appearance of the developed product (Safitri, 2016). Overall, the media validation results showed a value of 3.47 and entered the very valid category.

c) Test language credentials

Language feasibility tests are carried out to determine whether the language used in teaching materials is in accordance with the General Guidelines for Indonesian Spelling (PUEBI), the presence or absence of word errors and the accuracy of using terms (Handoko, 2016). This validation aims to ensure the content of teaching materials is easily understood by students and reduces the possibility of misunderstanding concepts due to the misuse of

sentences in teaching materials. The overall language validation score obtained is 3.60 and falls into the very valid category.

d) Testing of biology learners and teachers

The trial was conducted to determine the response and opinion of students and biology teachers to the use of respiratory system teaching materials developed. The initial trial was carried out by holding an online meeting with grade XI students of SMAN 23 Jakarta and from the meeting 55 students were obtained who were willing to become respondents to test the product. Meanwhile, trials on biology teachers were conducted by two biology teachers. The student trial got a score of 3.32 while the biology teacher trial got a score of 3.75 and both fell into the very valid category.

The assessment results of material feasibility tests, media feasibility tests, language feasibility tests, student trials and biology teacher trials as a whole can be seen in the graph below;
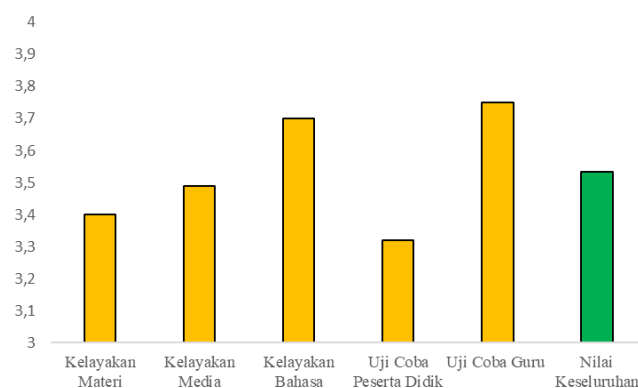
Picture 2. Results of the overall assessment of the test

The highest score was obtained in the biology teacher trial with a value of 3.75 while the lowest score was obtained in the student trial with a value of 3.34. The average value of the overall assessment conducted was 3.53 and was categorized as very valid based on (Ratumanans &; Laurens, 2011). Thus, it can be concluded that the respiratory system teaching material products through the Moodle LMS for distance learning that have been developed can be used without revision

Discussion

Using the Moodle LMS, teachers can present material from a variety of sources, such as scientific journals, the internet web, online videos, online galleries or textual files. Based on

literature studies from (Gani, Zaimah &; Wulandari, 2020) the diversity of information sources used in learning activities has a positive influence on increasing information literacy of students. Meanwhile, learning videos and images as well as website links that are also uploaded are expected to improve students' media literacy skills. Based on research from (Wijayati, Haqqie &; Ventivani, 2021), the use of online videos to deliver material can increase students' digital literacy, which is characterized by an increase in one of the elements in digital literacy, namely media literacy.

Research from (Syah, *et al*, 2021) found that collaborative learning models have a positive impact on increasing student information literacy. Moodle LMS strongly supports collaborative and interactive learning because it has a forum feature (Setiawan *et al*, 2021). The forum feature allows students to exchange information they get, express opinions and ask questions and answers to each other in a discussion, which activity has a positive impact on collaboration and communication skills which are also one of the elements in digital literacy (Zubaidah, 2018).

The image and video display feature on the Moodle LMS is very high quality because it can display images / videos in high resolution without the need for third-party applications. In addition, the Moodle LMS can be accessed from various devices such as smartphones, computers or laptops as long as the internet network is available which is related to one of the important elements of digital literacy, namely technological literacy. Based on (Nasution, 2018) providing opportunities for students to try, use and learn the functions of various technologies and learning applications can have a positive impact on students' technological literacy. Technology literacy is the ability to use and manage various forms of technology, information and communication products (Latip, 2020).

The use of LMS Moodle to bring respiratory system teaching materials in PJJ, can support efforts to increase students' digital literacy. This is because its features support various elements needed in digital literacy. With LMS Moodle, teachers can present teaching materials from various sources of information, which based on research from (Gani, Zaimah &; Wulandari, 2020) can support information literacy and *digital scholarship* skills of students. LMS Moodle also supports communicative and collaborative learning activities which are one of the important elements that influence digital literacy competence (Littlejohn, Beetham &; McGill, 2012).

The ability of LMS Moodle to integrate with the internet also provides opportunities for teachers to be able to use various internet-based learning platforms and media such as online image galleries and online video galleries in learning activities so that they can support the media literacy of students (Wijayati, Haqqie &; Ventivani, 2021). According to (Hastini, Fahmi &; Lukito, 2020) technological literacy as part of digital literacy is closely related to the use of digital technology, so online learning through the Moodle LMS can easily improve this ability. The ability of students to understand digital technology will also develop along with the use of Moodle in their learning. Based on research from (Anggrasari. 2020), online learning has a positive impact on students' digital literacy competencies and according to him, increasing digital literacy affects students' ability to process information digitally which ultimately has an impact on improving learning outcomes.

Respiratory system teaching materials through Moodle that have been developed are known to have advantages and disadvantages that need to be taken into consideration when they will be used in learning. The advantages possessed by respiratory system teaching materials through the Moodle LMS include having an attractive appearance, being able to display video, images, or audio needed in learning without the need for third-party applications, having various learning features that support interactive-collaborative activities high accessibility, integrated with the internet, can help teachers in compiling material systematically, and the main advantages of the Moodle LMS are that it can becomes a means for students to learn independently because students can access teaching material components that have been uploaded to the Moodle LMS at any time as long as needed, besides that teaching material components can also be downloaded to student devices to be

accessed offline.

The weakness possessed by respiratory system teaching materials through LMS Moodle is the need for an internet network. Students and teachers must have an internet network to be able to access the Moodle LMS. This deficiency can be overcome because of the *download feature* that allows students to download the material needed to be accessed offline but to access features such as quizzes and discussion forums, an internet network must be available. In this study, the effectiveness test of learning outcomes and digital literacy was not carried out, because it focused on developing respiratory system teaching materials through LMS Moodle. So that the teaching materials for the respiratory system through the new Moodle LMS can be said to be oriented towards improving the digital literacy of students. The advantages and disadvantages described are based on the results of assessments, suggestions, comments, and literature reviews conducted. It is hoped that the advantages and disadvantages of LMS Moodle respiratory system teaching materials found from this study can be used as a reference in further development or research.

COVER

Conclusion

LMS Moodle is an excellent application to be used as a medium for delivering teaching materials for distance learning activities. Respiratory system teaching materials integrated with LMS Moodle have been successfully developed based on the observations of biology students and teachers related to the needs of distance learning on respiratory system materials. The teaching materials developed are considered very valid based on the feasibility tests carried out. The value in the material aspect is 3.40, the value in the media aspect is 3.47 and the value in the language aspect is 3.70. The trials of students and biology teachers also showed very valid scores with student trial scores of 3.32 and biology teacher trial scores of 3.75. Overall the score obtained is 3.53 so that the product developed from this study is very suitable for use in schools.

Suggestion

It is very important for researchers to be able to present components of teaching materials that are in accordance with the development of science and technology and the development of 21st century learning, where in this era learning with internet-based digital media is very common. In addition to quantitative assessments of feasibility tests and early-stage trials, comments, suggestions and criticisms provided by respondents are also important to pay attention to in revising the product.

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