JURNAL PTK PENDIDIKAN TEKNOLOGI KEJURUAN
RESEARCH AND LEARNING IN VOCATIONAL EDUCATION

Vol. 3, No. 2 May 2020 **P-ISSN: 2621-3273**
E-ISSN: 2621-1548

Effectiveness e-modul based on project-based learning on Visual Programming Courses

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https://doi.org/10.24036/jptk.v3i2.7523

Abstract— This research aimed to analyze the effectiveness of e-modules based on Project Based Learning on Visual Programming. This research uses the Research and Development (R&D) method and the Instructional Development Institute (IDI) model. The research sample were students who were divided into the experimental class and the control class in the Visual Programming. Data analysis was obtained from the results of the posttest and then an analysis was carried out in the form of normality test, homogeneity test and t test. The results of the tests conducted in the control class consisting of 17 students obtained posttest results with an average value of 81.67% and the results of tests conducted in the experimental class consisting of 16 students get the results of the test with an average score of 86 , 54%. Based on prerequisite tests, data analysis, normal, homogeneous experimental research and the use of e-modules this results in significant differences between the control and experimental classes. Based on the results of the posttest and data analysis prerequisite test, it can be concluded that the e-module based on Project Based Learning that is used has been effective.

Keywords: *Validity, E-Modules, Project Based Learning, Visual Programming*

I. INTRODUCTION

The technological revolution is developing rapidly and bringing about many changes. In the current era of the Industrial Revolution 4.0, the emergence and development of the Internet, followed by the latest technology, has changed the way people live and relate to each other. Advances in technology can have an impact on automation in all areas. The pattern of life and human interaction is being changed by new technologies and approaches that combine the physical, digital and biological worlds in fundamental ways (Tjandrawinata, 2016).

The development of the Industrial Revolution 4.0 has a major impact on the quality of education in Indonesia. Education is a way to improve the welfare of the nation if education is able to innovate and compete with the changes that occur. One way is to use technology as a learning medium so that the learning process can make students actively develop their potential. Therefore, educators must contribute to the learning process.

Higher education is part of vocational education, which aims to prepare students to work according to their abilities. Education that prepares students to enter the world of work, through the process of learning and related to technical and practical issues, is referred to as vocational education (Brockmann, et al., 2008). Vocational education plays an important role in preparing students for the labour market in order to reduce unemployment, where these skills are useful for becoming entrepreneurs (Forster and Bol, 2018).

In vocational education, efforts must be made to improve the quality of education. Efforts are being made to promote the implementation of a Fourth Industrial Era curriculum in all vocational and academic higher education by adding new literacies

to the higher education curriculum. The aim is to improve the quality of higher education and lead to an increase in the quality of graduates with a curriculum that refers to the National Higher Education Standards.

In order to improve the quality of vocational education in the era of industrial revolution 4.0, educators need to understand teaching materials, have tactics in applying learning methods by using appropriate facilities used for learning needs. In order to achieve learning objectives, it is necessary to use effective teaching materials, which are materials that are systematically arranged and show the competencies that students should master. Teaching materials include textbooks, student worksheets, modules, audio teaching materials, handouts, etc. Modules play a role in shaping students' scientific attitudes (Arumsari, 2014).

In the realm of education, particularly amidst the advancements characterizing the Fourth Industrial Revolution, the integration of high-quality educational resources is paramount for addressing the limitations and deficiencies inherent in current pedagogical media. The incorporation of technological resources into instructional materials is also essential to facilitate the attainment of enhanced educational objectives, wherein these objectives pertain to the realization of various competencies among learners, specifically in the affective, cognitive, and psychomotor domains, culminating in measurable student learning outcomes.

The process of learning generally incorporates educational resources, one of which includes instructional modules. The module serves as a comprehensive reference utilized by learners during their educational endeavors, wherein the module encompasses instructional content, investigative exercises grounded in theoretical concepts, practical tasks, informative resources, and illustrative examples of their practical implementation.

Based on observations made in the study programme of Informatics Engineering Education, Department of Electronics Engineering at the Faculty of Engineering, Padang State University with one of the lecturers of the Visual Programming course, in the learning process where the learning resources owned by the students are jobsheets. For this reason, the researchers want to see the effectiveness of using learning e-modules that discuss material and content of work steps that are more complete than jobsheets. With a complete and systematic e-module, it is hoped that students will be interested and willing to learn more and practice the steps in the e-module that can support the learning outcomes. This is because each learner has unique learning differences, strengths and weaknesses, different interests and attention to learning.

The results of observational interviews with several students who have studied Visual Programming indicated that this course is a practical course whose learning only uses jobsheets as teaching materials. Therefore, some students only learn and are guided by the jobsheet and do not look for other references. On the other hand, only a short theory is presented in the jobsheet, so there is a lack of material explanation in each session. Therefore, e-modules are used so that the theory in the teaching materials is more complete and students can better understand and know more about the learning material.

Teaching materials in the form of e-modules will guide and better help students who have weaknesses in learning and searching for material on their own without any guidance such as learning modules. With e-modules, it is also expected that students will understand and comprehend the more complete material and clearer practical steps, so that there will be motivation to learn and students will be satisfied with the modules developed, so that there will be interest and it is hoped that there will be an increase in student learning outcomes.

A module constitutes an instrument that encompasses methodologies, resources, elucidations, and assessment techniques designed to achieve the intended objectives in the educational process. Modules represent a significant pedagogical material management strategy that emphasizes the function of education (Santyasa, 2009). The implementation of the module is anticipated to enhance the competencies and proficiencies of learners, fostering greater diligence in the practice of their skills.

There exist various classifications of educational frameworks, including Problem Based Introduction (PBI), Problem Based Learning (PBL), and Project Based Learning (PjBL), among others. A notable educational framework that assists learners in resolving challenges is Project Based Learning. Project Based Learning constitutes an instructional model that affords educators the capacity to orchestrate classroom learning through the integration of project-based tasks (Arkiang, et al., 2014). The objective is to facilitate independent learning among students by enabling them to engage with and fulfill the assignments presented to them.

In project-based learning, learners get used to solving real problems. It also makes it easier for learners to research and investigate. The role of educators in this learning is to prepare problems, provide questions, facilitate investigation and dialogue rooted in real life, which in turn is expected to increase and develop learners' competence (Santi,

2011). In project-based learning, learners are able to have independence and skills in completing the task at hand (Saputra, 2014).

In general, printed modules usually contain objectives, descriptions, summaries, tests and practical worksheets. While in project-based learning e-modules the content is almost the same as in printed modules in general, in this e-module there are characteristics of the PjBL learning model. Thus, there are differences in the way teachers present the learning contained in the PjBL-based e-module compared to using ordinary printed modules. The e-module is also produced in pdf format so that students can use their smartphones not only for communication and social media, but also for learning.

The e-modules used are expected to support a more effective learning process. This research is relevant to the research of (Laili, 2009), namely his research looks at the effectiveness of the development of e-modules, which concludes that the e-modules used are effective based on the cognitive and psychomotor learning outcomes of the students and the difference between the pre- and post-test results. Furthermore, this research is also relevant to the results of research Chasanah, et al., (2009) in his research which looks at the effectiveness of Project Based Learning based modules in an effort to improve students' cognitive learning outcomes. The results of this study showed that the modules used were valid and effective, with the average score of the experimental class being higher than that of the control class, which did not use PjBL-based modules.

The use of e-modules conducted by previous researchers shows that learning using e-modules based on Project Based Learning is effective in supporting learning media for students. For this reason, researchers are encouraged to see how the effectiveness of e-modules based on Project Based Learning in the Visual Programming course at the Electronics Engineering Department at Universitas Negeri Padang.

II. METHODS

This research method uses research and development (R&D). The R&D method is research that designs a product balanced with theoretical studies and tests the validity, effectiveness of the design to produce products that are useful and can be used (Sugiyono, 2016). This research chose the development model, namely IDI (Instructional Development Institute), which has three stages of development, namely define, develop and evaluate (Grabowski, 2003). The define stage is the initial stage which includes problem identification, curriculum analysis and concept analysis. In the develop stage, the initial design (prototype) of the product is prepared and the product is validated. Finally, the evaluate stage involves conducting trials and analysing the results of the trials.

The selection of the IDI model through a reflective process based on the systems approach is in line with the stages of research that researchers undertake, in addition to the fact that the procedure is simple and easier to use. Starting from a needs analysis, analysis of learner characteristics and analysis of existing concepts, it is expected that the use of the IDI model will make this e-module based on Project Based Learning valid, practical, effective and useful for students.

The data sources in this study came from students who studied visual programming courses in the 2019/2020 academic year at the Department of Electronics, Padang State University, which consisted of control and experimental classes. The data analysis of the effectiveness of this learning e-module was conducted using the t-test.First, the prerequisite analysis test was conducted, namely the normality test and homogeneity test.

III. RESULTS AND DISCUSSION

Data analysis is a section that presents the results of the analysis of the data collected during the research. Data analysis aims to answer the research questions. Effectiveness can be said to be the impact or results of an action, in this case the impact of using e-modules on the outcomes of students' learning comprehension. Effectiveness is tested as a measure of the success rate of a learning process. E-modules can be said to be effective if they have a good impact on the learning process. The results of the effectiveness test were obtained from the results of the post-tests by working on objective questions that had been validated beforehand. Before the analysis of the pre-test, the test of the question instrument is carried out.

3.1 Test the question instrument

3.1.1 Item validity test

The validity of the test instrument was tested by conducting a test of the questions on students of Informatics Engineering Education at Universitas Negeri Padang who had studied Visual Programming courses (outside the sample), with the assumption that both were conducted on students who had studied Visual Programming courses. An instrument is said to be valid if it can accurately reveal the data of the variables studied. The validity

of this test was given to 20 students and consisted of 30 objective questions and after testing there were 26 valid questions and 4 invalid questions. The 26 valid questions will be used in the post-test in the control and experimental classes.

3.1.2 Reliability test

Test reliability is a measure of whether the test can be trusted. The results of calculating the reliability of the question gave a value of 0.92. These results were compared with the r table. The test is declared reliable if the result of the r-calculation > the r-table. According to the r table, for n = 20 and a significant level of 5%, the value of r is 0.444. Then r count> r table = 0.92>0.444. From the results of the analysis and based on the interpretation of the r value, it can be seen that the test has a very high level of reliability.

3.1.3 Test the difficulty level

The question difficulty index is made to see if the test questions that have been created are in the difficult, medium or easy category. Of all the questions tested, the analysis showed that 21 were in the medium category and 9 were in the easy category.

3.1.4 The assessment of the differential efficacy

The assessment of the differential efficacy of the evaluated questions is subsequently examined, revealing that two questions fall within the inadequate category, one question is classified as poor, fourteen questions are designated as adequate, and thirteen questions are categorized as proficient.

3.2 Requirements test for data analysis

After testing the questions, the data analysis requirements were tested, which were seen from the post-test results of two classes, namely the control class that used the jobsheet as usual and the experimental class that used the developed e-module. These results are to see if the students' level of understanding is more improved when using e-modules as a learning resource.

The results of the post-test score of the control class obtained an average score of 81.67 with a maximum score of 96 and a minimum score of 69. Meanwhile, the experimental class had an increase with the acquisition of an average posttest score of 86.54. The highest score was 96 and the lowest score was 77. From the acquisition of this test it can be seen that there is an increase in the students' understanding of learning as seen by the increase in the posttest scores. Furthermore, a t-test was carried out to determine the significant difference between the scores of the two classes, the control class and the experimental class.

3.2.1 Normality test

The results of the normality test carried out are presented in Table 1. Based on the significant gains obtained using the one-sample Kolmogorov-Smirnov test, it is found significant for the control class 0.20 and the experimental class 0.20, which can be concluded that the data are normally distributed because the sig value > 0.05.

Table 1. Normality test

One-Sample Kolmogorov-Smirnov Test

		Kelas Eksperimen	Kelas Kontrol
N		16	17
Normal Parameters[a,b]	Mean	86,44	81,7059
	Std. Deviation	5,750	7,08665
Most Extreme Differences	Absolute	,170	,128
	Positive	,140	,128
	Negative	-,170	-,107
Test Statistic		,170	,128
Asymp. Sig. (2-tailed)		,200[c,d]	,200[c,d]

3.2.2 Homogenity test

The results of the homogeneity test of the results of the control class and the experimental class are shown in Table 2. Based on the homogeneity test presented in Table 2, a significant value of 0.546 is obtained, which is greater than 0.05, so it can be concluded that the control class and the experimental class have homogeneous variances.

Table 2. Homogeneity test

Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
,372	1	31	,546

3.2.3 T-test

Based on the normality test and the homogeneity of the posttest variance, it was found that both classes were normally distributed and had homogeneous variances, so the test of the difference between the two class averages, following the results of the t test.

Table 3. Results of the t-test

f	t_{count}	Sig.
33	2,098	0,04

Based on Table 3, the significant price of 0.04 is less than 0.05 and the tcount> ttable value is 2.098> 1.696 and the manual tcount is 2.1, so it can be concluded that there is a significant difference between the control class and the experimental class.

IV. CONCLUSION

E-modules used in the learning process are effective in improving students' learning. Based on the data obtained from the results of the effectiveness test of this Visual Programming e-module, the students' learning results (post-test) of the control class (class that does not use e-modules based on Project Based Learning) and the experimental class (class that uses e-modules based on Project Based Learning). The results of the test carried out in the control class consisting of 17 students obtained the post-test results with an average percentage of 81.67% and the results of the test carried out in the experimental class consisting of 16 students obtained the post-test results with an average percentage of 86.54%. Based on the data analysis assumption test, the use of this e-module obtained a significant difference between the control and experimental classes. Thus, it can be concluded that the use of e-modules can improve students' understanding compared to the use of job sheets in previous learning and is effective in the learning process.

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