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DEVELOPMENT E-MODUL GEOGRAPHIC INFORMATION SYSTEM BASED ON MOODLE

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ABSTRACT

The development of information technology has affected all fields, namely the field of education without exception. Information technology-based learning (e-learning) is learning where all information is centered on students. If the educator is not present, learning can still be done with e-learning learning which can be accessed using the internet. Current learning at ITB STIKOM Bali, especially in the Information Systems course, is still not effective due to limited learning resources that can increase student enthusiasm for learning. This lack of learning resources for students is a problem during a pandemic and currently facing the digital era due to unpreparedness in dealing with the digital world, this also occurs at the ITB STIKOM Bali campus which still uses learning resources that are less attractive and less interactive which causes students to be less interested to learn. This is supported by data from questionnaire results from 60 students who have completed GIS lectures with previous learning resources, around 72% of students stated that they agreed with the development of learning resources using multimedia e-modules. This course was chosen in the development of teaching materials because teaching Geographic Information Systems requires high-level thinking skills in the process of understanding theory and its applications, therefore higher-order thinking skills play an important role in developing understanding of the material and learning along with it. requires high concentration in digital map digitization. Based on these problems, it is necessary to develop learning resources in the form of Moodle-based multimedia-based e-modules that can be accessed by students online. The method of making an application using the method. The research method consists of literature study, MDLC (Multimedia Development Life Cycle) stages and evaluation. Testing the e-module by giving questionnaires to students taking Geographic Information Systems courses. The software used in making e-modules is Adobe Captivate and other supporting software in photo, audio, and video editing. Testing the effectiveness of the e-module by giving pre-test and post-test to 20 students randomly with an average N-Gain learning result of 0.78 in the high category so the e-module is very effectively used as a learning resource.

Keywords: E-Modul, Multimedia, Geographic Information System, MDLC (Multimedia Development Life Cycle

1. INTRODUCTION

The development of Information Technology from time to time is always changing. Almost all areas of life in society use information technology without exception in the field of education. The educational paradigm has changed due to the development of information technology from conventional learning processes or Teacher Centered Learning (TCL) to information technology-based learning where students become learning centers or known as Student Centered Learning (SCL).

This Student Centered Learning (SCL) based approach allows students to develop their creativity without limits, and students can utilize teaching materials, media or technology to acquire knowledge and students can determine their own learning style in seeking or acquiring knowledge. The implementation of Student Centered Learning (SCL) learning which involves student activity based on technology as a technological development that cannot be denied anymore, interesting online learning resource facilities are still needed because towards independent learning in the face of the digital era of the industrial revolution 4.0, adequate electronic learning resources are needed. The emergence of changes and shifts in learning paradigms has an impact on various aspects of learning, including in instructional design and media development which need to be integrated with technological developments Nita & Ali (2020).

This lack of learning resources for students is a problem during a pandemic and currently facing the digital era due to unpreparedness in dealing with the digital world, this also occurs at the ITB STIKOM Bali campus which still uses learning resources that are less attractive and less interactive which causes students to be less interested to learn. This is also supported by data from distributing questionnaires to 60 students who have taken Geographic Information Systems courses or have completed GIS courses with previous learning resources, namely Microsoft power point, the questionnaire results data are in Appendix 2. Questionnaires with the Guttman scale are distributed online using google form with the result being that the high category frequency is 43 meaning that out of 60 students only 43 people around 72% agree with the development of multimedia-based e-modules for Geographic Information Systems courses. The frequency of the low category was 17 students, around 28%, meaning that as many as 17 students did not agree that the previous learning resources were developed into multimedia-based e-modules. Based on the comparison of the results of data processing, it can be concluded that it is very necessary to have multimedia e-modules for the development of learning resources beforehand, seen from the number of students in the high category more than the data of students who do not agree with the development of multimedia-based e-modules for the Systems course. Geographic Information. Teaching Geographic Information Systems requires high-level thinking skills in the process of understanding the theory and its application, therefore higher-order thinking skills (Higher Order Thinking Skills) play an important role in developing understanding of the material and learning Thamrin & Widodo (2019). Development of understanding of the material can be done by selecting the appropriate learning model and method in the learning process. The selection aims to make student learning active, interactive, and creative in the learning process Mutmainnah et al. (2021). Choosing the right learning method is a manifestation of the creativity of a teacher so that students are not bored or bored in receiving courses, especially Geographic Information Systems because it requires high concentration in the process of digitizing digital maps and understanding the concepts.

Multimedia-based e-modules as teaching materials or learning resources that are more practical in their operations to support GIS learning. The goal is for students to understand and apply it more quickly. Books with too many descriptions and too long tutorials in operating GIS tools actually confuse students. Learning outcomes are influenced by various factors, including interest and motivation to learn, learning media, learning strategies, learning methods. One of the difficulties in understanding abstract material can be overcome with learning media Mutmainnah et al. (2021). Based on these problems, this research provides solutions in making teaching materials or learning resources for Geographic

Information Systems courses packaged in the form of interactive learning multimedia e-modules that can be accessed online by students via moodle on the e-learning website of the ITB STIKOM Bali campus. E-Module in delivering content through text, audio, video, animation and so on so that learning is expected to be fun and easy to understand. The software used in making e-modules is Adobe Captivate and other supporting software in photo, audio, and video editing. The research method consists of literature study, MDLC (Multimedia Development Life Cycle) stages and evaluation.

According to the research results of Nita Sunarya Herawati and Ali Muhtadi that the application of the use of e-modules in general can be carried out in a feasible category and gets positive responses from students and there are differences in learning outcomes between the results of the pretest before using the e-module and the post test after using the e-module. After testing with several experts that the e-module is suitable for use as a learning medium Nita & Ali (2018)

2. MATERIALS AND METHODS

2.1. E-MODULE CONCEPT

E-Module is a form of module that is packaged digitally and interactively because the material can be presented in the form of pdf files, audio, video, animation and so on which can make students learn actively and independently. E-module is an electronic version of the module where access and use is carried out through electronic devices such as computers, laptops, tablets or even smartphones. E-modules are a set of digital or non-printed teaching materials that are systematically arranged to be used for independent learning purposes so that it requires students to learn to solve problems in their own way. E-modules can make learning activities more interactive because in the presentation they can be inserted in the form of animations, images, videos, and audio Masruroh & Agustina (2021). E-Modules will also be useful in increasing the effectiveness of online teaching and learning activities because they can be accessed at any time. Electronic modules or e-modules are modules in digital form, consisting of text, images, or both which contain material inside accompanied by simulations that can and are appropriate for learning Herawati (2018).

The developed e-module must have the necessary characteristics in order to be able to produce modules that are able to increase the motivation of its users Fajarini (2018). The characteristics of the e-module being developed are self-instruction, self-contained, stand-alone, adaptive, and user-friendly.

2.2. GEOGRAPHIC INFORMATION SYSTEM

Geographic Information Systems is one of the courses in the curriculum in the Information Systems major at the ITB STIKOM Bali campus. Geographic Information System (GIS) or Geographic Information System (GIS) is a combination of the three main elements, namely system, information, and geography. Geographic Information System is a collection of components that interact with one another in order to collect data, process data, store and produce information to support decision-making, control, and provide an overview of the activities carried out within the company. Supuwiningsih & Muhammad Rusli (2020). The concept of information is the result of data processing and geography is the study of the earth's surface. The concept of a geographic information system is a collection of components that interact with each other in data processing to produce geographic information whose implementation is in the form of digital maps. Geographic

information system can also be defined as an information system that can analyze, store, update, integrate and display all forms of information related to the earth's surface.

2.3. LEARNING MULTIMEDIA

The multimedia concept put forward by Vaughan in 2006 is multimedia consisting of text elements, images/photos, graphic art, sound, animation, and video elements that are digitally manipulated Rusli et al. (2017). Learning multimedia can be interpreted as a multimedia application that is used in the learning process, channeling knowledge, skills, and attitudes and can stimulate the thoughts, feelings, attention and willingness of those who learn so that the learning process occurs intentionally according to the learning objectives. In general, the benefits that can be obtained from multimedia learning are that the learning process is more interesting, more interactive, the amount of teaching time can be reduced, the quality of learning can be improved, and the teaching and learning process can be carried out anywhere and anytime, and students' learning attitudes can be improved.

2.4. MOODLE

The LMS (Learning Management System) used in this study, to be accessible to e-modules by students, is Moodle. Moodle (Modular Object Oriented Dynamic Learning Environment) is a website-based CMS (Content Management System) application that can change face-to-face learning media into online face-to-face learning or what is called e-learning. Moodle is the most popular open source program among existing e-learning programs. This Moodle application was first developed by Martin Dougiamas in August 2002 with Moodle version 1.0. The use of the Moodle application is very helpful, especially in the midst of the Covid-19 pandemic situation which requires social distancing, so this Moodle application can be used as a solution so that teaching and learning activities continue as they should. LMS is a set of web-based systems used by teachers/lecturers/and/or students to share material, send and complete assignments and communicate online Astriani & Ismah (2021). The advantage of using LMS in learning during a pandemic is that students' learning time becomes flexible because it can be accessed at any time via electronic devices such as their laptops or gadgets Wiragunawan (2020).

2.5. METODE

MDLC (Multimedia Development Life Cycle) is a system development method that is suitable for developing multimedia-based systems Riyanto and Singh (2015). Multimedia Development Life Cycle consists of six stages, namely Kumala et al. (2020)

1) Concepts

The stage to determine the purpose and who are the users of the program. The concept stage is the stage for determining the purpose and to whom multimedia is addressed (audience identification). In addition, it determines the type of application (presentation, interactive, etc.) and the purpose of the application (entertainment, learning, etc.). Basic rules for design are also determined at this stage e.g., size, target. The output of this stage is usually in the form of a narrative document to express the project objectives to be achieved.

2) Design

The stage of making specifications regarding product architecture, style, appearance, and material requirements for the product. Design (design) is the stage of making specifications including product architecture, style, appearance and material requirements or materials for the program. Specifications are made as detailed as possible so that in the next stage, namely collecting and assembling materials, new decision-making is no longer needed, it is enough to use storyboards to draws a description of each scene by listing all multimedia objects.

3) Material Collecting

The stage of collecting materials according to the needs of the work done. Material collection is the stage of collecting materials according to the needs being worked on. These materials include clip-art, graphics, animation, video, audio. This stage can be carried out in parallel with the assembly stage, but it is also possible that the material collecting stage and the assembly stage will be carried out in a linear and non-parallel manner.

4) Assembly

Manufacturing Stage. The assembly stage is the stage of making all objects or multimedia materials made. Project creation is based on the design stage, such as a storyboard, flowchart, or navigational structure.

5) Testing

Testing Stage. This stage is carried out after the completion of the assembly stage by running the product whether there is an error or not. This stage is referred to as the alpha testing stage (alpha test) where testing is carried out by the manufacturer. The function of this stage is to see whether the results of making the project are as expected or not, then a test table will be made to test the product criteria Irawan et al. (2015).

6) Distributions

The product will be stored in a storage medium. At this stage the product will be stored in a storage medium. If the storage media is not sufficient to accommodate the product, compression of the product will be carried out. This stage can also be referred to as the evaluation stage for the development of finished products so that they become better. The results of this evaluation can be used as input for the concept stage of the next product.

Figure 1

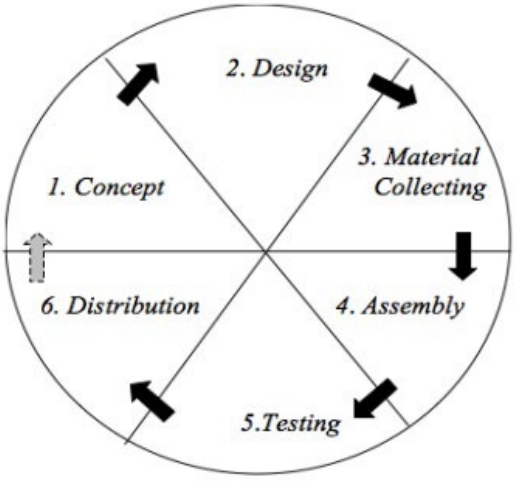

Figure 1 MDLC (Multimedia Development Life Cycle)

3. RESULTS AND DISCUSSIONS

Review previous sources by providing a number of online questionnaire questions to 60 students who had previously taken Information Systems courses with answer choices using the Guttman scale. The Guttman scale only has 2 answers to the questions in the questionnaire, namely the answer "Yes" has a value of 1 and the answer "No" has a value of 0. The following is a table of categories based on the results of data processing.

Table 1

Table 1 Value Category

Category	Value	Percentage Intervals	Frequency	Frequency percentage
High	6-10	51%-100%	43	72%
Low	0-5	0%-50%	17	28%

Based on the results of data acquisition through questionnaires from 60 students who took the Geographic Information Systems course, it can be concluded that there were 2 identified categories, namely high and low. The frequency of the high category is 43, meaning that out of 60 people, only 43 people, around 72%, with a total value of answers regarding previous learning resources that were less interesting and hoped that previous learning resources could be replaced by using multimedia-based e-modules or agreed to the development of multimedia-based e-modules for subjects. Geographic Information Systems course. The frequency of the low category was 17 students, around 28%, meaning that as many as 17 students did not agree that the previous learning resources were replaced by multimedia-based e-modules. Based on the comparison of the results of data processing, it can be concluded that it is very necessary to have multimedia e-modules for the development of learning resources beforehand, seen from the number of students in the high category more than the data of students who do not agree with the development of multimedia-based e-modules for the Systems course. Geographic Information.

3.1. E-MODULE DEVELOPMENT RESULTS

1) Concept Stage

This stage is the initial stage of developing the e-module for the Geographic Information System (GIS) course, which is to determine the purpose of the e-module being built and determine the users of this e-module. The purpose of this e-module is to provide knowledge about the concept of Geographic Information Systems through learning resources in the form of multimedia e-modules that are more interesting and effective because they can be accessed online via Moodle as a form of LMS (Learning Management System).

2) Design Stage (Design)

This stage is the second stage in the MDLC stage, which is the stage in making the Geographic Information System e-module storyboard. Storyboard Meetings 1 and 2 discussed the geographic introductory sub-material

Figure 2

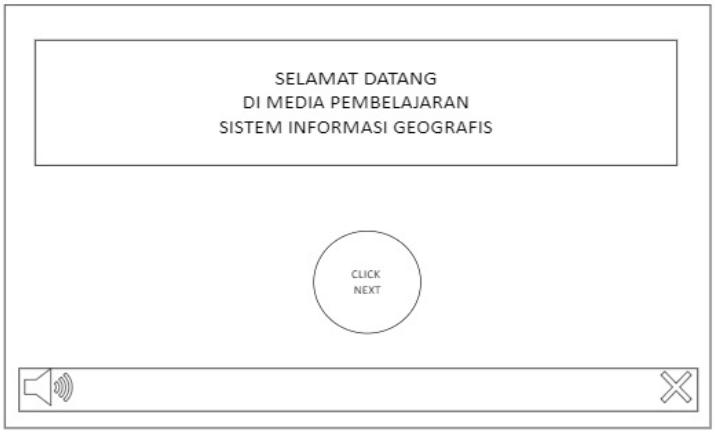

Figure 2 Storyboard Meetings 1 and 2

The storyboards for Meetings 3 and 4 discussed the sub-matter of coordinate systems and map projections which can be seen in Figure 3.

Figure 3

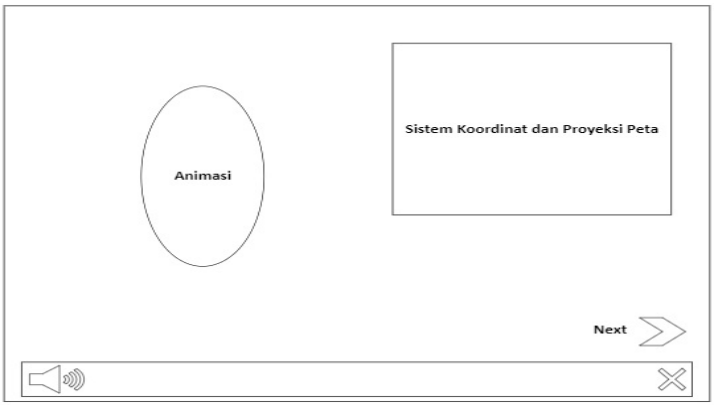

Figure 3 Storyboard Meetings 3 and 4

3) Material Collection

This stage is the stage of gathering materials such as the content contained in the e-module which is adjusted to the SRP (Semester Learning Plan), the software used is Adobe Captivate, and the use of Ocen audio software for audio editing, the use of Adobe Photoshop images and software for video editing.

This stage is the stage of gathering materials such as the content contained in the e-module which is adjusted to the SRP (Semester Learning Plan), the software used is Adobe Captivate, and the use of Ocenaudio software for audio editing, the use of Adobe Photoshop images and software for video editing.

Meetings 1 and 2: Geographical introduction

Meetings 3 and 4: Coordinate system and map projection

Meetings 5 and 6: Processing of spatial data and attribute data

Meeting 7: Raster and vector data

Meeting 8: Data Visualization and Presentation in GIS

Meeting 9: Making spatial data and attributes

Meeting 10: Basic GIS (spatial and attribute analysis) operations

Meeting 11: GIS operation (spatial and attribute analysis) continued

Meeting 12: Raster data analysis

Meeting 13: Internet-based GIS

Meeting 14: GIS Implementation

4) Assembly

This stage is the stage of making the Information Systems course e-module according to the design in the form of a storyboard, combining content with audio, video, and animation narration. This e-module was developed using Adobe Captivate software. Meetings 1 and 2: the first appearance of the e-module for Geographic Information Systems courses which discuss geographical introductory sub-materials

Figure 4

Figure 4 Initial View of the E-Module Meetings 1 and 2

Meetings 3 and 4: the first display of the e-module for the Geographic Information System course which discusses the sub-material of coordinate systems and map projections.

Figure 5

Figure 5 Initial View of the E-Module Meetings 3 and 4

5) Testing phase

This stage is the testing stage of the Geographic Information System e-module that was built, the test is carried out by the e-module developer (alpha test) and the

second test by the user (beta test) by giving questionnaires to students as e-module users.

6) Distribution (Distribution)

At this stage, the e-module is stored by distributing it to students via the Moodle LMS that has been provided by the ITB STIKOM Bali campus, so that it can be accessed by students.

Meetings 1 and 2: E-Modules uploaded into the ITB STIKOM Bali E-Learning Moodle which discuss geographic introductory sub-materials

Figure 6

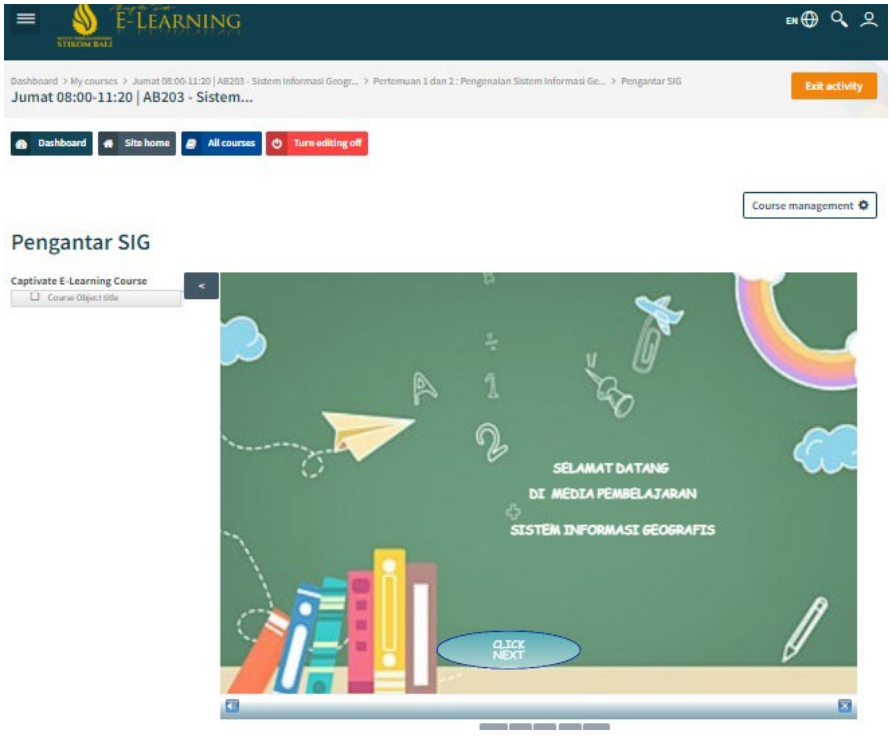

Figure 6 Combined E-Module with Moodle

3.2. STUDENT LEARNING OUTCOMES

By randomly assigning pre-test and post-tests to 20 students, the newly built e-module will be evaluated in terms of how well it aids students enrolled in Geographic Information Systems courses in their learning process. The results are as follows in Table 1.

Table 2

Table 2 Learning Outcomes

Respondent	Pre-Test	Post-Test	N-Gain
1	90	100	1
2	95	100	1
3	80	100	1
4	85	100	1
5	80	90	0.5
6	90	100	1
7	90	100	1
8	70	100	1

9	80	90	0.5
10	80	90	0.5
11	90	100	1
12	95	100	1
13	90	95	0.5
14	80	90	0.5
15	85	95	0.67
16	80	90	0.5
17	90	100	1
18	90	100	1
19	60	80	0.5
20	80	90	0.5
Rata-rata	84	95.5	0.78

N-Gain Formula Meltzer (2002)

$$N - Gain = \frac{Skor\ PostTest - Skor\ PreTest}{Skor\ Ideal - Skor\ PreTest}$$

According to the category table, the N-Gain learning outcomes of 20 randomly selected students are, on average, 0.78, and because 0.78 > 0.7, the value is classified as high. Consequently, using e-modules as student teaching resources can be a useful way to enhance learning.

4. CONCLUSIONS AND RECOMMENDATIONS

This research has produced an e-module for the course Geographic Information Systems which can be accessed by students through the LMS in the form of Moodle. This e-module is based on multimedia, namely e-modules packaged using animation, text, audio, and video with the aim of attracting students' interest in learning in an asynchronous form. The development of this e-module uses the MDLC (Multimedia Development Life Cycle) method which consists of the concept stage, design stage, material collection stage, e-module creation stage, testing stage and distribution stage. This e-module can be accessed online through Moodle so that it can help students study effectively according to their wishes in learning because this e-module is interactive. Lecturers can also make it easier to provide material that has been replaced with e-modules so that the role of the lecturer changes to that of a facilitator. Testing the effectiveness of the e-module by giving pre-test and post-test to 20 students randomly with an average N-Gain learning result of 0.78 in the high category so the e-module is very effectively used as a learning resource.

CONFLICT OF INTERESTS

None.

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