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DEVELOPMENT OF INTERACTIVE DIGITAL MODULES BASED ON PROBLEM-BASED LEARNING ON GLOBAL WARMING MATERIALS FOR HIGH SCHOOL STUDENTS

Naufal Hibatullah[a)], Vina Serevina[b)], Hadi Nasbey[c)]

Program Studi Pendidikan Fisika, Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Negeri Jakarta, 13220, Indonesia

Email: [a)]naufalhibatullah1302619010@mhs.unj.ac.id, [b)]vinaserevina@unj.ac.id, [c)]hadinasbey@unj.ac.id

Abstrak

Modul Digital Interaktif berbasis Problem Based Learning (PBL) adalah sebuah inovasi pembelajaran yang dirancang untuk membantu siswa memahami konsep pemanasan global dalam pembelajaran fisika dengan cara yang lebih interaktif dan tentunya efektif. Modul ini berisi beberapa komponen seperti materi, soal dan contoh dalam kehidupan berupa foto maupun video yang saling terintegrasi. Penelitian ini bertujuan untuk menghasilkan modul digital interaktif berbasis *Problem Based Learnning* pada materi pemanasan global 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 interaktif yang dapat diakses dengan mudah melalui perangkat komputer, laptop, dan 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, Pemanasan global, interaktif.

Abstract

Interactive Digital Module based on Problem Based Learning (PBL) is a learning innovation designed to help students understand the concept of global warming in physics learning more interactively and effectively. This module contains several components such as materials, questions, and examples in life in the form of photos and videos that are integrated. This study aims to produce an interactive digital module based on Problem-Based Learning on global warming material that is valid for use as a physics learning medium equipped with digital technology that allows students to obtain information through various media such as video, simulation, and animation. This development research uses ADDIE (Analyze, Design, Develop, Implement, Evaluate) model. The final product of this research is an interactive digital module that can be accessed easily through computers, laptops, and smartphones. The products will be validated by media experts, material experts, and learning experts, and conducted tests to physics teachers and learners.

Keywords: Digital modules, Problem Based Learning, Global Warming, interactive.

PENDAHULUAN

The topic of global warming triggered by greenhouse gases began to receive attention since the 1970s as part of environmental issues. The topic of global warming arises amid the incessant population growth, the threat of several species of flora and fauna, the oil and energy crisis, and the issue of waste. However, this topic was submerged for more than 20 years, then reappeared at the end of the 20th century along with the energy crisis due to dwindling petroleum reserves [1].The issue of global warming has become a hot topic in recent years, and it is essential that high school students have a thorough understanding of the phenomenon. Interactive digital modules based on problem-based learning (PBL) have emerged as an effective tool for teaching this complex subject in a way that is engaging and memorable.

The purpose of learning Physics is basically to lead students to understand the concepts of physics and their interrelationships in solving problems that exist in life. Physics is often said to be complicated because of its abstract concept, this causes students to experience difficulties when studying Physics and solving physics problem. To help students understand abstract physics concepts, media is needed in physics learning. The use of learning media has a positive influence on student learning outcomes because it creates interactive learning.

Digital modules are a type of educational software that allows students to interact with content in a dynamic and engaging way. PBL is an instructional approach that emphasizes the use of real-world problems as a means of promoting critical thinking and problem-solving skills. By combining these two approaches, educators can create a powerful learning experience that is both effective and enjoyable.

One of the key advantages of digital modules is their interactivity. Rather than simply reading about global warming, students can engage with the material in a way that is both visual and tactile. For example, a digital module might include interactive simulations that allow students to experiment with different scenarios and see the impact of various factors on global temperatures.

Another advantage of digital modules is their flexibility. Because they are delivered online, students can access them from anywhere with an internet connection. This means that students can work at their own pace, review material as needed, and collaborate with peers in real-time. PBL, on the other hand, is an instructional approach that emphasizes the use of real-world problems as a means of promoting critical thinking and problem-solving skills. By using real-world problems, students are forced to think critically and creatively to find solutions. This approach has been shown to be highly effective in promoting deep learning and long-term retention of information.

By combining PBL with digital modules, educators can create a powerful learning experience that is both engaging and effective. For example, a digital module on global warming might present students with a real-world problem, such as the impact of rising sea levels on coastal communities. Students would then be tasked with researching the problem, analyzing data, and proposing solutions.

One of the characteristics of the 21st century learning model is blended learning, a combination of face-to-face methods in the classroom with the use of digital media and online media. In 21st century learning, technology is a must [2].Information technology and communication systems have been commonly used in the field of education and learning. The influence of technology and information on the quality of education is very significant, because students will be easier to access learning materials, faster, more, and varied from various learning sources [3]. Based on the description that has been submitted, it is necessary to develop digital module based problem based learning on global warming material for high school students.

METODOLOGI

This research uses research and development methods (R&D), methods referring to the ADDIE development model.

There are 5 stages in the ADDIE development model, this is shown in the following figure.

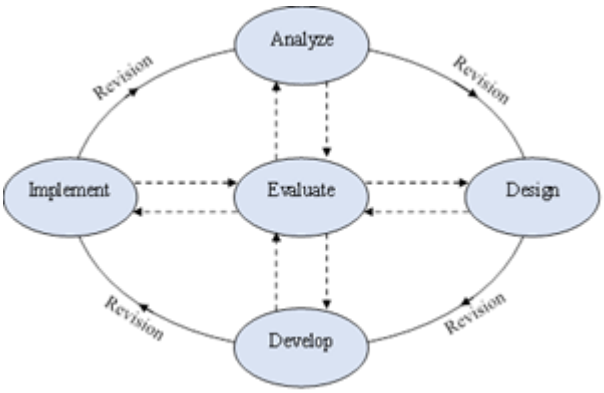

FIGURE 1. ADDIE Development Model

Analyze

This stage aims to identify possible causes of discrepancies. The analysis phase contains the identification of existing problems in life to determine research objectives, confirm the intended users or audience, and identify the resources needed.

Design

The aim of this stage is to design suitable test steps and methods. The design stages are as follows: perform a task inventory, set performance goals, and create a test strategy.

Develop

This stage contains activities to realize the design plan that has been made, namely to produce the product you want to develop, and to test the validity of the product being developed.

Implement

This stage contains conducting limited product trials to implement products that have been developed in classroom learning.

Evaluate

This stage aims to evaluate each step. At this stage an evaluation of the product being developed is carried out, both before and after implementation.

Research Instrumen

The instruments compiled and developed consisted of media expert validation instruments, product readability tests by teachers and limited trials by students.

1. Media Expert Validation Instrument
   In this instrument the aspects discussed include media aspects and product design aspects.
2. Teacher Readability Test Instrument
   In this instrument the aspects discussed include media aspects, interaction aspects, and product design aspects.
3. Limited Trial Instrument of Students
   In this instrument the aspects discussed include media aspects, interaction aspects, and product design aspects.

HASIL DAN PEMBAHASAN

The results produced in this study in the form of problem-based digital module based learning on global warming material. Presented using the book creator where students can access the material, write down the results of the discussion and fill in the answers directly on the module. This Module is also equipped with pictures and videos to make it easier for students to better understand the material presented. This module is used as a learning resource that can be accessed by students anytime and anywhere.The following are the outcomes from each stage of the ADDIE model:

Analysis phase

In this phase, field studies are carried out to identify problems faced by students, and literature reviews are carried out to explore potential solutions to overcome these problems. Based on the findings of field studies, it was revealed that the most common challenges faced by students include watching learning in class using books alone, ignorance of related concepts and the dangers and impacts of global warming the following presents the results of a survey conducted on 56 respondents.

Based on the survey findings, it can be concluded that students need media that can help in long-term memory retention and provide visualization for the topic of global warming . Of the 56 respondents, 96.4% said that in their schools there are no digital modules to support learning and 92.9% said that they need digital modules in their schools. This shows that the use of digital modules as a learning medium has the potential to increase student motivation and learning outcomes.

Design phase

In this phase the design of interactive digital modules for global warming materials. The design to be developed is as follows:

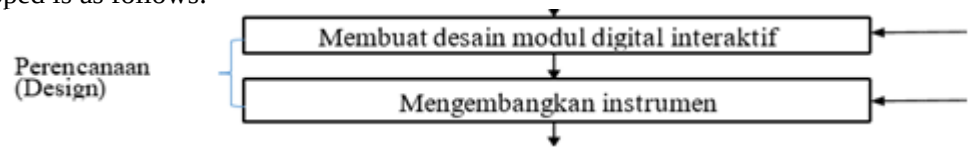

FIGURE 1. Module manufacturing planning

Tools used to develop products include laptops, canva design apps, website book creator, quizzes, and wordwall.

Development phase

The initial design of the interactive digital module that will be developed is as follows:

(a) (b)

FIGURE 2. (a) Front Cover, (b) Back Cover

(a) (b)

FIGURE 3. View form (a) Competence , (b) Concept Map

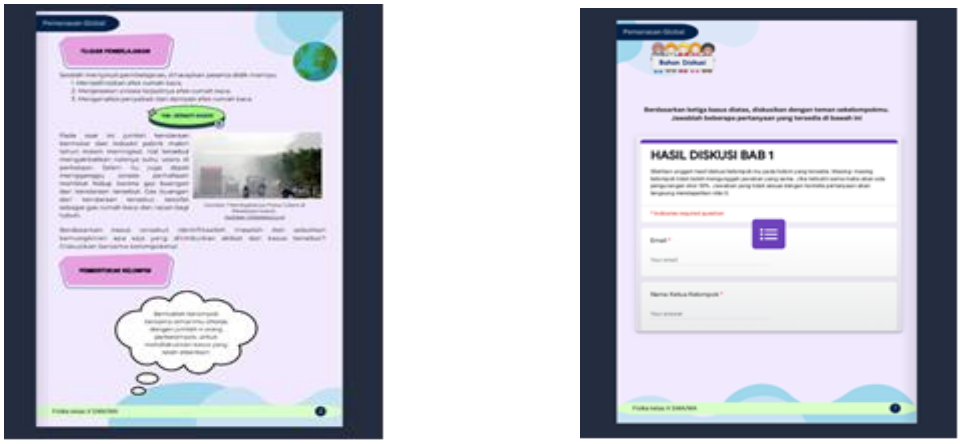

FIGURE 4. Module content overview

FIGURE 5. Module content overview and evaluasi test

In facilitating the use of these modules, a set of learnings is created that will guide students. Modules contain subject competence, basic theory, and evaluations that will find out the extent to which students understand the material.

Implementation phase

During the implementation phase, the developed digital modules will be tested for feasibility by media experts. This test aims to assess the feasibility of the module as a learning medium for students. Media experts will evaluate the game using a Likert scale questionnaire, rating it on a scale of 1 to 5. Their feedback will be used to make necessary improvements. After due diligence, modules will be piloted with teachers to assess their readability, and limited trials will be conducted with students to gather their feedback.

Evaluation phase

Evaluation occurs at every stage of the process, where feedback and suggestions are carefully reviewed and used to refine and improve the product. The main objective of this evaluation is to assess the extent to which the digital module has successfully achieved its development goals as an appropriate learning tool for students studying global warming.

SIMPULAN

In conclusion, the development of interactive digital modules based on problem-based learning on global warming materials for high school students is a highly effective way to teach this complex subject. By combining the interactivity of digital modules with the critical thinking skills promoted by PBL, educators can create a powerful learning experience that is both engaging and effective. As the issue of global warming becomes increasingly urgent, it is essential that we equip our students with the knowledge and skills they need to address this critical issue.

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REFERENSI

[1] S. Guntoro, “Saatnya Menerapkan Pertanian Tekno-Ekologis,” Jakarta: Agromedia Pustaka, 2011.

[2] M. Sari, “Blended learning, model pembelajaran abad ke-21 di perguruan tinggi,” *Ta'dib*, vol. 17, no. 2, pp. 126-136, 2016.

[3] N. Jalinus, “Media & Sumber Pembelajaran,” Jakarta: Kencana, 2016.