DEVELOPMENT OF PHYSICS MODULE INTEGRATED MOODLE USING LAB ROTATION IN SENIOR HIGH SCHOOL

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ABSTRACT

The use of technology-based learning resources in the teaching and learning process provides benefits in increasing student independence and literacy. It can be an answer to the challenges of industrial revolution 4.0. However, realizing technology-based learning resources is still a challenge, because it is necessary to have the right learning model to achieve the desired results. Therefore, this research developed a moodle-based physics module using a rotation lab model using the ADDIE research method to answer the demands of the industrial revolution 4.0. This study aims to determine the validity and practicality of the moodle-based physics module using a rotation lab model. The moodle-based physics module using the rotation lab is in the very valid category, scoring 87. Meanwhile, in the practical aspect of the moodle-based physics module using the rotation lab model, it scored 91, which is in the efficient category.

Keywords: Development; Rotation Lab; Module; Moodle

I. INTRODUCTION

The industrial revolution 4.0 is a change in the pattern of life and mindset of a nation that eventually changed the order of a country in terms of economy, society, politics, and culture. The industrial revolution developed from industrial revolution 1.0 to 4 [1]. Industrial revolution 4.0 is characterized by cyber-physical where all are operated using machines. Industrial Revolution 4.0 is known as the internet of things because all systems have touched the virtual world. These systems cooperate simultaneously through a network of data and machine-assisted machines created to make human work easier [2].

The challenge faced in the era of the industrial revolution 4.0 is in preparing human resources who are skillfully ready and have an advantage in the competition in the future. To answer these challenges, education is needed to develop students' potential. So that the teacher must be ready to guide and help students find and explore the potential that exists in them [3].

Education 4.0 is the answer to the challenges of the industrial revolution 4.0 so that the role of a teacher is not replaced by a cyber system where the role of teachers becomes aligned to find solutions, solve problems and produce innovations[4]. Therefore, if the learning process cannot be aligned with the existing system, then the role of the teacher will be replaced so that the educational goals cannot be carried out. The purpose of education is explained in Law N0 20 of 2003 article 3 is to develop the potential of students to become human beings who have faith and piety in God Almighty, have a noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens.

The government has designed ten national priority steps in facing the challenges of the industrial revolution, steps in the field of education, namely by improving the quality of human resources. This improvement is carried out by improving the quality of schools and creating an educational curriculum that is in line with the industrial revolution 4.0[5].

To overcome this, better and more efficient LMS-based learning tools are needed in the learning process. LMS is programmed and created specifically for schools so that teachers and students can use it directly in the learning process. The LMS is Moodle, where moodle is software created to help to learn activities based on the
internet and the web. Moodle comes from the word Modular Object-Oriented Dynamic Learning Environment, meaning that moodle is a web-based object-oriented dynamic learning place [6].

Moodle is a web-based Learning Management System that is dynamic so that it can be accessed anytime and anywhere. Moodle transforms printed learning resources into web-based [7]. Moodle can be freely accessed through http://moodle.org, so it can be easily used and modified as needed [8]. Through moodle-based E-learning, educators can manage the learning process online and offline at the same time so that learning goals can be achieved. The use of moodle in the learning process follows the theory of constructivism learning, where the learning process can occur when there is an increase in the learner's logical and conceptual development caused by the learner's active interaction [9]. The features in moodle LMS include assignments, feedback, forums, quizzes, chat, and lessons [10].

With a suitable LMS, it will be easier for teachers to develop learning tools used in the teaching and learning process. Learning tools include a syllabus, learning implementation plan (RPP), student activity sheets (LKS), modules, student assessment instruments, and teaching media. Each learning device has its function in the learning process [11], as well as modules and worksheets, which have the same function as learning resources that help the teaching and learning process but have differences in the final goal to be achieved.

Modules are learning tools arranged according to the goals and needs of students in the learning process, where students can learn on their own according to the instructions in the module and can conduct tests to test themselves and provide feedback directly [12]. Modules are the most accessible medium to learn anywhere and anytime, conveying learning messages that can explain words, videos, animations, and images, increase student motivation, the learning load is evenly divided, and the teacher can know student development better [13].

Moodle-based modules should be supported by the application of learning models that are appropriate to education 4.0. One of the characteristics of education 4.0 is the student-centered learning process and flexibility that allows learners to interact and collaborate in the classroom and remotely [4]. The model that fits these characteristics is the blended learning model.

The blended learning model not only provides students with computers in the learning process but also teaches students to take advantage of technological tools in the learning process [14]. The Lab Rotation model is the appropriate learning model for implementing physics learning in schools. In this learning model, the learning process is specifically designed in the e-learning laboratory [9]. In implementing the rotation lab learning model, students learn in the classroom in computer laboratories for online learning. The advantage of this learning model is that teachers can provide teaching materials that can keep up with the times by utilizing cyber technology such as e-learning so that the competency standards to be achieved can be carried out more optimally [2]. In addition, the Lab rotation model is easy to apply in schools because teachers can directly control the learning process because all activities carried out are in the school in the form of discussions in the classroom and evaluation through e-learning in the laboratory [15]. There are three primary stages in the blended learning model that refer to ICT-based learning, proposed by [16], namely: 1) seeking of information, 2) acquisition of information and 3) synthesizing of knowledge.

Using the rotation lab provides advantages where students can learn more independently but still be accompanied by the teacher so that misconceptions can be avoided. Lab rotation can also increase student motivation in learning because they are not in the same room for a long time so that students do not quickly feel bored and bored [17].

Behind the advantages, it has, of course, some challenges must be faced to apply the learning process using the rotation lab optimally. The challenge that must be faced is the need for a complicated learning management system to help adapt each student to the online content provided [18]. Implementing a lab rotation-type blended learning model must provoke students' creativity in discussing, interacting, and collaborating to get maximum results [19].

In physics learning, the most important thing is students who are actively learning. At the same time, the teacher is expected to master the material to be taught, understand the situation of students so that they can teach according to the circumstances and development of students, and compile materials so that they are quickly captured by students [20]. So that with the learning module using the suitable model, it will produce learning that follows the learning objectives.

With the EXISTENCE of a MOODLE-based physics module using the Lab Rotation model, it is hoped that it will be able to align education in Indonesia with the challenges of the industrial revolution 4.0. Therefore, the development of a moodle-based physics module with a rotation lab model is essential to do. Based on this description, research was conducted entitled Development of MOODLE-Based Physics Modules using the Rotation Lab Model in High School Learning.
II. METHOD

The type of research carried out is research and development (R&D). The chosen model is a research model developed by Dick and Carrey (1996), namely the ADDIE model for designing learning systems. ADDIE stands for Analysis, Design, Development, Implementation, and Evaluation. Based on product development measures, ADDIE's research and development model is more precise and complete for developing learning tools [21].

The selection of this model is based on the consideration that this model was developed systematically and based on the theoretical foundation of learning design. This model is arranged programmatically with a systematic sequence of activities to solve learning problems related to learning resources that follow the needs and characteristics of learners [22].

This research begins with the stage of analyzing the needs and potentials possessed by the school. After knowing the needs and potentials of the school, then proceed with the product design stage. The product resulting from this research is in the form of a moodle-based physics module using a rotation lab model on newton's law of gravity, effort, and energy, wherein the module, there are learning instructions, competencies to be achieved, learning materials, supporting information, exercises, student worksheets, and evaluations. The instruments that must be prepared after the product design are the product validity instrument used to assess whether the product is valid or not and the practicality instrument to assess the practicality of the product used. Furthermore, a product is developed following the design that has been designed and evaluated by experts from the aspects of media and materials. After the module is said to be feasible, then the module is tested by the school in a small group. The evaluation stage is improvements based on the shortcomings that have been found in accordance with the indicators that have been made to produce a viable and practical product for use on a large scale in the learning process. The category for valid and worthy obtained a value greater than and equal to 60.

III. RESULTS AND DISCUSSION

The research was conducted based on the steps in the research method, namely, using the ADDIE model. Initially, an analysis of the physical material to be developed in the module was based on two categories, namely material that was considered problematic and material that, in the learning process, was difficult to conduct experiments due to limited time or unsupportive means so that newton's law of gravity material and effort and energy were obtained. After that, it is continued with the design process of the Moodle-based physics module, where the initial form of the desired module and the instruments used in the validation and practicality process are designed. Three experts carry out validation. The module validation results are divided into four components: the content substance component, the learning design component, the display aspect component, and the utilization aspect component.

The first component is the substance of the contents. In the substance of the content, there are two indicators, namely, the substance of the material and the substance of blended learning. In the substance of the content, the lowest sub-indicator presents physics material and the truth of concepts, principles, laws, and theories. This is due to the presence of some images that are not yet relevant to the material presented. The solution to this problem is to change illustrations to illustrations in real phenomena that occur in everyday life.

![Content Substance Validation Results](image)

Based on the chart above, it can be seen in the substance of the content that there are seven sub-indicators, of which six sub-indicators are temporal indicators, and one sub-indicator is blended learning. The highest sub-indicators are found in sub-indicators 1 and 5, namely the clarity of the instructions and the language used, with a value of 100. The category is very valid, while the lowest sub-indicators are located in sub-indicators 3 and 4,
namely the presentation of physics materials and the truth of concepts, principal, laws, and theories with a value of 75 and valid categories.

The second component is learning design. Learning design is seen from the module design and blended learning design. Module designs get the lowest marks on the suitability of purpose, material, and sample questions. In the module, there is no description of indicators on basic competencies of skills. After revision, the basic competency indicators for skills have been added. As for the blended learning design, it is already in the range of 83-92.

Fig 2. Module Design Validation Results

Based on the chart above, it can be seen in the learning design that there are 12 sub-indicators, of which seven sub-indicators are module indicators, and five are blended learning. The highest sub-indicators in the module design are found in sub-indicators 1 and 2, namely the suitability of the title in the module and the primary competency literature in the module, which is worth 100. At the same time, the lowest sub-indicator is located in sub-indicators 4, 5, and 6, namely the suitability of the material, sample questions, and evaluations, with a value of 75.

Blended design indicators can be seen in chart 3. The results of module design validation get the highest scores on sub-indicators 8, 9 and 10, namely in feedback, evaluation, and access that students have, with a score of 92. Meanwhile, the lowest score in sub-indicators 11 and 12 is access to self-assessment. It encourages students to learn independently, with a score of 83.

Fig 3. Blended Design validation results

The third component is the display aspect. In general, the appearance of moodle-based physics modules is already attractive. However, there are some suggestions in the display, such as size and typeface, so that the appearance of the moodle-based physics module can look proportional.
The display validation results get the highest score with a value of 92, which has a very valid category on sub-indicators 2, 3, and 5, namely on the type and size of fonts, combinations of fonts, and videos presented on moodle. While the other sub-indicators are worth 83, and the category is very valid.

The last component is the use of the software. Moodle-based physics module control got the lowest score in validation but was still in the valid category. Meanwhile, in the e-learning aspect, validation results have been obtained, which are in the very valid category. The validation of utilization aspects results in consists of two indicators, namely module utilization indicators and e-learning utilization indicators. The utilization indicator consists of five indicators: module control, information discovery, module operation, assisting the learning process, and the use of supporting software. The sub-indicators with the highest values are the 2nd, 3rd and 5th sub-indicators. Meanwhile, the indicators for the use of E-learning have the same value in each sub-indicator, where the sub-indicators are interactivity in e-learning, navigation, and access to e-learning.

Based on all aspects, validation results were obtained for the moodle-based physics module as in Graph 7.
Fig 7. Validation Results of each Component

Based on graph 7, it can be seen that the component with the highest validation value is found in the utilization component with a score of 89 which is in the very valid category, while the lowest score is in the learning design component and the display aspect is in the very valid category with a score of 86. So that the average result of validation of the moodle-based physics module is in the very valid category with a score of 87.

After validation is carried out, revisions are carried out following the suggestions that the validator has given. Furthermore, a test of the response of teachers and students to the moodle-based physics module was carried out. In the teacher response test, an assessment questionnaire was filled out by three teachers from SMA N 2 Payakumbuh after using the moodle-based physics module. So that the results of the teacher response test were obtained in the very practical category with a score of 91. Furthermore, a revision was made of the moodle-based physics module based on the advice given by the teacher. After the moodle-based physics module was revised, the moodle-based physics module was tested on a small scale to 16 students of SMA N 2 Payakumbuh. The results of small-scale trials obtained an average percentage of practice, which was 87 with a very practical category. The last stage is an evaluation related to the constraints in developing moodle-based physics modules and the final results of moodle-based physics modules. With the positive results obtained for the moodle-based physics module, developing a moodle-based physics module is worthy of further development.

The obstacles faced in this study are that the modules developed are limited to Newton's law material, effort and energy and the research carried out is limited to the practicality test of the moodle-based physics module. To overcome this, it is necessary to have further research so that a moodle-based physics module can be produced in all materials and an effectiveness test is carried out to measure its effectiveness so that it can then be used thoroughly in the school environment.

IV. CONCLUSION

Moodle-based physics module development research using a rotation lab model developed using the ADDIE model produces valid and practical modules to develop and use widely. The validity of the moodle-based physics module on Newton's law of gravity and effort and energy is in the very valid category with a score of 87. Components in content substance, learning design, appearance, and utilization of software are in the very valid category. Based on trials in schools through small groups, moodle-based physics modules with a rotation lab model can attract students' learning interests and facilitate teachers in the teaching and learning process. The practicality of the moodle-based physics module on Newton's law of gravity material and effort and energy is in the very practical category with a score of 94 based on teacher response and 89 on student response.

REFERENCES


