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Research Article

E-Modul Based Flipped Classroom Learning Models in Vocational Education

Ambiyar[1]*, Raimon Efendi[2], Waskito[1], Iffah Rojiyyah[1] and Ratih Agustin Wulandari[2]

[1]Universitas Negeri Padang, Sumatera Barat, Indonesia
[2]Universitas Dharmas Indonesia, Dharmasraya, Indonesia

Abstract.
This research is motivated by the lack of innovative learning media used in that it is still less innovative, only using media available in the environment and not utilizing technology. The aim of this research is to produce an E-Module oriented to the flipped classroom model that can improve students' achievement of 21st century competencies. This study used a development research design with the ASSURE development model. The results showed that the E-Module oriented to the flipped classroom model using the Kvisoft Flipbook Maker application in learning computer network security developed met valid criteria with the characteristics of the media content in accordance with the curriculum, clear design and layout, ease of media operation, clear language. , simple, concise, easy to understand, and the presentation is clearly adapted to the characteristics of students. The results of observations and questionnaires show that the learning media is practical with characteristics that have clear content and objectives, are easy to read, have an attractive appearance and can increase student attractiveness and interest in learning computer network security. In addition, the media developed has also been effective in increasing student activity and learning outcomes and the 21st century students' learning competencies have also increased.

Keywords: Flipped; Classroom learning; learning competencies

Corresponding Author: Ambiyar; email: ambiyar@ft.unp.ac.id

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1. Introduction

Changes in the dimensions of life cannot be avoided by every human being in the face of the Covid-19 pandemic. All must follow the health protocol, this is what is called a new order in life which is called New Normal Life [1]. New Normal Life has changed the perspective of learning in the world of education. Although we cannot ignore the great debate of policy makers about when the learning process in schools during the Covid-19 epidemic began. But all cannot just stand still and surrender to the situation, all elements must move actively and collaborate to find a solution what must be done [2]. New Normal Life can not be just a theory, but it must be done in scientific terms. Likewise education, policy makers must also decide something that can save the lives

of education actors (teachers, lecturers, and students) because this is related to the future of the nation's generation.

Facing the New Normal Life Era in Education, the Ministry of Education has issued a Distance Learning guide as outlined in the Minister of Education and Culture Circular Number 4 of 2020. The most important thing in this guide is how important the role of teachers is in developing Distance learning patterns to students, meaning that it still involves students, meaningful learning, collaborating with parents, students, principals and teachers, are more qualitative in nature and do not harm each other. Its implementation requires creativity and innovation during the pandemic. If we are careful and careful with these guidelines, there is a common thread that we can conclude regarding distance learning, namely being online (online or online), offline (offline or offline) [3] [7]. What is the pattern, the Blended Learning Model, Flipped Classroom and using e-modules can be the best solutions, although not necessarily ideal for other teachers [8] [9]. Learning patterns that are applied in New Normal Life must hold the principles of harmless and realistic on the patterns of What (Content and Content), Who (learning profile, current needs), How (Learning Design and Implementation). So this is where independent learning is applied.

Flipped classroom is the latest innovative learning method in the digital era. This method is one of the blended learning models that is so effective that educators who are preparing to implement blended learning are recommended to use it [10] [11]. Research reveals this method is very effective in changing students from passive to active, be responsible for mastering learning content, because this method activates and develops students' thinking skills, both independently and collaboratively. With this method, the teacher acts more as a facilitator, guide and motivator.

Learning is the provision of conditions that result in the learning process in students [12]. Provision of conditions can be done with the help of educators or discovered by individuals. The learning process can also be said to be an activity that involves individuals in an effort to gain knowledge, by utilizing various sources for learning and implementing learning strategies that are in accordance with technological developments. This integration can develop the skills of students in the field of technology and improve learning outcomes. Global demands require the world of education to always and constantly adapt technological developments to efforts to improve the quality of education, especially adjusting its use for education, especially in the learning process [6] [13] [14].

The learning process is essentially a communication process, namely the process of delivering messages from the message source to the message recipient. This message

delivery process can be done synchronously and asynchronously [15] [16]. This confirms that the learning process must be learner-centered. Educators are not the only source of learning or information sources, but act as facilitators and motivators in learning [5] [7]. There are several learning strategies and learning media that can be integrated by educators in the learning process in the current era of digitalization to increase the activeness and independence of students in the learning process.

Learning computer and network engineering courses must pay attention to aspects of students' learning abilities as well as facilities and infrastructure that support the implementation of this learning, such as learning strategies, teaching materials used in the learning process [17] [18]. In computer and network engineering courses there is also practicum learning that requires teaching materials that can make it easier for students to master the subject matter, and develop students' thinking skills, such as the presence of images, audio and video in the learning media used, as well as learning strategies that can increase students' interest in learning.

Based on the existing problems, it is necessary to develop a teaching material in the form of a Flipped Classroom Learning Strategy Oriented E-Module in the Computer and Network Engineering course so that the learning process becomes more interesting and arouses student interest in learning. The development of E-Module with a Flipped Classroom Learning Strategy is aimed at making students interested and active in learning and the learning process does not occur in one direction and can improve student learning outcomes, so that students can learn according to their abilities and master all study materials in full [19] [23].The purpose of this study is seen from several aspects, namely aspects of validity, practicality and effectiveness of E-Module development in the Computer Network Security Course.

2. Methods

This study used a development research design with the ASSURE development model. According to Smaldino, et al. [24]. The ASSURE model is used to help educators manage the learning process and assess the learning outcomes of students. This is in accordance with the problem behind this research. It is hoped that this research can develop a valid, practical, and effective Flipped Classroom learning strategy oriented E-Module in the Computer and Network Engineering course. Broadly speaking, the research and development procedure cycle using the ASSURE model.

The test subjects in this study were students in the Computer Network Security learning course for the Even Semester Student of the Information Systems Study Program,

Faculty of Computer Science, Dharmas University Indonesia. To see the practicality and effectiveness of developing E-Module oriented Flipped Classroom learning models in the Computer Network Security course. Types of data are primary data, namely data obtained directly which is taken through validation questionnaires, practicality questionnaires, student learning outcomes to gain effectiveness, and student motivation questionnaire sheets.

3. Results and Discussion

Modules are different from books, modules are teaching materials in printed form that are systematically arranged into the smallest learning units to achieve certain learning objectives. With advances in technology, printed materials can be made flexibly without requiring a lot of money. The current module can be transformed electronically, so it is called an E-Module, which is a module that is formed in digital form, so that it can be carried anywhere, can be read and studied anywhere without the need for a special room. Various kinds of digital sophistication, E-modules can be stored and read in electronic communication storage (smartphone). If the printed module can only insert pictures and graphics, then the E-module can be inserted with audio, video animation or learning that explains a real problem, so that it can enrich students' learning experience, E-module can also be equipped with self-evaluation.

The use of E-modules can be used for offline learning (outside the network), students do not have to meet face to face, the teacher just shares certain links with students, so students can save it automatically on students' devices, they just need to learn independently following the learning instructions made by teachers, they can reflect on learning and can have deeper discussions when they meet on a limited basis. E-module deployment does not require internet connection.

This research was conducted based on the stages of developing the ASSURE model (Analyze Learners, State Standards and Objectives, Select Strategies, Technology, Media, and, Utilize Technology, Media and Materials, Require Learner Parcipation, Evaluate and Revise.). The results of the research carried out are described as follows.

3.1. Analyze Learners

This stage analyzes the condition of the learners that occur before the development is carried out. Through this analysis, an overview of facts, expectations and alternative solutions to basic problems will be obtained that makes it easier to determine or select

the teaching materials developed. In the Analyze Learners Stage, an analysis of the condition of students that occurs before development is carried out, such as: analyzing the general character of students; diagnosing students' initial abilities and learning styles of students. This aims to determine the appropriate teaching materials and strategies for students in computer and network engineering courses.

3.2. State Standards and Objectives

At this stage the researcher determines the standards, objectives and learning materials that will be developed into the E-Module teaching material. Formulating learning objectives and standards needs to pay attention to the basics of strategy, media and the selection of appropriate media.The importance of Formulating Goals and Standards in Learning is the basis for this learning assessment, showing what knowledge and competencies will be mastered by students. Besides that, it also becomes the basis for more meaningful student learning. So that beforehand students can prepare themselves for participation and activeness in learning.

Learning objectives must be formulated in the form of a formula based on ABCD. Audience (A) is a learner or student with all its characteristics. Behavior (B) is a learning behavior developed in learning. Conditions (C) is a condition or environment that allows students to learn well. Degree (D) is a special requirement or criteria formulated as evidence that the achievement of learning objectives and the learning process is successful.In the State Standards and Objectives Stage, standards, objectives and materials in computer and network engineering courses will be developed into E-Module teaching materials, while the material to be developed into the E-Module is IPV4 and IPV6 Addressing ; Routing; Data Link Layer; Internet connection; Physical Layer; and Wireless LAN.

3.3. Select Strategies, Technology, Media, and Materials

The third stage is to design and produce the E-Module in accordance with the pre-defined computer and network engineering subject matter, determine the initial design, develop the E-Module, compile the E-Module assessment instrument used to assess the quality of the E-Module developed.

The making of this E-Module uses the Kvisoft Flipbook Maker pro 3.6. 10 application as the main software, then supported by several other software such as Adobe Photoshop CS3 which is used to make book backgrounds and covers, the filemora

application is used to edit videos, Microsoft Power Point which used to create and edit learning materials and the candyPDF application which is used to convert material in PDF form so that it makes it easier to enter material into the main application which is made into an E-Module.

Making Story Board which aims to be used as a reference in designing the product being developed. The storyboard, which is also a visual script that will be used as the outline of a project, is shown a shot by shot which is commonly referred to as a scene. With storyboards, it is easier for us to convey story ideas to others. The following is the E-Module development storyboard for the computer security course. One of the steps for creating media is to run the Kvisoft Flipbook Maker application to create a new project, in the add file or import PDF section.

3.4. Utilize Technology, Media and Materials

The fourth stage is the use of the E-Module by students and lecturers, before it is used, media, material and language experts validate the E-Module which was developed to ensure that the three components can be used in real situations. According to Smaldino, et al (2002) in making effective learning is supporting learning using technology and media in the systematic selection of strategies, technology and media and teaching materials.

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3.5. Require Learner Parcipation

At this stage, an E-Module assessment is carried out in terms of practicality. Students and lecturers give responses regarding the use of E-Modules in Computer and Network Engineering courses. Student involvement in learning can improve student memory or retention of the content or subject matter, it can be said that the higher the intensity of student involvement in learning, the higher the students' memory and understanding of the material presented.

Based on the practicality test, it can be seen that the percentage of student responses to the practicality of the E-Module in the computer and network engineering course is 91,6% with the very practical category. In addition, the E-Module makes student participation and activity increase. Student activities observed in this study were visual acivities, listening activities, motoractivities, and emotional activities in using the E-Module. After all the scores are added up and averaged, the student activity score is 91.6% with very good criteria. The results of student activity recapitulation can be seen in the following table 1.

TABLE 1: Recapitulation of Student Activity Score Results.

No.	Assessment Aspects	Rating result	Category
1.	Visual Activities	92 %	Very good
2.	Listening Activities	80 %	Good
3.	MotorActivities	100 %	Very good
4.	Emotional Activities	100%	Very good
	Average	91,6%	Very Good

3.6. Evaluate and Revise

At this stage the researchers tested the effectiveness of learning outcomes from the E-Module developed in the computer and network engineering course using the control class and the experimental class, the activity of evaluating learning outcomes was carried out to assess the achievement of student learning outcomes against predetermined learning objectives. This evaluation is carried out using a written test, which is to provide a test in the form of multiple choice questions. The results of student learning tests will be used to determine the level of effectiveness of the E-Module being developed and student learning motivation.

The descriptions of the research data on learning motivation variables as a whole reveal the following information: total score, lowest score, highest score, mean, median, mode, standard deviation and variance. Based on the frequency distribution of the data above, it can be explained that the distribution of learning motivation data for experimental class students is on a normal and varied curve. Testing using the Analysis Of Variance (Anova). As a result of this fourth test the following statistical Table 3 were obtained:

It is known that F_{count} is 5.8862 with F_{table} is 4.0981. Therefore, F_{count}t is greater than Ftable, which means that there is no interaction between learning motivation and student learning outcomes in the informatics engineering study program in computer

TABLE 2: Results of the Fourth Test Analysis.

Varians Source	JK	Dk	RJK	F_{hitung}	F_{tabel}
Line (A)	2102,5	1	2102,5	29,2918	4,4139
Column (B)	84,1	1	84,1	1,1717	4,4139
Interaction (AB)	422,5	1	422,5	5,8862	4,0981
In Cell (w)	2584	36	71,778		
Sum	5193,1	39			

and network engineering courses. The plot image shows that students who have high motivation who are taught using the E-Module in the experimental class are higher than the control class. Furthermore, students who have low motivation who are taught using E-Module in the experimental class are also higher than the control class. Thus it can be concluded that the E-Module is indeed suitable to be used as a learning material for courses in the Information Systems Study Program.

4. Conclusions

The development of an E-Module with a flipped classroom strategy in computer and network engineering courses has met the criteria for valid, practical and effective characteristics. The results of the E-Module validity in the Computer Network Security course show very valid criteria after validation by media, material, and language validators after being revised once with an average value of 94.5% in the very valid category. The results of the E-Module Practicality in the Computer Network Security course show very practical criteria after a practicality assessment was carried out by students with an average score of 92.5% in the very practical category and lecturers with an average score of 96% in the very practical category. The results of the E-Module effectiveness in the Computer and Network Engineering course show the effective criteria after being seen from the results of student activity observations with an average value of 94%. So it can be concluded that an E-Module has been produced that meets the criteria of validity, practicality, and effectiveness to improve students' understanding of computer and network engineering subject matter.

Developing an E-Module in computer and network engineering courses needs to analyze student characteristics in designing an attractive E-Module so that it can increase student learning motivation and achieve learning goals. E-Module development in computer network security courses must pay attention to aspects of validity, practicality, and effectiveness because these factors greatly determine the quality of products that

are made to be used in the learning process. E-Module on computer network security can be considered as a medium in learning because it can improve student learning outcomes and learning activities.

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