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The Relevance of E-Module Based on Problem Based Learning in the Era of the Industrial Revolution 4.0

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ABSTRACT
This study aims to test the socio-cognitive theory by implementing e-module economic learning based on problem-based learning to improve student learning outcomes. The design used in this study was a quasi-experimental design with a pretest - posttest control group design model. In this study, collecting data with documentation, observation, and tests were then analyzed using an independent sample T-test. The results showed that the application of the e-module affected student learning outcomes. The significant increase in student learning outcomes in the experimental class is shown using e-module economic learning based on problem-based learning and statistical testing. These findings confirm that problem-based learning through the e-module can improve student learning behavior with the learning model's syntax. Therefore, it is necessary to apply e-modules to be used in the learning process following technological development in the industrial era 4.0.

Keywords: *e-module, problem-based learning, learning outcomes*

1. INTRODUCTION

The era of disruption is a challenge to the development of science. Apart from being a challenge, the era of distortion can also be an opportunity for the world of education [1]. These challenges cannot be avoided, so there needs to be a fast and precise response, especially in education. Changes are caused by technological developments, namely online-based or internet networks, to be of tremendous benefit if managed properly. The technology referred to according to [2] which is currently trending and even becoming a phenomenon are websites, blogs, microblogging sites, electronic mail (e-mail), Yahoo Messenger (YM), Google Talk (G talk), and those currently to be excellent in all circles is social networking.

Advances in information technology are often associated with the industrial revolution 4.0. A new paradigm displaces the phenomenon of change that changes the previously established paradigm due to technology, especially in education. Industrial Revolution 4.0 has changed the landscape of educational innovation controlled by artificial intelligence and digital frameworks [3]. In the past, education was the basis for character building to make good and character individuals. Current changes tend to prepare a generation that has superior competitiveness but sometimes neglects character building. So what happens is moral decadence in the younger generation, which is marked by the desire to gain instant success. Meanwhile, according to [4], Character education is a process of strengthening character and morals to determine learning success. Besides, these changes have an impact on changing approaches in the learning process.

Education has an important role in national development because education aims to improve the quality of Human Resources (HR). Education is more than just teaching, which can be a process of knowledge transfer, value transformation, and personality formation with all the aspects it includes [5]. Teachers or lecturers are used as a foundation and great confidence in changing and improving students' quality [6]. A teacher plays a very important role in improving the quality of education, where the teacher becomes a designer in the learning process. Teachers and lecturers must create and design classroom learning to provide students with knowledge and skills in facing life in the future. A form of success in learning is that students can apply the knowledge obtained and applied in everyday life. The good and bad of education are influenced by how a teacher can convey or teach science and life values that can bring students to realize their dreams, both for themselves, their families, the community, and their nation [7]. One of the aspects of student success in the learning process is the learning outcomes in the courses being undertaken.

Learning outcomes are the abilities that students have after receiving their learning experiences [8]. The success of the learning process can be seen from the learning outcomes achieved by students. Assessment is used to test and measure the achievement of learning outcomes achieved by using various assessment tools in the learning process [9], [10]. One of the efforts made to improve student learning outcomes is media as a strategy in the learning process, affecting student learning outcomes [11]. One of the strategies used in learning is to use the e-module as the media used in the learning process.

The use of the e-module as a learning medium must be considered proper by the teacher to support student learning motivation. The choice of e-module as a learning medium is one of the right strategies because it adapts to technological developments, especially in the current digital era. The learning process with IT's application will provide learning materials using various media that will positively affect student achievement [12].

E-Module or electronic module presents independent teaching materials that are systematically arranged into the smallest learning units that are presented digitally or electronically. To achieve certain learning objectives presented in an electronic format in which there are animation, audio, and navigation, users are more interactive [13]. E-Module is a form of module teaching material that is converted into digital form equipped with multimedia support, which can be read using a computer, smartphone, or a special reader. E-module is one example of technological developments that can improve the learning process's quality [14]. In addition to the use of media in learning, teaching methods can affect student success in the learning process. Efforts made to improve student learning outcomes are by combining electronic media with problem-based learning models.

Problem-based learning (PBL) is an active teaching strategy that allows students to lead and take responsibility for the learning process [15]. Problems are provided as a stimulus to apply reasoning skills to understand better the underlying mechanisms responsible for the problem and possible ways of solving them [16]. Another goal of the PBL learning models is to help students develop thinking skills and problem-solving skills. Based on research conducted by [17], PBL is a more effective teaching method for selected topics than conventional teaching methods. Media and learning models can be applied as a source of learning in schools to make students active and learning more interesting. This study aims to test the socio-cognitive theory by implementing e-module economic learning based on problem-based learning to improve student learning outcomes.

2. METHOD

This research is a quantitative study with an experimental research design. Experimental research is a description of the research process carried out by researchers who are used to regulate a situation that is used as a comparison required by the experimental hypothesis. The design used in this research is a true experimental research design (true experimental design). The true experimental design used was the pretest - posttest control group design. The research procedures are as follows:

1.1. Forming an experimental group and a control group from a population with the same predicted conditions.
1.2. Give the same pretest or initial test (O1) to the experimental group and the control group to determine the initial state of the two groups.
1.3. Providing treatment (X) to the experimental group while the control group was not given treatment.
1.4. Provide the same posttest or final test (O2) to the experimental and control groups.

The above research procedure can be described as follows.

Table 1. Research Design

		Pretest	***Treatment***	***Posttest***
Experimental	R	(O_1)	X	(O_2)
Control	R	(O_3)	-	(O_4)

The population in this study was students of the Department of Economic Education, which consisted of 4 classes with 118 students. While the sample in this study was 68 students who were randomized using a purposive sampling technique. The methods used to collect data are documentation, observation, and test methods. This study uses the documentation method to obtain data such as students, teachers' names, student names, and school facilities. Documentation data is used as a complement in the preparation of this study. The observation method in this research is used to obtain data or information in the field by using direct observation when students are taught using the e-module of problem-based learning based on economic learning. This study uses tests to obtain data about student learning outcomes, which are then analyzed. The data analysis technique used the Prerequisite Test, namely the Normality and Homogeneity Test. While the data obtained in the study will be processed by conducting hypothesis testing. The data analysis conducted was to analyze the student learning outcomes using the Two Independent Samples t-test.

3. RESULTS AND DISCUSSION

This study aims to determine the implementation of problem-based learning e-modules to improve student learning outcomes. This research was conducted on

students of the Department of Economic Education using two research classes: the experimental and control classes. This study used a Pretest - Posttest Control Group Design, where only one group was given treatment or treatment while the other 1 (one) group used learning as usual. Before the research, a pretest was carried out given to the experimental class and the control class. It is intended to determine students' initial state as a benchmark for student diversity based on student ability level. After the pretest is carried out, each class is given learning, and at the end of the treatment process in the experimental class and the control class not given treatment will be given a posttest. The test was given to determine the differences and how effective the implementation of problem-based learning e-modules was in improving learning outcomes.

Furthermore, to prove a significant difference between the experimental class and the control class students, the t-test was carried out. This test also tests the hypothesis to determine the effectiveness of implementing the use of problem-based learning e-module in improving student learning outcomes. The criteria used in making the hypothesis is the level of $\alpha = 0.05$. H0 is rejected if the significance of probability (sig) $<\alpha$ (0.05) or $t_{count} > t_{table}$ and if the significance level of probability (sig)$> \alpha$ (0.05) or $t_{count} < t_{table}$ then H_0 is accepted. The following is the pretest result data to determine the initial state of the students.

Table 2. Data for the pretest of the experimental class and control class

Group Statistics

	Class	N	Mean	Std. Deviation	Std. Error Mean
Value	Experimental	34	58,53	13,736	2,356
	Control	34	58,82	12,677	2,174

Source: 2020 data processing results

Based on table 2, it can be seen that the pretest mean or average value of the experimental class pretest is 58.53 and the pretest mean or average value of the control class pretest is 58.82. Show that the pretest average value of the experimental class is smaller than the control class value so that it can be said that there is a similarity in the students' initial state. However, to prove whether there is a significant difference between the experimental class's learning outcomes and the control class is presented in table 3 below.

Tabel 3. T-test of pretest values for the experimental class and control class

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Nilai	Equal variances assumed	,291	,591	-,092	66	,927	-,294	3,206	-6,694	6,106
	Equal variances not assumed			-,092	65,579	,927	-,294	3,206	-6,695	6,107

Source: 2020 data processing results

Based on table 3, it can be seen that the t-test significance value is 0.927. The significance value is greater than 0.05, and the t_{count} value is 0.092 $<t_{table}$ 1.997, which means that H_0 is accepted. Show that there is no significant difference in the mean pretest scores of students between the experimental class and the control class. So, technically, the research can be done because it is seen from the students' initial abilities, which are relatively the same. Furthermore, to determine the difference in the experimental class's learning outcomes and the control class, the t-test was carried out using the posttest value data of students who had been given treatment in the experimental class, and the control class was not given treatment. The following are the results of the posttest calculation for the experimental and control classes.

Table 4. Posttest Value of Experiment Class and Control Class

Group Statistics

	Class	N	Mean	Std. Deviation	Std. Error Mean
Value	Experimental	34	82.94	6.291	1.079
	Control	34	73.53	9.888	1.696

Source: 2020 data processing results

Based on table 4, it can be seen that the pretest mean or average value of the experimental class pretest is 82.94 and the pretest mean or average value of the control class pretest is 73.53. Show that the value of student learning outcomes in the experimental class is superior to that of the control class, but to prove whether there is a significant difference between the experimental class's learning outcomes and the control class is presented in table 5 below.

Table 5. The t-test of the Posttest Value of the Experiment Class and Control Class

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Nilai	Equal variances assumed	5.892	.018	4.683	66	.000	9.412	2.010	5.399	13.425
	Equal variances not assumed			4.683	55.953	.000	9.412	2.010	5.385	13.438

Source: 2020 data processing results

Based on table 5, it can be seen that the t-test significance value is 0.000. The significance value is less than 0.05, and the tcount value is 4.683> ttable 1.997, which means that H0 is rejected, and H1 is accepted. Thus, there is a significant difference in the average student learning outcomes between the experimental and control classes. The experimental class students' learning outcomes using problem-based learning e-modules are better than the control class using conventional learning. Based on these tests, it can be concluded that the use of problem-based learning e-modules is effective for improving student learning outcomes in the experimental class.

Implementation of E-Module Based on Problem Based Learning

Based on the results of the assessment during the learning process using e-module based on problem-based learning through cognitive assessment, it is known the student learning outcomes. Learning activities were carried out four times the face to face in the experimental group and the control group. According to the research design, the learning process is carried out using true experimental, which is used as the pretest – posttest control group design. The treatment or treatment given was using an e-module based on problem-based learning in the experimental group, while treatment was not given to the control group. Based on the results of the pretest, it is known that the mean pretest or average value before using the e-module based on problem-based learning is 58.83. Meanwhile, the posttest score or the value after using the e-module of problem-based learning based on economic learning using cognitive assessment was 82.94. Show an increase in student learning outcomes in the experimental group after using a problem-based learning e-module.

The increase in the average value of learning outcomes before (pretest) and after (posttest) in the experimental group using a problem-based learning e-module shows that the e-module effectively improves student learning outcomes in addition to seeing the average value of student learning outcomes, which shows a significant increase in the calculation using the t-test. Based on table 4, it can be seen that the t-test significance value is 0.000 or less than 0.05, and the t-count value is 4.683> t table 1.997, which means that there is a significant difference in the average student learning outcomes between the experimental class and the control class. Show that the learning outcomes of experimental class students using problem-based learning e-modules have increased significantly. Thus, it can be concluded that the implementation of e-module economic learning based on problem-based learning is effective in improving student learning outcomes.

This study's results are by research conducted by [18], that electronic modules and print modules can improve student learning outcomes, in line with research results [19], which states that e-modules are developed. More interesting, more efficient, and more effective, as seen from the student response questionnaire's results, increased student learning outcomes known from the pretest and posttest scores. This is supported by research [20], showing that learning media are valid and effective in the learning process. Based on the researchers' strengthening above, it shows that the implementation or use of problem-based learning e-modules is effectively used in the learning process to improve student learning outcomes. Other than that. E-modules can be used as an alternative in the learning process that varies according to technological advances and responds to challenges for the world of education.

The use of media that is collaborated with a learning model is one way to face the industrial era 4.0. As stated by [21], the technology-based teaching and learning method is known as Education 4.0, inspired by Industry 4.0 aims to increase digital technology competence at all

levels and increase digital technology for teaching and learning. The Industrial Revolution 4.0 is a digital era and claims that educational institutions have also received the educational revolution. The Industrial Age 4.0 provides innovative ideas in teaching and learning and uses information and technology in the process [22]. Teachers are required to be creative and innovative in processing classroom learning by the demands of the times. Likewise, [23] said the most valuable qualities of a creator are having a level of education, professionalism, learning abilities, and creativity. The teacher or lecturer is a creator or system maker who processes the classroom conditions in the learning process. The availability of an educational flexibility system can provide a significant increase [24]. For this reason, the e-module of problem-based learning is an educational technology innovation that can be used as an alternative to teaching materials in the learning process.

4. CONCLUSION

Based on the results of the research and discussion described above, it can be concluded that the implementation of problem-based learning e-module is effective in improving student learning outcomes. Improved learning outcomes seen from the pretest or before using e-problem based learning obtained an average value of 58.53. After using problem-based learning, the e-module obtained an average value of 82.94. The average value of learning outcomes indicates that the e-module based on problem-based learning gives good and positive responses. The effectiveness of e-module based on problem-based learning is also supported by statistical calculations that the significance value of 0.000 <0.05 or the value of t_{count} 4.683> t_{table} 1.997 so that H1 is accepted and H0 is rejected, which indicates that the implementation of e-based on problem-based learning is effective in improving student learning outcomes.

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