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Development of Web-Based Geography E-Modules on Indonesian Population Dynamics

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Abstract
This study aims to determine the improvement in students' learning outcomes using e-modules and to examine whether there is a difference in the improvement between students who use e-modules and those who use printed modules. The research employed a quasi-experimental method with a control group design. Pre-tests and post-tests were conducted to measure the improvement in students' learning outcomes, represented by the N-Gain score. The results show that both learning media effectively enhanced students' learning outcomes, with the average N-Gain scores for both groups falling within the high category. There is a significant difference in the improvement of learning outcomes between the group using e-modules and the group using printed modules.

Keywords
Development; modul; geography

I. Introduction

Education is a means and process developed by humans to improve personal abilities. Nowadays, education is considered highly important in line with the development of the working world. According to Yana et al. (2020), with various learning opportunities, the growth and development of students are directed and encouraged towards achieving the desired goals. Education is expected to create a new generation of individuals who are more developed and have specialized skills. The development of formal education today is carried out in schools to study general knowledge. According to Law No. 20 of 2003 on the National Education System, Article 1 states that education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have spiritual religious strength, self-control, personality, intelligence, noble character, and the skills needed by themselves and society, as well as to develop all potential through the learning process.

In the 21st century, education has become increasingly important to ensure that students have learning and innovation skills, the ability to use technology and information media, as well as skills to work and survive using life skills. The Ministry of Education and Culture (Kemdikbud) formulated that the 21st-century learning paradigm emphasizes the ability of students to seek information from various sources, formulate problems, think analytically, and work and collaborate to solve problems (Research and Development, Kemdikbud, 2013). The learning process has followed current technological developments, one of which is internet-based learning. The application of internet-based learning (e-learning) is a new medium that can address students' passive attitudes. According to Sari (2018), one effort to address this is to increase student involvement in learning through the use of educational media, preparing students to face the challenges of the industrial revolution 4.0, aiming to prepare young generations for the technology-based working world.

The development of education worldwide is inseparable from the progression of industrial revolutions globally, as economic changes have indirectly influenced educational systems in various countries. The industrial revolution began with: 1) the 1.0 Industrial Revolution in the 18th century through the invention of the steam engine, enabling mass production of goods; 2) the 2.0 Industrial Revolution in the 19th-20th

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century through the use of electricity, making production costs cheaper; 3) the 3.0 Industrial Revolution around the 1970s through the use of computerization; and 4) the 4.0 Industrial Revolution around 2010, through artificial intelligence and the Internet of Things as the backbone of human and machine movement and connectivity (Trisyanti, 2018).

The term "Industry 4.0" originated from a project initiated by the German government to promote the computerization of manufacturing (Zafitri et al., 2018). This era will also bring about innovations in various human activities, including science and technology as well as general education in schools. Additionally, skills in searching for, managing, and delivering information, as well as proficiency in using information and technology in the field of science, are especially needed at the school level. However, in Indonesia, many students still use manual modules in their learning process, such as in schools located in rural areas.

Geography is a core subject in high school, especially for those in the Social Sciences (IPS) stream. Geography as a core subject in the Social Sciences is still perceived to have many issues and difficulties in the educational process. A common issue, and one deeply ingrained in society's mindset, is that geography is largely about memorization. This problem, as described above, leads to a decline in students' motivation to learn. Learning motivation is an essential aspect of smooth learning activities, and each student's motivation to learn geography varies. This difference is rooted in each student's perspective on the meaning of geography learning (Amelia, 2018). A decrease in students' motivation impacts the achievement of learning objectives. Efforts are needed to increase students' motivation to ensure learning objectives can be achieved.

Based on the national exam (UN) report from the Center for Educational Assessment of the Ministry of Education and Culture (Puspendik Kemendikbud), the average geography score in the Aceh Province in 2016 was 53.10, and in 2019, it was 48.54. This data shows a decline in geography scores over the past three years, indicating a decrease in motivation to learn geography. This is supported by data from the Social Sciences department at SMA Negeri 1 Kalasan, showing the number of students choosing geography as a specialized subject for the national exam: 2 students in 2016, 10 students in 2017, and 3 students in 2018. This is the lowest number compared to other specialized subjects, such as sociology and economics. This is due to the weak learning process in geography at schools, and the learning objectives have not been achieved. Teachers should have a deep understanding of teaching (Imansari & Sunaryantiningsih, 2017).

Besides a decline in student motivation, unachieved learning objectives can be due to teachers who are less prepared to teach professionally. Teachers and students, as educational participants, should use advanced internet-based technology in the classroom to increase students' motivation and learning outcomes. One example of technology use in the learning process is the use of internet-based learning media.

Using internet-based learning media in the teaching and learning process can spark students' interest in the subject, stimulate motivation and engagement, and lead to improved learning outcomes. Media used by teacher's complements or aids teaching, helping students better understand the material presented, thereby achieving good learning outcomes. In this case, media plays a crucial role in learning (Cholifah & Wibawa, 2016). In the learning process, teaching media acts as a channel that conveys messages from the message source, in this case, the teacher, to the message recipient, the students (Umar, 2014). The advancement of information technology in science has influenced various types of learning media, including internet-based media such as the web.

In essence, recent developments in internet-based web technologies make it easier for everyone to communicate, participate, share, and create online networks, enabling them to spread their own content (Tyas, 2015). Internet-based learning media has the most potential for development in school learning. The internet technology that receives the most attention is the web, where e-modules focus on images and videos. Through image and video media, students are expected to be more interested in learning geography. Instagram, which is popular among teenagers and accessible via smartphones, can be used anywhere.

However, based on preliminary observations by the researcher of students at SMA Negeri 1 Kalasan, teachers still rarely use learning media in geography classes. Classroom learning is delivered in the form of PowerPoint slides, lectures, notes in books, and group discussions where teachers provide problems in worksheets to understand the material. Observations also show that many students often feel bored and end up using their phones during discussions.

Conventional learning, as described above, prevents students from achieving their full learning potential. A pleasant and engaging learning environment is needed to capture students' interest. The use of internet-based learning media is still rare in geography, especially at SMA Negeri 1 Kalasan. Students access the internet to supplement the material on their own. Data from the Central Bureau of Statistics (BPS), quoted from the official website www.bps.go.id, shows that the percentage of Indonesians using mobile phones has increased, reaching 59.59 percent in 2017. This data shows that more people access the internet via mobile phones than other devices such as laptops and computers. Mobile phones are quite practical to carry and have the potential to be used as a learning resource.

Based on the above, the researcher is interested in studying the development of web-based geography e-modules on the topic of Indonesia's population dynamics to improve student learning outcomes. The use of this teaching material is very suitable considering the increasing number of internet users on smartphones, and it could benefit others besides high school students. This electronic module can display photos and videos that can be used to share geography content in visual and video formats.

II. Research Methods

The development in this research is a process that refers to the product produced in the research project, which takes the form of a web-based e-module learning device based on the 4D learning model. This model is a modification of the 4D model recommended by Thiagarajan, which consists of Define, Design, and Develop stages. This study uses the research and development (R&D) method, employing the four-D model for its research design. This research involves lecturers as evaluators and advisors to improve and refine the developed product. The stages of the 4D development model proposed by Thiagarajan (in Sutarti and Irawan, 2017) begin with the Define stage, followed by the Design stage, the Develop stage, and finally the Disseminate stage. In this study, only three stages are implemented: the Define, Design, and Develop stages, while the Disseminate stage is not carried out due to time constraints.

The procedure for developing the teaching materials in this web-based e-module follows the 4D model, which consists of four steps: (1) Define, (2) Design, (3) Develop, and (4) Disseminate. The population refers to the entire subject of the research. In this study, the population consists of all students in class XI IPS 1 for the experimental group and XI IPS 2 for the control group at SMA Negeri 1 Kalasan for the academic year 2022/2023, totaling 50 students, comprised of 25 students in XI IPS 1 and 25 students in

XI IPS 2. A sample is a portion of the population's number and characteristics (Sugiyono, 2016).

The sample for this research includes students from class XI IPS 1 and XI IPS 2, selected using saturated sampling technique, meaning that the entire population is used as the sample. The sampling consideration is based on the results of scores and discussions with the teacher. The sample for this research consists of 30 students from XI IPS 1 and XI IPS 2 at SMA Negeri 1 Kalasan, which will undergo trials conducted twice. The initial trial was conducted on March 12 at SMA Negeri 1 Kalasan.

The researcher used two classes as samples, namely the control class (X2) and the experimental class (X1). In the experimental class, students received instructional treatment using the e-module learning materials, while the control class did not receive this treatment and instead used standard textbooks. The quasi-experimental research design involves the researcher not conducting randomization in assigning subjects to the research groups (Yusuf, 2016). The researcher uses two classes as samples, employing a post-test only control design, where the post-test is administered after the learning process to determine the effect of the treatment provided.

In the initial trial, the teacher administered a pretest after the students completed their assignments. The teacher then provided the link to the e-module and gave instructions on how to use the web-based e-module. After the students finished reading and answering the questions contained in the e-module, the teacher administered a posttest, followed by the distribution of questionnaires, and concluded the learning activities. The data collection tools used was tests and questionnaires.

The data collection technique involved multiple-choice tests containing 10 questions. Additionally, observations were conducted using sheets provided to observers to monitor the teaching process. Documentation included photographs of activities during the research, as well as interviews with the social studies teacher at the school regarding the learning activities, methods, models, and teaching materials commonly used during lessons. The data analysis technique involved measuring learning outcomes, particularly in the cognitive domain or knowledge

III. Results and Discussion

3.1 Specifications of the Developed Product

a. Cover e-modul

Figure 1. *of the cover*

On the initial display of the web-based e-module, there is a cover/title and identity of the e-module. To access this web-based e-module, students can open the link that will be shared by the teacher in the group. The cover display features the title "Dynamics of

Indonesia's Population," along with the logo of Yogyakarta State University and the name of the developer.

3.2 Material

Figure 2. *of the Material*

The material contains several options. Students can click the button corresponding to the topic they will study. Within the material, there is a Student Worksheet (LKPD). The LKPD presents several problems that will be solved by the students in groups. Then, there are several questions to be answered. The results of the problem-solving in the LKPD are presented in a work, which the students then showcase.

3.3 Product Feasibility Test

Based on the validation results conducted by subject matter expert validators, the overall percentage of the assessment indicators is 87.3%, categorized as "very valid," but with the note that revisions should be made according to the feedback and suggestions from the expert validators. The assessment by the subject matter expert consists of three evaluation aspects. The first aspect is the suitability of the content, with a percentage of 87%, followed by presentation at 90%, and language at 85%. The second and third aspects of the assessment pertain to the accuracy of the concepts, where the validator provided suggestions for improving issues related to everyday life, thus enabling active student involvement.

Based on the suggestions and input from the subject matter experts regarding this aspect, enhancements such as the selection and addition of illustrative images, writing, and reviewing material and evaluation questions were recommended. According to Andriyani et al. (2020:123), student engagement in learning activities is fundamentally about constructing their own knowledge. They actively build an understanding of the problems or everything they encounter during the learning process. Based on the validation results conducted by the expert validators for learning media, the overall percentage of the assessment indicators is 88%, categorized as "very valid," but with the note that revisions should be made according to the feedback and suggestions from the expert validators. The assessment by the media expert consists of two indicators: the display (design) at 89% and software engineering at 87%. However, revisions are needed in accordance with the suggestions and input from the expert validators. The evaluation of this aspect is related to the design and background color of the cover.

3.4 Product Effectiveness Test

The preliminary research was conducted in the form of a pretest and posttest using the One-Group Pretest-Posttest Design to determine the significant difference in learning outcomes between students before and after using the web-based e-module as a teaching material. The lesson began with a greeting and attendance check, followed by the distribution of the pretest questions, which had a completion time of 15 minutes, with answers submitted individually. The results showed that, on average, students were only able to answer question. The next activity involved dividing students into groups to answer the Student Worksheet (LKPD). Students were given 90 minutes to read and complete the questions in the E-LKPD. The results indicated that, on average, students experienced difficulty with the essay question number 6 in the E-LKPD.

In this stage, measurements of students' learning outcomes were conducted before and after the instruction, specifically through Pre-Test and Post-Test assessments. The data analysis used descriptive analysis techniques. The results of the analysis are presented in Table 1, which shows the measurement of students' learning outcomes aimed at testing the effectiveness of the web-based e-module that was used during the instruction. The average pretest score for the control class was 30.68, while the average post-test score for the control class was 67.32. For the experimental class, the pretest score was 37.52, while the average post-test score was 86.24, indicating an improvement. Therefore, it can be concluded that there is a significant difference in learning outcomes before and after instruction in both the experimental and control classes. According to the results, the highest scores were achieved in the experimental class. This means that teaching using the web-based e-module is more effective than using standard textbooks.

IV. Conclusion

Based on the research results, the conclusion is that the effectiveness of the e-module is evident, as its effectiveness can be assessed based on learning outcomes. The average score of students before using the e-module was 37.52, while the average score after using the e-module was 86.24. According to the N-Gain analysis, students' learning outcomes showed a value of 0.62, categorized as high, indicating that learning through the e-module significantly improves students' learning outcomes. The significant difference between the pretest and posttest scores confirms its effectiveness. The results of the paired sample t-test revealed that the null hypothesis (H0) was rejected and the alternative hypothesis (Ha) was accepted, allowing us to conclude that there is a significant difference in learning outcomes after students used the e-module.

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