

The Development Of E-Modules Project Based Learning for Students of Computer and Basic Networks at Vocational School

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ABSTRAK

In the learning process, the teacher acts as the teacher center by using conventional methods so that it causes students to pay less attention to the teacher, and sometimes students experience boredom in learning. The purpose of this research is to develop project-based learning media for computer-based electronic modules and networks. This study uses the Research and Development (R&D) method with 4-D development procedures which include Define, Design, Develop, Disseminate. The data analysis technique uses descriptive analysis techniques to describe the value of the validity, practicality, and effectiveness of the project-based learning E-module. The results of this development research are: the validity of the E-module based on project-based learning is declared valid with the value category $0.83 > 0.61$, the E-module practicality is based on the responses of two teachers with an average score of 89.3 in the very practical category and 36 student response with an average score of 85.03 in the very practical category. The effectiveness of e-module project-based learning is stated to be

effective in improving learning outcomes. Based on the research results, it can be concluded that E-module learning based on project-based learning is valid, practical, and effective to be used as a learning medium in basic computer and network subjects.

Introduction

The advancement of technology and information in the 21st century continues to develop rapidly which changes the pattern of human life and has an impact on education. In 21st century education the skills students need to be able to compete globally are critical thinking skills, the ability to communicate effectively, innovate, solve problems through negotiation and collaboration as well as an entrepreneurial spirit and the ability to access and analyze information. The development of science and technology increasingly encourages renewal efforts in utilizing the results of technology in the teaching and learning process. All schools are required to apply appropriate technology for the learning process, especially in vocational high schools. Vocational high schools are educational institutions that have different characteristics from state schools, namely that there are productive or practical subjects. Vocational High School (SMK) is an educational unit level that prepares graduates to become skilled workers according to their field of expertise.

One of the fields contained in SMK is the computer field where graduates are required to be skilled in both hardware and software so that this field is included in practical subjects. Practical subjects are a set of subjects that function to equip students to have work competencies in accordance with the Indonesian National Work Competency Standards (SKKNI) or competency standards agreed upon by institutions representing the business or industry. Based on the spectrum and curriculum of SMK 2013 in the field of computer and network engineering, there are 9 basic competencies that class X (ten) students must have, namely carrying out computer assembly and testing, configuration and application of BIOS, and installation operations. . . systems, hardware and software installation, hardware maintenance, and hardware problem analysis. Therefore, to achieve this competency, a medium that can help students understand the material and is skilled in both theory and practice is needed. Teachers are required to be able to use the tools or learning media provided by the school, and these tools are in accordance with the developments and demands of the times so that it is very important in their mastery.

The problem that occurs today is that many teachers do not use learning media for the learning process. besides that, teachers also tend to use conventional learning models in learning so that it makes students feel bored in learning (Wulandari, Sudatha, & Simamora, 2020). This problem is also found in one vocational high school. Based on the results of observations and interviews conducted at SMK Negeri 5 Padang, it was found that several observations regarding the learning process were still in the Teacher Center learning, meaning that the learning process was dominated by teachers with the help of power points. Learning activities also still use conventional methods which cause students to pay attention to teachers in delivering learning material, sometimes students experience boredom in the learning process, so that not all students are able to achieve the expected learning outcomes, this has led to the growth of new innovations in creating learning media by researchers at SMK Negeri 5 Padang. The results of further observations at SMK Negeri 5 Padang, class X Computer and Basic Network teachers, found that there were students who had not completed it, meaning that they had not reached the KKM (Minimum Completion Criteria) in these subjects, this was due to the lack of learning media used during the process. learn how to teach. Student learning outcomes in Network and Basic Computer subjects at SMK Negeri 5 Padang class X TKJ can be seen in the following table:

Tabel 1. Hasil belajar siswa pada mata pelajaran komputer dan jaringan dasar untuk kelas X tahun pelajaran 2020/2021

Class	Class Average Score	The number of students	Student scores	
			Scor <75	Scor ≥ 75
X TKJ 1	75	36	23	13
	Percentage	100%	70,89 %	85,22%

Based on Table 1, it can be seen that there are some students who do not reach the KKM score, namely 23% of Class X TKJ, among other factors that affect student learning outcomes, namely the lack of interest in the material provided. and lack of time to carry out student practicum in schools. Based on these problems, one of the solutions offered is the use of teaching materials that can make students learn independently. Ba (Yasa, Chrisyarani, & Mudiono, 2018) Teaching training in the form of E-modules. Research conducted by (Kimianti & Prasetyo, 2019; Pramana, Jampel, & Pudjawan, 2018) states that E-modules can be used by students in independent learning and can effectively improve student learning outcomes.

E-module is a presentation of teaching materials electronically and can be used independently, is designed completely and systematically in a particular learning unit and is presented in an electronic format, where each learning process is linked by a link that is able to realize learning (Serevina, Sunaryo, Raihanati, Sari, & Juwita, 2018; Sugihartini & Laba, 2017). E-modules are more interactive and are equipped with other learning media such as video, audio, and animation to enrich students' learning experiences (Safitri, 2017). E-module is also a learning resource that contains material, methods, limitations and systematic and interesting evaluation methods designed to electronically achieve competencies that correspond to difficulties. The e-module is designed in accordance with the curriculum and is made in the form of non-printed teaching materials with displays using electronic devices such as computers or androids. E-module is an independent learning media that contains only one learning material (Silalahi, 2020; Yasa et al., 2018).

Student independence is prioritized in using the E-module. One of the subjects that require independence is productive subjects. So it can be concluded that the existence of an electronic module can add learning media that can help students explore knowledge and deepen practical knowledge (Asrial, Syahrial, Maison, Kurniawan, & Piyana, 2020; Diantari, Damayanthi, Sugihartini, & Wirawan, 2018). Principles of electronic module development. Several principles of E-module development were initiated by the Ministry of Education and Culture (Pramana et al., 2018), namely Modules are expected to foster student interest, b) Written and made for students, c) Formulating learning objectives, d) Flexible packaging, e) Arranged according to the needs and learning objectives that students want to achieve, f) Focus provides opportunities for students to practice, g) Helps learning difficulties, h) requires a careful navigation system, i) provides a summary, j) The language used is semi-communicative formal, and interactive, k) Made for the learning process, l) Requires RPP (introduction, presentation, closing), m) There is feedback, n) Supports self-assessment, o) explains how to use the E-module, p) There are instructions for use from start to finish.

Benefits of Using Electronic Modules, namely E-modules can help students learn independently to have communicative language and are two-way in nature, making it easier for students to learn subject matter (Kimianti & Prasetyo, 2019; Udayana, Wirawan, & Divayana, 2017). The electronic module is also a teaching material that is systematically arranged and can present material coherently, in the electronic module there are material and practice questions that make it easier for students to learn the material (Pramana et al., 2018). Electronic modules can reduce the use of paper in the learning process. In addition, this electronic module is expected to be used as an alternative learning that is efficient and effective, as well as interactive (Laili, Ganefri,

& Usmeldi, 2019; Udayana et al., 2017). The existence of the E-module is expected to be a source of new learning for students which is expected to increase understanding of concepts and learning outcomes.

Project-based learning model is a learning model that helps students seek knowledge with experience itself and collaborate with the process in the learning process (Sari, Sartijono, & Sihono, 2015). This systematic project-based learning model engages students in the formation of knowledge and skills through a long and structured search / inquiry process towards authentic, complex questions and assignment and product designs (Suryandari, Sajidan, Rahardjo, Prasetyo, & Fatimah, 2018). Project Based Learning is a learning method that uses problems as a first step in collecting and integrating new knowledge based on experiences in real activities (Diah & Riyanto, 2016; Istiningrum, 2017). It can be concluded that project-based learning is project work that contains complex tasks based on challenging questions and problems, and requires students to design, solve problems, make decisions, conduct investigations, and provide opportunities for students to work independently.

The purpose of this research is to develop project-based learning media for E-module based on basic computer and network subjects. This study has a difference with previous studies in the variables studied. This project-based learning-based e-module was developed for basic computer and network subjects. It is hoped that through this research, teaching materials in the form of project-based learning E-modules can be used by students to learn independently so that they can significantly improve student learning outcomes.

Method

The project-based learning model for the development of electronic module learning media was developed using the 4D (four-D) development model. Stage 4D starts from the following stages: (1) define (define); (2) design (design); (3) develop (development); (4) disseminate (spread) (Rajagukguk & Simanjuntak, 2015). The 4-D development model is suitable for use in this development because it is in accordance with the problems that underlie the research.

At the define stage, there are four stages of analysis (1) Needs Analysis (2) Curriculum Analysis (3) Student Characteristics Analysis, and (4) Material Analysis. At the design stage, there are four stages of design (1) Preparation of test standards (2) Media selection (3) Format selection (4) Preparation of initial designs. Furthermore, in the floating stage there are three stages (1) validation stage (2) practicality test (3) effectiveness test. Last one. The dissemination stage aims to determine which E-modules are developed so that they can be used effectively in the learning process. At the dissemination stage of this research it is not an actual research objective so the distribution stage is limited to distributing E-modules to teachers who teach basic subjects of computers and networks.

The data collection instruments used in this study were: (1) validity questionnaire instrument, (2) practicality questionnaire instrument, (3) question instrument effectiveness. The data analysis technique is descriptive in nature by describing the validity, practicality and effectiveness of using project-based learning electronic modules on basic computer and network subjects. The validity analysis used the V Aiken formula.

Result and Discussion

This research produces project-based learning based on electronic module learning media on basic computer and network subjects through the 4-D Model development stages consisting of four stages, namely: define, design, develop, and disseminate (Rajagukguk & Simanjuntak, 2015). The first stage is defined, perform needs analysis, student analysis, and curriculum. This needs analysis is carried out to find out the problems and obstacles faced in the learning process, the goal is to create solutions that are appropriate to the conditions at school. Curriculum analysis is carried out to see the suitability of the teaching materials discussed with the core competencies of the subjects, learning objectives, reviewing the syllabus, and the suitability of learning strategies, and reviewing the literature related to the module, so that electronic modules are developed according to the competency demands learned by students. Student analysis aims to see students' abilities, background knowledge to students' thinking abilities.

In the second stage, the design is carried out by designing an electronic module by paying attention to subjects in accordance with KI, KD, material and learning objectives for electric motor installation. The main activities at this stage are writing, analyzing, and editing electronic modules designed with attention to language, word structure, objective format, evaluation and images, video, audio and animation. The E-module design is tailored to the results of the needs analysis, curriculum analysis, and student analysis. So that the electronic module developed is an application that is used via Android so that it is easy to use by students anywhere and anytime.

The third stage is developed, namely developing an electronic module in accordance with the suggestions and revisions of the validator, so that the electronic module is valid and worthy of being tested. In this third

stage, the validity, practicality and effectiveness of the electronic module are tested. A media can be said to be valid, if the results of the validity which are processed using the Aiken's V formula indicate a value that is within the valid interpretation range according to the provisions. Based on the validity test by the validator, the results of the material validity test were obtained, namely the average of three aspects, namely the appearance aspect, the programming aspect, and the utilization aspect. Furthermore, from the results of the material expert validity test, it was found that the E-module was included in the valid category based on an average of three aspects, namely aspects of content, learning and summary.

After the define, design and develop stages were carried out, the last stage the researchers did was the disseminate stage. At this stage, the developed electronic modules are distributed. Dissemination requirements if the developed electronic module is valid, practical and effective from the validators and trials that have been carried out. The deployment stage is by uploading the electronic module in the playstore then the teacher and students can download it on the playstore using android. So that later both teachers and students can open the module at any time and study the module content independently or in groups. The requirements for dissemination after the electronic module which has been developed are declared a practical and effective validator from the validator and tested. The results of the data validity test with Aiken's V are presented in table 2.

Table 2. Validity test results

Aspect	Media expert			Material Expert		
	1	2	3	1	2	3
Aspects are average	0,84	0,83	0,83	0,78	0,85	0,89
Validation value		0,83			0,84	

Based on the calculation results, the results of the data validation test get a value of $0.83 > 0.61$ so that it can be categorized as valid. Then the results of the practicality test data are presented in table 3.

Table 3. Practicality Test Results

No	Practical electronic module	Percentage	Category
1.	The result of teacher practicality	89,30%	Practical
2.	The results of student practicality	85,03%	Practical

The practicality test results of the teacher's response to the use of project-based learning with electronic modules obtained an average of 89% with the category of practice and student responses to the use of project-based learning with electronic modules obtained an average of 85% with the category practicum Furthermore, the test effectiveness test data is presented in table 4.

Table 4. Practicality Test Results

No	Activity	Percentage	Completeness	Information
1	Pretest	70,89 %	$\leq 75\%$	BT
2	Posttest	91,67%	$\geq 75\%$	T

The results of the value effectiveness test showed that the student learning outcomes showed that the posttest score reached the minimum completeness value, namely 91.67%. Based on the results of the practicality test, it can be concluded that the project-based E-module on computer and basic networking subjects is feasible to use and effectively improves student learning outcomes significantly. Project-based e-modules on basic computer and network subjects are feasible and effective to use to improve student learning outcomes because they are caused by several things, namely as follows.

First, project-based E-modules developed with 4D development models can improve student learning outcomes because E-modules can make students learn independently. The project-based E-module teaching materials developed can be used independently by students and are easily accessible by students. The e-module developed is a teaching material that has five main advantages, namely self-instructional (facilitating independent learning), self-contained (containing all material), stand-alone (not dependent on other teaching materials, adaptive, and use friendly. (easy to use) (Kimianti & Prasetyo, 2019; Pramana et al., 2018). The e-module developed has adapted to the times that were developed in electrocyclic form so that it is more practive and efficient. Research conducted by Warsita (2017) states that technology development in learning must produce products in the form of learning media that can be used as learning resources.

Second, the E-module is developed on a project basis so that it can increase student activity in learning. The project-based learning model invites students to seek their own knowledge and experience in the learning process (Sari et al., 2015). This learning model is packaged systematically and, in the learning, process also involves students in the formation of knowledge and skills so that they can hone their skills and knowledge because students are required to be able to make complex assignments and products. This project-based learning model is systematic involving students in (Sari et al., 2015; Suryandari et al., 2018). The project-based learning model is a learning method that uses problems as a first step in collecting and integrating new knowledge based on experiences in real activities (Diah & Riyanto, 2016; Istiningrum, 2017). So, it can be concluded that project-based learning can make students active and provide opportunities for students to work independently in solving problems or projects that are obtained.

Penelitian yang dilakukan oleh Pramana et al (2018) menyatakan bahwa E-modul berbasis *problem based learning* layak digunakan dalam proses pembelajaran dan dapat meningkatkan hasil belajar siswa. Penelitian yang dilakukan oleh Suarsana (2013) juga menyatakan pengembangan E-modul berorientasi pemecahan masalah dapat meningkatkan berpikir kritis siswa. Penelitian yang dilakukan oleh Marzuki & Basariah (2017) dapat meningkatkan berpikir kritis siswa dalam belajar. Penelitian yang dilakukan oleh Haryati (2017) juga menyatakan bahwa model pembelajaran *problem based learning* dapat meningkatkan berpikir kritis siswa sehingga dapat meningkatkan hasil belajar siswa.

Conclusion

Based on the results of data analysis, it can be concluded that the E-module based on project-based learning in the subject of Computer and Basic Networks in class X students in the field of computer and network engineering expertise is suitable for use in the learning process. This project-based learning e-module can also significantly improve student learning outcomes. So, it can be concluded that project-based learning-based E-modules are effectively used in the learning process to improve student learning outcomes.

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