

IMPROVING BIOLOGY LEARNING OUTCOMES THROUGH PROBLEM-BASED LEARNING E-MODULES IN THE LABORATORY OF KUTACANE STATE SENIOR HIGH SCHOOL 1

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Abstrak

The lack of innovative media in the biology learning process has a significant impact on the decline in learning outcomes of students at Kutacane 1 Public High School because they feel bored in the biology learning process. This became the basis for conducting this study. This study aims to describe the process of developing and validating PBL-based E-modules. This research is a development study using the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation. The methods used for data collection include observation, interviews, and questionnaires. The data analysis techniques employed are qualitative descriptive analysis and quantitative descriptive analysis. The PBL-based E-module design is valid with: (a) blended learning is valid with: (a) expert review results with very good qualifications (90.6%), (b) expert review results of biology learning design with very good qualifications (97.1%), (c) the results of a review by learning media experts with a very good qualification (92.5%), (d) the results of individual trials with a very good qualification (95%), (e) the results of small group trials with a very good qualification (95%). Thus, this study shows that the validity of the problem-based learning-based E-module in terms of qualifications is very good and suitable for use in the biology learning process at SMA Negeri 1 Kutacane.

Kata kunci: Improving Biology Learning Outcomes

INTRODUCTION

Education is the most influential foundation for improving the quality of life of a nation. Through the educational process, a person's cognitive abilities will expand and increase. Education can be a measure of the quality of human resources (Asrial, et al., 2020). Law No. 20 of 2003 (Praditya, 2019) states that education is a conscious and planned effort to create an active learning environment so that students can develop their potential and personality in a positive direction. Education can nurture intellectual and emotional potential, enabling individuals to become better versions of themselves. Based on this, it can be said that education plays a crucial role in preparing high-quality human resources. In this era of industrial revolution, one of the factors influencing the world of education is the rapid development of technology. Technology is one of the tools that can advance the world of education. Technology can be used as a solution to educational problems, which will provide benefits in improving the quality of education (Pratama et al., 2017; Wulandari et al., 2020). The rapid development of technology has led to print media being abandoned in favor of computer technology in the learning process. This is evidenced by the existence of digital-based teaching materials such as e-books. Rapid technological advancements can indeed help educators to be more innovative in developing teaching materials. However, a common issue today is that many teachers still use conventional teaching materials. This is also the case at the Biology Laboratory of SMA Negeri 1 Kutacane. Based on observations and interviews conducted with biology teachers in

grade 10, it was found that the learning materials used by teachers in teaching are printed materials, and teachers still predominantly use the lecture method in instruction. Additionally, students do not yet have practical learning materials that allow them to learn anytime and anywhere. This has an impact on students' learning outcomes. The average midterm exam score for 10th grade students in Biology for the 2019/2020 academic year was 54.9. Only 1 out of 25 students met the minimum passing grade (KKM). The KKM that students should achieve is 70.

Based on this issue, the solution chosen to address the problem so that students can learn independently, become more motivated, and improve their academic performance is to develop instructional materials in the form of E-modules. E-modules are instructional materials packaged in a digital format. E-modules can help teachers facilitate student learning (Asrial et al., 2020; Citrawathi et al., 2016). (Diantari et al., 2018; Udayana et al., 2017) state that e-modules are digital learning media that are systematically organized so that students can learn independently and solve existing problems. Based on these opinions, it is concluded that e-modules are systematically organized digital teaching materials presented in electronic form. E-modules can increase students' interest and motivation in learning. This is proven by research conducted by Wirawan et al. (2017), which states that e-modules can improve students' learning outcomes, making them suitable for supporting the learning process. Aryawan, et al. (2018) stated that interactive e-modules can be used to significantly improve student learning outcomes. Hastari, et al. (2019) also stated that e-modules are effective in increasing student activity and motivation in learning, thereby improving student learning outcomes. It can be concluded that e-modules can increase student motivation in learning, thereby having a positive impact on student learning outcomes.

E-modules play an important role in the learning process by helping teachers explain lesson material. The advantage of e-modules over other print media is that they are interactive. E-modules, which are packaged in digital form, can be read on laptops or computers. E-modules also feature facilities such as educational videos, animations, images, and audio. (Diantari et al., 2018; Sugihartini & Laba, 2017) also state that E-modules are interactive, making navigation easier by displaying images, text, and videos accompanied by tests and providing automatic feedback. Thus, E-modules can be considered one of the best alternatives to enhance students' understanding, thereby improving their learning outcomes. Temuan tersebut mengindikasikan bahwa perlunya upaya meningkatkan hasil belajar siswa khususnya pada mata pelajaran Biologi kelas X. Selain bahan ajar, model pembelajaran juga memiliki peranan penting dalam meningkatkan hasil belajar siswa. Berbagai macam model pembelajaran dapat digunakan oleh guru dalam proses pembelajaran. Model pembelajaran yang kreatif dan inovatif dapat meningkatkan kompetensi siswa. Aspini (2020) menyatakan model pembelajaran dapat digunakan sebagai upaya memaksimalkan daya nyaman siswa dalam belajar dan meningkatkan ketrampilan berpikir siswa. Salah satu kompetensi yang harus dimiliki oleh siswa pada abad ke-21 yaitu berpikir kritis dalam memecahkan suatu masalah. Diah & Riyanto, (2016); Lubis, (2018) juga menyatakan bahwa kompetensi berpikir kritis, keterampilan pemecahan masalah, komunikasi dan teknologi, serta pembelajaran kontekstual sangat diperlukan pada abad ke-21. Karakteristik siswa menengah atas yang telah mampu berpikir kritis, dan materi biologi dipandang sebagai suatu sederhana, tetapi dapat juga dipandang sebagai suatu yang kompleks dan rumit Hassanudin (Qumillaila, dkk, 2017). *Problem based learning* atau pembelajaran berbasis masalah merupakan model pembelajaran yang menantang siswa untuk berpikir kritis dalam memecahkan permasalahan yang ada. Hadi & Rahmantika, (2016); Serevina, et al., (2018) state that PBL is a learning method that presents problems to students and requires them to solve and provide solutions to these problems. The characteristics of PBL include a focus on

interdisciplinary learning, authentic inquiry, producing tangible outcomes such as reports, and collaboration (Shofiyah, 2018). This learning model can be used by teachers to encourage students to think critically in solving existing problems. This is evidenced by research conducted by Serevina et al. (2018), which states that PBL can significantly improve science process skills for secondary school students. Retnowati et al. (2018) also state that PBL can improve students' cognitive skills in problem-solving. Research conducted by Sumardjoko & Musyiam (2018) found that PBL can improve student learning outcomes by 75%. Based on this research, it can be concluded that PBL can enhance students' critical thinking skills, thereby positively impacting their learning outcomes.

This study aims to describe the design and validity of problem-based learning-based E-modules for 10th grade students in the even semester at the Kutacane 1 Public High School laboratory. This study will combine the PBL model with E-module teaching materials. Based on previous studies, this study differs from other studies. The differences lie in the materials used in the creation of teaching materials, as well as the research subjects. The selection of E-modules with the PBL model is tailored to the facilities available and the characteristics of the students. The steps are in accordance with the syntax of the PBL learning model. Trianto (Prasetyanti et al., 2016) states that there are five steps in the PBL learning model, namely (1) orienting students to the problem, (2) organizing students for learning, (3) guiding individual and group investigations, (4) developing and presenting the results of the work, and (5) analyzing and evaluating the problem-solving process. These steps are combined with E-module instructional materials as a learning resource. By using E-modules with the PBL learning model, it is hoped that biology learning outcomes can be improved. This combination of model and instructional materials will serve as an alternative that teachers can use to develop and innovate creative and innovative learning.

RESEARCH METHODOLOGY

This development research was conducted from February 3, 2020, to July 26, 2020. The subjects of this study were: 1 subject matter expert, 1 instructional design expert, 1 educational media expert, 3 participants for individual testing, and 6 participants for small group testing. The research development procedure followed the ADDIE model, which consists of five steps. The stages of the ADDIE model according to Tegeh and Jampel (2017:79) are: (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation. The ADDIE model was used because each step is systematic and easy to understand, making it easy to use. Data collection in this study was conducted using observation, interviews, and questionnaires. Agung (2017:101) states that the observation method is a means of assessment by conducting systematic direct observation.

The purpose of the observation method is to collect real data. The interview method is a method of collecting data through systematic questioning, with the results recorded carefully (Agung, 2017:104). The questionnaire method is a way of collecting data by providing a list of questions to respondents, which are answered in writing (Agung, 2017:106). This method was used to measure the feasibility of E-module products by experts (subject matter experts, learning design experts, and learning media experts). The instruments used to collect research data were observation sheets, interview sheets, and questionnaire sheets. Observation sheets were used to determine the learning facilities available to schools and students, as well as to observe the learning process in the classroom. The instruments used to collect research data were observation sheets, interview sheets, and questionnaire sheets. Observation sheets were used to

determine the learning facilities available to schools and students, as well as to observe the learning process taking place in the classroom. The instruments were then evaluated by experts with expertise in the variables being studied.

After being reviewed by experts, content validity was obtained and analyzed using Gregory's formula. Experts who have assessed the instruments by clarifying the instrument items will tabulate the assessment results in a matrix, then calculate the content validity (Retnawati, 2016:32). The data analysis methods used in this development study are qualitative descriptive analysis and quantitative descriptive analysis. Qualitative descriptive analysis is "a systematic data processing method in the form of sentences to obtain general conclusions" (Agung, 2017:118). This method is used to process data from trials conducted by subject matter experts, learning design experts, and learning media experts, as well as individual trial subjects and small group trial subjects. Information in the form of feedback, criticism, and suggestions from the questionnaire is used to revise the E-module product. Quantitative descriptive analysis is a "systematic method of processing data in numerical form to draw general conclusions" (Agung, 2017:118).

RESULTS

This study will discuss two main points: describing the design of PBL-based E-modules and describing the validity of PBL-based E-modules. The design of PBL-based E-modules uses the ADDIE development model. The development of PBL-based E-modules begins with the analysis stage. The results obtained through the analysis activity are:

- (1) analysis of learning activities, it was found that some students were unable to learn independently due to a lack of interactive media in the learning process,
- (2) analysis of learning facilities, it was found that learning facilities such as computer labs, LCDs, and internet access were adequate.

Adequate learning facilities can be used by students in learning, such as independent learning. The second stage is design. During the design phase, the following were carried out:

- (1) creating flowcharts and storyboards for the e-module. The flowchart was created to understand the workflow of the developed E-module.
- (2) Creating the E-module framework, this was done to outline the E-module and the systematic arrangement of materials within the E-module. The function of the E-module framework is to facilitate the development of the E-module.
- (3) Determining the E-module interface design. The purpose of this design is to make the E-module attractive and easy to read.
- (4) Developing assessment instruments. Instruments were developed to determine the validity of the developed product.
- (5) Developing a lesson plan (RPP).

The RPP was developed to guide learning activities using E-module teaching materials with the PBL learning model. The third stage was development. In the development stage, the following activities were carried out:

- (1) E-module content development. This activity was carried out by collecting teaching materials on Biology for Grade X.

(2) E-module development.

After the teaching materials were developed into complete teaching materials, the next step was to create an E-module that could be accessed via a computer or laptop. The fourth stage is implementation. During the implementation phase, the activities carried out include:

- (1) product validation testing by experts, including subject matter experts in Biology for Grade 10, instructional design experts, and educational media experts.
- (2) Product testing includes individual testing involving three students and small group testing involving six students.

The purpose of product testing is to determine the attractiveness and feasibility of the developed E-module. The final stage is evaluation. During the evaluation stage, the data collected during implementation is evaluated. The evaluation is formative, aiming to assess the developed E-module product, including expert validity, individual testing, and small group testing. Based on these stages, the PBL-based E-module has been successfully developed by applying the ADDIE model.

CONCLUSION AND RECOMMENDATIONS

The conclusion of this study is the development of an E-module based on problem-based learning, namely: first, the design of an E-module based on problem-based learning developed in accordance with the ADDIE model, namely: (a) the analysis stage, (b) the design stage, (c) the development stage, (d) the implementation stage, and (e) the evaluation stage. Second, the development of the problem-based learning-based E-module successfully achieved excellent qualifications in every content validity test, instructional design validity test, instructional media validity test, individual trial, and small group trial. The problem-based learning-based E-module is suitable for application in the learning process so that learning problems can be resolved effectively.

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