

Unity-Engine-Based E-Module to Increase Learning Results from Online Learning

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ABSTRACT

The development of technology is currently moving very fast. These developments affect student learning in schools. However, the teachers have not used it properly, so learning is not in accordance with the needs of students. This is also due to the limited teaching materials used. This research aims to develop the teaching materials of the unity-based *E-module* and its utilization. The stages started from analysis, design, development, and implementation. The instruments were used to determine the feasibility of validation sheets and questionnaires. The results of the study indicate that teaching materials are feasible to use. The assessment of media experts indicates this gets a percentage score of 88%, the assessments of material experts get a percentage score of 75%, the assessments from linguists get a percentage score of 86%, and the assessments by teachers get a percentage score of 95%. Based on the explanation of the research results above, it can be concluded that the teaching materials of Unity engine-based energy E-Module and its utilization can be used in the learning process.

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1. INTRODUCTION

The development of technology and communication in the 4.0 era had an impact on the learning process, which initially focused on face-to-face learning, to online and distance learning (Lau et al., 2014). With this paradigm shift and teaching practice, every teacher is required to be able to adapt (Chiu et al., 2016) and be innovative in delivering learning, including developing teaching materials that can meet student needs and improve student learning outcomes (Göksu & Atici, 2013). In schools in Indonesia, especially in the regions, the use of teaching materials is still a lot in printed form. For this reason, it is necessary to have electronic learning modules to meet students' needs (Almekhlafi, 2021) because *E-modules* are one of the alternative teaching materials that are relatively new for students (Bierman et al., 2010).

Electronic modules (*E-modules*) were developed to respond to technological developments and help students understand teaching materials. Several studies have shown that *E-modules* have additional learning components that are different from printed modules, such as interactive and illustrated content (Kesim & Yildirim, 2017; Roskos et al., 2017) are easily accessible to students, and increase reading motivation (Davidson & Carliner, 2014; Evans et al., 2017; Lim & Hew, 2014; Lin et al., 2018). However,

some *E-modules* are only in the form of online *portable document format* and are not interactive (A. Embong et al., 2012; A. M. Embong et al., 2012; Gu et al., 2014) which can inhibit students' creativity and reduce students' motivation to learn. Therefore, it is important to develop interactive *E-modules* to be more *user-friendly* and increase students' creativity and motivation (Liu1 et al., 2018; Wang, 2018).

E-books are learning resources that are easy to use in the classroom, do not take up much space, are light to carry, and are cheaper than textbooks (Elias et al., 2012). The use of e-books also does not show a negative impact on the attitudes and behaviour of Suffolk University Boston students. This means that there is no significant effect on student attitudes and behaviour between the use of E-modules and textbooks (Weisberg, 2011). So, several e-book developments continue to be carried out by researchers, both at the university level and high school. Choi et al. developed an e-book in middle school by utilizing interactive features in a computer, which was considered more effective in accommodating the various needs of high school students in Korea (Choi et al., 2011). However, research on e-books conducted in primary schools is still scant. Therefore, this study seeks to develop interactive *E-modules* that suit the needs of elementary school students. The *E-modules* in this study are developed based on the Unity Engine to make them easy for elementary school students to use.

2. METHODS

This research is development research that aims to produce a product. The product being developed is the unity-engine base energy *E-Module* and its utilization in elementary schools. The research stages start from analysis, design, development, and implementation (Ngussa, 2014). Figure 1 below illustrates the stages used.

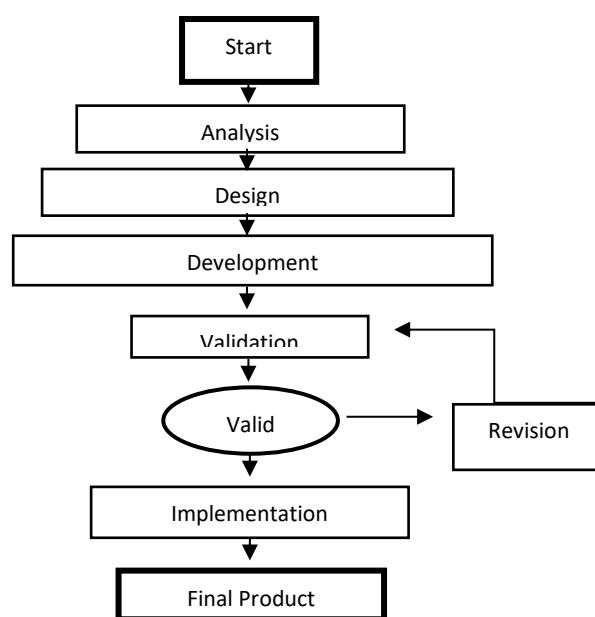


Figure 1. Stages of Research

In Figure 1, it can be explained that the development stages start from;

2.1 Preliminary Analysis

The initial analysis was carried out to analyze the problems that exist in schools by observing and identifying student activities in elementary schools in conducting online learning, during the *Covid-19* pandemic. This activity was carried out by means of observation and interviews at several public elementary schools in Indonesia. Observations were conducted during the online learning of fourth

graders for one week at five elementary schools, by using observation sheets in turn. Observations were made to see the activity, motivation, facilities, media, and teaching materials used by the teacher during the learning process. The results of the observations will be strengthened by data interviews. Structured interviews were conducted for one week, with a duration of approximately one hour at the end of each lesson, with eight fourth-grade teachers from each of these schools. It aims to determine the learning process carried out, the obstacles faced, the effectiveness of the media and teaching materials used, as well as student responses to the learning carried out.

2.2 Design

At the design stage, the researcher designs teaching materials that will be developed according to the energy material and its utilization. The first step is to make materials that support energy and its use. The researcher collects reference materials looking for references in the Natural Sciences (IPA) textbook for the energy section and its utilization (A. Chico, 2013; Kong, 2013; Pimentel, 2019). The reference used by the researcher is not only from the 2013 curriculum learning books but also combines material from several sources because it deepens the energy material and its utilization. References to energy images and their use in the making of material content come from internet sources with good quality. The image that is used as an example can be seen in Figure 2.

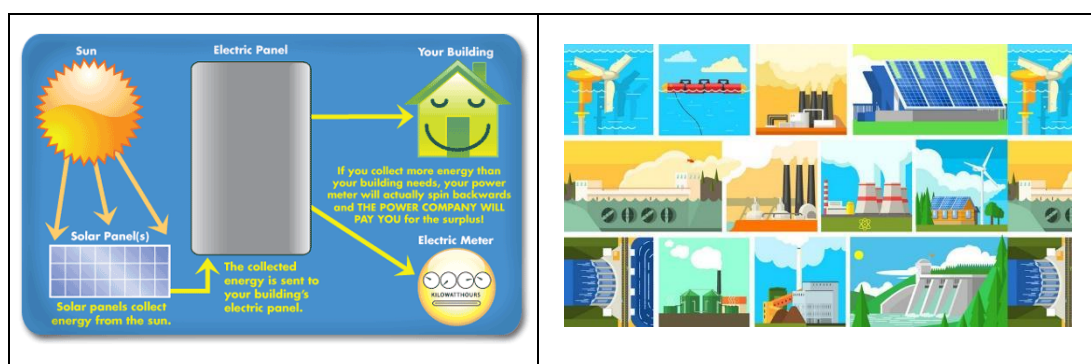


Figure 2. Example of Energy

The second stage is the design of the framework and questions. The framework and questions are packaged in a language that is friendly to elementary school students. Planning the teaching materials consists of an introduction, instructions for using *E-modules*, evaluation questions, material summaries, answer keys, and a glossary. In the *E-modules* there are also interesting pictures and music. The making of teaching materials by the researcher is designed to be easier and more fun. In addition, the researcher compiled research instruments in the form of product validation sheets for content, language, and media experts.

2.3 Development

The development of *E-module products* begins with the creation of teaching materials and evaluation questions through the Microsoft Word program. Meanwhile, the background, icons, and other displays are designed using Adobe Photoshop. The materials that have been prepared are then inputted into the Unity Engine application so that the existing *E-modules* are more interesting and interactive.

For the interactivity of teaching materials, users can provide input or action on teaching materials by selecting (clicking) the available navigation buttons. Then, the teaching materials will give a reaction or response by displaying user requests. For example, if the user selects the *material menu*, a selection of materials that the user can understand will appear. Product revision is carried out to find out the shortcomings of the *E-Modules* teaching materials to validators of media experts, material experts, and linguists. Material experts, media experts, and linguists are given a questionnaire in the form of an assessment of the teaching materials that have been designed. Expert validators can also provide comments and suggestions for the improvement of *E-Modules* teaching materials.

2.4 Implementation

At this stage, the researcher conducted a trial of teaching materials limited to 36 class IV students with their own *android* smartphones. Implementation was carried out in public elementary schools in Indonesia. The implementation activity began with an explanation and operation of teaching materials to students and teachers. The researcher also provided opportunities for several students to operate the *E-modules* teaching materials themselves. The goal was that students could also operate correctly, making it easier to learn the existing material. The researcher also provided evaluation questions in the form of multiple choices, that could be done directly on the *E-modules* which aimed to measure the extent of student understanding. It was followed by giving questionnaires to teachers and students after completing product trials.

3. FINDINGS AND DISCUSSION

The purpose of this research is to develop the energy of E-modules and their use that can help students learn independently when learning online. These E-modules were developed using the Unity Engine application. The use of Unity Engine was chosen because this software is very easy to use, the interface is simple and easy to understand (Xia et al., 2019), and provides a high level of graphics (Polancec & Mekterovic, 2017).

The use of technology in the online learning process will help students learn independently. The presentation of the E-modules material that is packaged on an Android basis, provides a difference from the printed modules so far, thus increasing students' motivation in reading it. This is because this application can make it easier for students to use it and is also interactive (Koca et al., 2019; Kucera et al., 2018) because this application is an application that is used to create Android-based games (Tsai et al., 2021). Therefore, many features such as image processing, graphics, and sound input can be used to attract students to read them (Mangen et al., 2013).

The analysis stage is starting with the analysis of existing problems in elementary schools. The results of interviews and observations made by researchers show that the learning process that runs in elementary schools during the COVID-19 pandemic uses online learning. However, the online learning process has not been matched by the availability of supporting teaching materials. The teaching materials used are still in printed form which is shown through PPT, also the interactive student involvement is not visible. Since learning is only one-way, it has an impact on the weak ability and low motivation of students to participate in learning (Turel & Ozer Sanal, 2018).

In the product design stage, at this stage, the researcher compiles the *E-Modules* design in the form of teaching materials, questions, and answer keys using Microsoft Word. As for the media, it is created using Adobe Photoshop. Meanwhile, the process of developing the Energy *E-Modules* and its implementation based on the Unity Engine is presented in Figure 2.

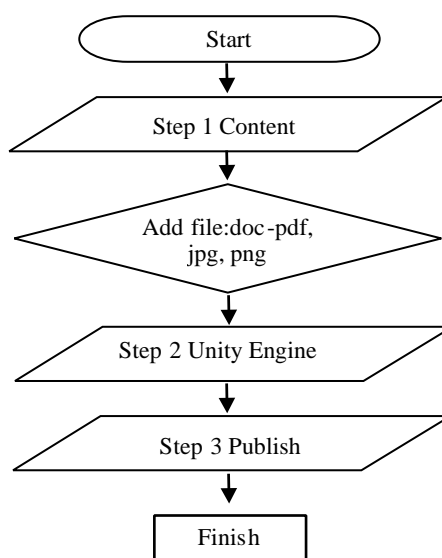


Figure 2. The Unity Engine-based *E-Modules* development flow chart

The development of energy *E-Modules* and their utilization is based on the Unity Engine according to the flowchart presented in Figure 2. This process begins with the collection of content which includes teaching materials, questions, answer keys, and media. Content creation uses Microsoft Word word processing software because it is accessible and easy to use. While the existing image and animation media are made using Adobe Photoshop to make it more interesting for students to read. The *E-Modules* content that has been created is then converted into program code written in JavaScript using the Unity Engine.

Next is the validation of the *E-Modules*. At this stage, validation tests are carried out by experts. The validated components include media, material, and language, by using a validation sheet. Ratings from media experts get a percentage score of 88%. The assessments from material experts get a percentage score of 75%. The assessments from linguists get a percentage score of 86%. The assessments from linguists get a percentage score of 86%. The assessment by teachers gets a percentage score of 95%. Thus, based on the validity value obtained, the Unity engine-based energy *E-Modules* and their utilization that was developed can be said to be feasible to use (Turel & Ozer Sanal, 2018).

The development of the *E-Modules* from the printed modules is one form of learning resource innovation that has several benefits. These *E-Modules* can introduce digital learning resources directly and easily for children, the distribution is also not complicated, the duplication process is simple and manageable, it can provide multisensory experiences build logical connections between knowledge, and is compatible with use in various platforms (Ackerman & Goldsmith, 2011; Jou et al., 2016).

The implementation of the Unity Engine-based energy *E-Modules* and its utilization was carried out at SD Negeri Tugurejo 01 Wates. It was obtained from the scores of students working on evaluation questions, involving 16 students. The questions tested were multiple-choice types with 10 questions. The results obtained by students working on the effectiveness test questions have an average of 82. The average gains obtained have shown the completeness of student learning outcomes because the minimum completeness criteria for students is 75.

4. CONCLUSION

The development of the *E-Modules* is carried out in several stages, including analysis, design, and development of the program and its implementation. The software used in developing is Unity Engine. The results of the development can be concluded that the development of the Unity-Engine Energy *E-Modules* and its utilization is feasible to be used as a source of student learning, especially when learning online.

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