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INTERACTIVE DIGITAL MODULE PHYSICS (IDMP) BASED ON PROBLEM BASED LEARNING (PBL) ON THE CONCEPT OF WORK AND ENERGY

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Abstrak

Interaktif Digital Modul Physics (IDMP) berbasis Problem Based Learning (PBL) adalah sebuah inovasi pembelajaran yang dirancang untuk membantu siswa memahami konsep usaha dan energi dalam fisika dengan cara yang lebih interaktif dan efektif. IDMP ini berisi beberapa komponen seperti teori, soal dan video yang saling terintegrasi. Penelitian ini bertujuan untuk menghasilkan modul digital berbasis *Problem Based Learnning* pada materi usaha dan energi yang valid digunakan sebagai media pembelajaran fisika yang dilengkapi dengan teknologi digital yang memungkinkan siswa untuk memperoleh informasi melalui berbagai media seperti video, simulasi, dan animasi. Penelitian pengembangan ini menggunakan model ADDIE (*Analyze, Design, Develop, Implement, Evaluate).* Produk akhir dari penelitian ini berupa modul digital berbentuk sebuah aplikasi android sehingga dapat diakses dengan mudah melalui smartphone. Produk akan divalidasi oleh ahli media, ahli materi, dan ahli pembelajaran, serta dilakukan ujicoba kepada guru fisika dan peserta didik.

Kata-kata kunci: modul digital, *Problem Based Learning*, usaha dan energi.

Abstract

The Interactive Digital Module Physics (IDMP) based on Problem Based Learning (PBL) is an innovative learning tool designed to assist students in understanding the concepts of work and energy in physics in a more interactive and effective way. IDMP consists of several components such as theory, problems, and integrated videos. This research aims to produce a digital module based on Problem Based Learning on the topic of work and energy that is valid as a physics learning media equipped with digital technology, enabling students to obtain information through various media such as videos, simulations, and animations. This development research uses the ADDIE model (Analyze, Design, Develop, Implement, Evaluate). The final product of this research is a digital module in the form of an Android application that can be easily accessed through a smartphone. The product will be validated by media experts, subject matter experts, and learning experts, as well as tested by physics teachers and students.

Keywords: digital modules, Problem Based Learning, work and energy.

PENDAHULUAN

Physics is one branch of science that studies matter and all the interactions and forces that govern it. It also plays an important role in the development of science and technology [1]. Students sometimes dislike physics lessons due to the abundance of formulas, incomplete materials, lack of varied example problems, or the challenges of distance learning, leading to a lack of motivation to study and complete assignments. To realize student-centered learning, educators are required to create effective and enjoyable learning activities for students. [2].

As time goes by and with the advancement of technology, teaching materials have also undergone changes, including module materials. Now, modules have transformed into digital modules, which have the advantage of presenting multiple materials using interactive learning media [3]. In the development of these digital modules, they can be integrated with Problem-Based Learning (PBL) approaches. Problem-Based Learning is a learning model aimed at providing real-world problems to students in order to identify learning materials [4]. Students will then discover problems and solutions to resolve them, thereby enhancing their problem-solving skills [5].

Based on a needs analysis conducted through a Google Form in a 10th-grade class at a public high school in Jakarta, with a total of 65 respondents, the following results were obtained:

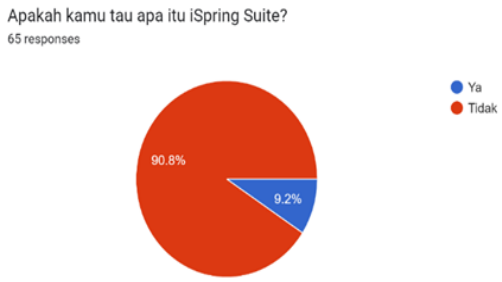

FIGURE 1. Students' knowledge of iSpring Suite

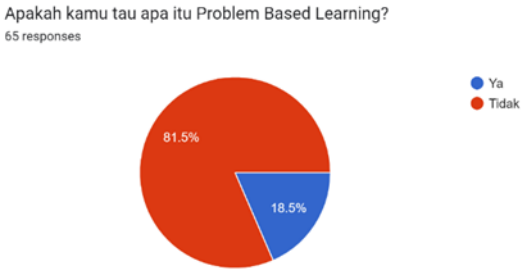

FIGURE 2. Students' knowledge of Problem Based Learning

Based on FIGURE 1, 90% of the respondents answered that they are not familiar with iSpring Suite application, and only less than 10% are aware of this application. Meanwhile, based on FIGURE 2, 81.5% of the respondents answered that they are not familiar with Problem-Based Learning, and only 18.5% are already familiar with Problem-Based Learning.

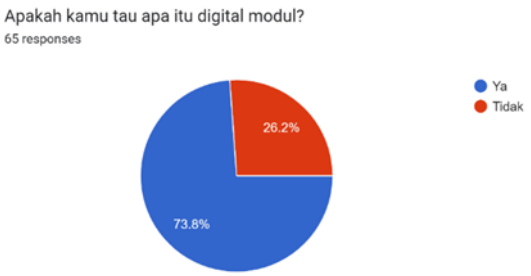

FIGURE 3. Students' knowledge of Digital Modules

FIGURE 4. The need for instructional modules as learning materials

Based on the above respondents' results, many students are only familiar with what a module is, and only a few are unaware of what a digital module is. Furthermore, there are still many students who have never learned to use a module, with up to 80% of the respondents answering that they have never learned using a module.

FIGURE 5. The need for content/materials for digital modules

Furthermore, based on other needs analysis, 83.1% of the respondents answered that the topic of work and energy is still a difficult concept for them to understand in 10th-grade Physics.

Based on relevant previous research and the results of the needs analysis conducted through the Google Form above, there is a need for the development of interactive digital modules for the topic of Work and Energy. The development carried out in this study is an interactive digital module based on Problem-Based Learning (PBL). The advantages of the interactive digital module to be developed are that it provides comprehensive explanations of the topic related to everyday life, includes example problems and exercises, and incorporates video explanations of the material, all presented based on Problem-Based Learning. Therefore, research is needed to integrate current and practical learning with the PBL instructional model, aiming to stimulate students' knowledge by investigating the Application of Interactive Digital Module Physics (IDMP) based on Problem-Based Learning (PBL) for the concept of work and energy.

METODOLOGI

The research method used in this study is the Research and Development (R&D) method. The model used in this research is the ADDIE model, which consists of five stages: 1. Analyze, 2. Design, 3. Development, 4. Implementation, and 5. Evaluation [6]. The following are the steps of development using the ADDIE model according to Branch [7]:

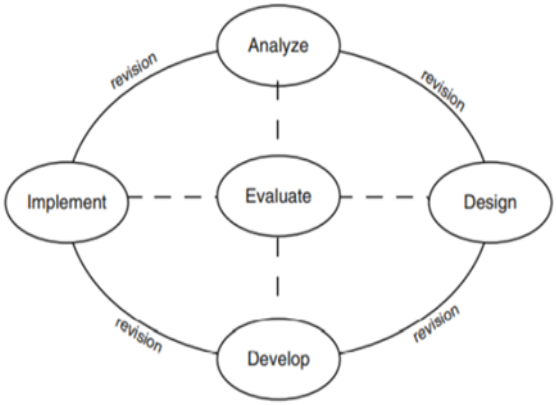

FIGURE 6. Model ADDIE

From the ADDIE development concept diagram above, it can be seen that evaluation can occur at each stage with the aim of identifying the need for revisions. The ADDIE model is systematically developed and based on theoretical foundations of instructional design. This model is structured in a programmed manner with systematic sequences of activities in an effort to solve learning problems related to appropriate learning resources that align with the needs and characteristics of learners [8].

Data Collection Techniques In this study, there are three types of validation questionnaires that will be used. First, a validation questionnaire for media experts is used to evaluate the validity of the interactive digital module for physics learning in terms of media and technical aspects. The second

questionnaire, the validation questionnaire for subject matter experts, is used to assess the suitability of the content in the developed digital module for physics learning. The third questionnaire is the validation questionnaire for learning experts.

HASIL DAN PEMBAHASAN

Based on the steps of the ADDIE research methodology, the results of the study in accordance with the conducted research and development procedures are as follows.

Analyze

The first stage is analysis, and the purpose of the analysis is to generate statements related to a problem, identify its causes, and ultimately find solutions to the existing problem. Analysis can be conducted through interviews or observations using questionnaires targeted at both teachers and students. Based on the needs analysis of the 65 respondents, 83% of the respondents answered that the topic of work and energy is difficult for them compared to other topics. Furthermore, 90% of the respondents answered that they are not familiar with the iSpring Suite application, and only less than 10% are aware of this application. Moreover, 81.5% of the respondents answered that they are not familiar with Problem-Based Learning, and only 18.5% are already familiar with it. Based on other results, many students are only familiar with what a module is, and only a few are unaware of what a digital module is. Additionally, there are still many students who have never learned to use a module, with up to 80% of the respondents answering that they have never learned using a module. Furthermore, based on other needs analysis, 83.1% of the respondents answered that the topic of work and energy is still a difficult concept for them to understand in 10th-grade Physics.

Design

After conducting the analysis, the next step is design. Design is the stage of planning, where the researcher begins to design a problem-based learning (PBL) digital module for the topic of work and energy. In this stage, the researcher gathers information about the product to be developed. Additionally, the researcher creates a storyboard for the development of the digital module. Digital modules are an innovative form of physics learning in the 21st century. This is because digital modules align with the technological advancements used in education. The development of technology-based learning will facilitate students in understanding various complex concepts. The limited time provided in the classroom makes the development of technology-based learning media a necessity. One aspect that can be developed is the interactive digital module for the topic of work and energy. The introduction of this module is an effort to support digital learning.

(a) (b)

FIGURE 7. Design of Digital Module Cover (a); Table of Contents of the Digital Module display (b)

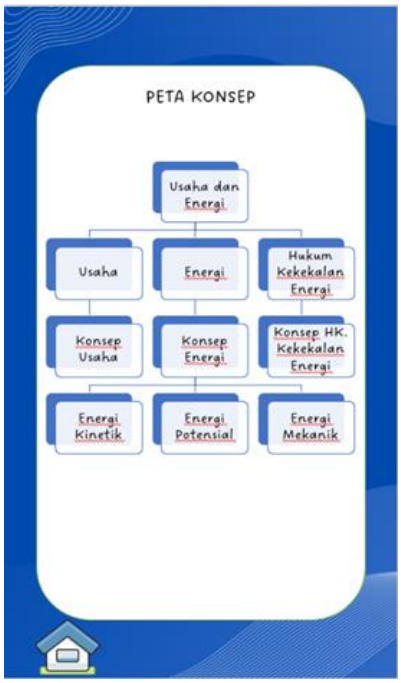

FIGURE 8. Display of the concept map in the digital module

Development

In this stage, the development of a PBL-based electronic module on the topic of work and energy is realized. In developing the module, the researcher utilizes the Power Point application integrated with the interactive application iSpring Suite 11, and the final form of this product takes the shape of an Android application. In this development stage, validation testing and product revision will also be conducted. This is done to obtain feedback on the validity of the developed media. The validation tests to be conducted include content validation by subject matter experts, media validation by media experts, and instructional validation by instructional experts.

Implementation

In the implementation stage, the learning media is tested in physics education. The developed learning media will be tested with teachers and students in one of the senior high schools (SMAN) located in Jakarta. Subsequently, the teachers and students will be given a questionnaire to provide feedback and criticism on the developed interactive digital module.

Evaluation

Evaluation is conducted at each stage (evaluation of needs analysis, evaluation at the design stage, evaluation at the development stage, and evaluation at the implementation stage). Therefore, based on the ADDIE development concept diagram, it can be said that evaluation can occur at every stage with the purpose of identifying the need for revisions.

SIMPULAN

The interactive digital module in physics based on PBL is developed using the research and development method (Research and Development) with the ADDIE model. In its presentation, this digital module can visualize the concepts in the topic of work and energy using various media such as images, videos, animations, and other supporting multimedia. The research process is still ongoing for validation by experts during the development stage. With this PBL-based digital module, high school students, especially those in grade X, can use it as a physics learning tool that assists them in understanding the concepts of physical quantities and measurements. It can be accessed anywhere and anytime.

UCAPAN TERIMAKASIH

Thank you, the author conveys to those who were willing to assist in the smooth creation of this journal. May kindness be rewarded in other ways.

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