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The Effect Of The Flipped-Product Based Learning Model To Improve Student Learning Outcomes

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Abstract:
This research aimed to explore how the product-based flipped classroom learning approach affected web development courses. This study has a posttest-only design and is a quasi-experimental study. In this study, 70 semesters 3 students were used as test subjects. The traditional method is used in the control class, whereas the flipped product-based learning model is used in the experiment class. This research has the benefit of allowing students to learn autonomously and imaginatively, as well as solve issues and activate learning. Through the LMS Google Classroom, students can access learning resources from anywhere. In addition, students in web programming courses can create products and advertise digital marketing items. One-way ANOVA with SPSS software was used to analyze the data. The outcomes of this study demonstrated that the experimental and control classes' pre-test results were not significantly different since they were not provided any therapy. The experimental and control classes, especially the control class 78 and the experimental class 85, have significant disparities in post-test learning results. As a result, this study is appropriate for use in the learning process.

Keywords: flipped-product based learning, flipped classroom, web programming

I Introduction

Learning with traditional methods such as listening to lectures, face-to-face discussions, presentations, textbooks and paper tests in class is no longer relevant when it comes to the 21st century and during the Covid-19 outbreak. Traditional learning methods have gradually been supplanted by online learning approaches. Online education enables students to learn independently by providing online tutorials, discussion forums, ebooks, chat, and online assessments [1][2][3]. Traditional learning methods tend to make students passive and ultimately make teaching and learning activities unpleasant and boring [4][5][6][7].

One of the innovative learning models that are believed to be a solution to replace traditional learning methods is the flipped classroom [8][9]. This learning model will guide students to learn independently through learning videos before coming to class, while activities in class are more focused on discussion activities [10].

Flipped classroom or so-called reverse class is a learning model that integrates technology-based teaching methods [11]. Flipped classroom provides opportunities for students to learn independently both inside and outside the classroom. The flipped classroom, which is included in the blended learning model, has advantages such as students being able to have discussions at any time, all students can participate according to the time and place they want, and have plenty of time to discuss and argue [9][12].

Based on the literature review, several problems were found in the traditional learning process, namely, when students are given assignments, students need additional sources of information to do assignments other than the material that has been given. With the flipped classroom, students can access learning materials at any time through e-learning. Thus, students' high-order thinking can increase. Learning using flipped classroom is more effective than traditional learning [13]. Similarly, Tang's research on Engineering students at Chengdu University of Information Technology (CUIT) found that students are generally dissatisfied with the results of online learning, particularly in communication and question and

answer. Additionally, the study revealed that in times of distraction and reliance on online teaching, this might be facilitated by including flipped classrooms, which have been shown to improve student learning, attention, and assessment of student learning [14].

Product-Based Learning is described as the methods or measures that educators must take to enable students to actively learn, participate, and interact with competency - orientation in order to produce a product, either goods or services that are required. Product-based learning is learning that allows students to develop critical thinking abilities while also allowing them to collaborate. Students are required to be involved in the learning process through product-based learning, such as expressing crucial questions about the product to be manufactured [15]. Friadi's research on Web programming and mobile devices is less than ideal. According to the research, using the Product-Based Learning-Teaching Factory approach in a mobile programming course can help students develop cognitive, psychomotor, and affective skills [16].

In this study, the authors combine the flipped classroom with a product-based learning model to see student learning outcomes. The research was conducted at the Potential Utama University on 3rd-semester students who took web programming courses. Learning that is applied online is synchronous and asynchronous. Learning is done synchronously using zoom and google meet or others, while asynchronous learning can be done using the Learning Management System (LMS). There are many LMS that can be used such as Moodle, Google Classroom, Edmodo, Schoology, etc [17]. While in this study the author uses google classroom because it is more practical, easy to use, full-featured, and can train students' independence. The steps for using the Flipped Product Based Learning model are as follows:

Table 1.
SYNTAX OF FLIPPED PRODUCT BASED LEARNING

Steps	Procedures	Student
Step 1	Formulation of learning outcomes	Asking questions about learning and assignments
Step 2	Understanding the concept of lecture material	Present group assignments and discuss
Step 3	Summative evaluation	Take exams and answer exam questions
Step 4	Project task design	Make presentations and discuss
Step 5	Designing business designs and products	Students do project assignments and discuss
Step 6	Digital marketing	Students present and discuss the results of business progress carried out using digital marketing
Step 7	Process evaluation and project task reporting	Students present the results of their progress and analysis of the business that has been carried out
Step 8	Summative evaluation	Take exams and answer exam questions

The use of the Flipped Product Based Learning syntax can also be seen in the image below:

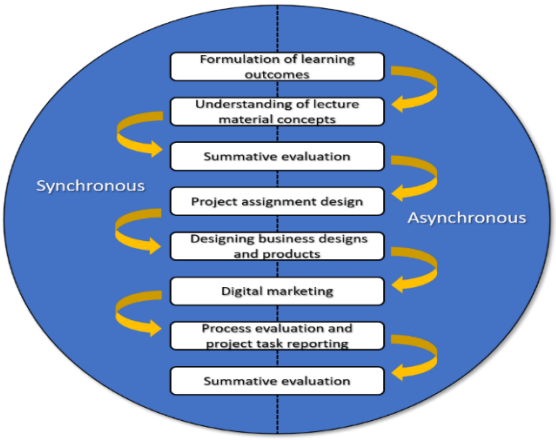

Figure 1. Implementation of the Flipped Product Based Learning Model

The success of the flipped product-based learning model to improve learning outcomes is determined by several factors, namely self-motivation, experience incompetence, and social linkages [18]. Self-motivation is felt when able to take responsibility for choices and support. Competence is felt when students can respond in each lesson. Social connectedness is perceived as the need to have a sense of belonging and connectedness to others.

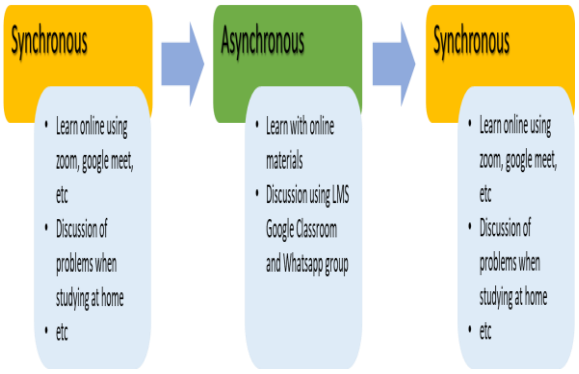

Figure 2. Learning Activities using the Flipped Product Based Learning Model

Based on Figure 2 above, the use of the flipped product-based learning model is divided into 2 stages. When learning is done online using zoom, the lecturer directs students before learning begins, discusses, helps students find solutions to problems when learning is done at home, student's independence towards the use of technology, etc. [19]. Meanwhile, in the second stage, learning is carried out using the LMS Google Classroom. Students learn independently by accessing the material provided in the form of videos and can repeat the material before synchronous learning is carried out. Students feel enthusiastic when they are given the responsibility to study the teaching materials that have been given. Using the flipped model can help students understand the learning material provided [20].

The research steps in the experimental and control classes can be explained as follows:

• In the control class, the lecturer uses traditional learning methods. At each meeting, the lecturer provides lecture materials in the form of modules and PowerPoint. Students are asked to focus on listening and following the directions of the lecturers as well as recording new information that students get. The purpose of learning with traditional methods is to help students to develop competence and increase student knowledge. However, students find it difficult to solve any learning problems in class. Lecturers allow students to ask if they have difficulties in solving the problems given. With traditional learning, the learning process becomes passive.

• In the experimental class, learning is carried out in 2 ways, namely synchronous and asynchronous. Before the lecture is carried out synchronously using zoom, students are expected to study the material to be taught using the Google Classroom LMS (Asynchronous). Learning materials have been provided by the lecturer in the form of video tutorials, PowerPoint slides, and modules. Students can also obtain information from other sources. In addition to accessing learning materials in the LMS Google Classroom, students can also have discussions. After students study the material given, then in synchronous learning students no longer learn theory, but students must be active in solving problems that will be given and actively discuss in groups. In this study, the lecturer is not only a lecturer but also a facilitator for students. During the learning process, it is expected that students can develop independent, creative learning skills and be able to solve problems, and be able to promote products that have been produced using digital marketing.

2 Literature Review

2.1 Flipped Classroom

Blended Learning is an innovative educational strategy in which students acquire instructional information outside of the classroom via videos while the classroom is utilized to apply subject matter [12][21][22]. Becker describes flipped learning as having five components: 1) students take an active role in learning; 2) technology facilitates direct learning; 3) students review material online prior to class; 4) students are assigned real-world problems, and 5) activities in the classroom are centered on discussion and other communicative activities that are guided directly by the lecturer [11].

According to the experts' explanations above, flipped learning is a learning model that incorporates technology to make learning more active and efficient. It fosters interactions between students and other students, as well as between students and lecturers, encouraging students to participate actively in problem-solving [22]. In flipped learning, students are obliged to view the instructional video prior to beginning the lesson in class. Numerous advantages are associated with the flipped learning technique. For the most part, it appears to be a reasonable advantage (e.g., increased instruction time is more engaging), particularly when teaching them in a blended setting that includes both face-to-face and online training [9]. Students can use class time to work on problems, develop concepts, and engage in collaborative learning via Flipped Learning [23].

2.2 Product Based Learning

In the 21st century, education around the world is in the era of internet-based information and communication technology with the term industrial revolution 4.0. Development of the Industrial Revolution 4.0 in various fields. It can be said that the industrial revolution 4.0 is a paradigm that

occurs when the work environment in the business world and the industrial environment must be adopted into the world of education. Product-based learning models can contribute to creating a better learning process effectively and efficiently [16]. Product-based learning is an educational process used to produce a product or service based on work standards. The educational process is designed based on procedures and standards of the world of work so as to improve students' skills and expertise [15]. In this study, students were led to produce a product in the form of a website that could later be marketed through digital marketing. Digital marketing has been widely used to promote business or just in the world of tourism, e-commerce, and education [24]–[26].

3 Research Method

The current study is a quasi-experimental design with a pre-post-control group test. The purpose of this study was to determine the effect of flipping web programming courses using the Flipped Product Based Learning model. The research lasted one semester and included sixteen meetings (5x45 minutes). The experimental and control classes employ the same learning materials, and the lecturer has no relationship with the pupils, resulting in objective results.

3.1 Research Design

This study uses quasi-experimental research to see the effect of the Flipped-Product Based Learning model. The study was conducted for 1 semester where meetings were conducted online. The experimental and control classes used the same materials so that they had objective results.

3.2 Participant

The participants in this study were 3rd-semester students at Potent-si Utama University who took web programming courses. The number of participants in this study was 70 students. 35 students in the experimental class will be taught using the flipped product-based learning model. Learning is done using Zoom, LMS-Google Classroom and Whatsapp Group. In the control class, 35 students use flipped learning.

3.3 Data Collection

The data were gathered using pretest and posttest scores from both the experimental and control classes in order to compare learning outcomes. The test is comprised of 40 multiple-choice questions pertaining to web programming.

3.4 Data Analysis

The descriptive statistical test and the one-way statistical test ANOVA were used to assess the data. The test was designed to determine the extent to which the Flipped Product Based Learning paradigm influenced student performance in both the experimental and control classes. The study's findings were analyzed using SPSS 25 software at a significance level of 0.05 for each of the two test scores. The Kolmogorov-Smirnov test was used to determine the homogeneity of the data, and the Levene's Quality Test was used to determine the normality of the data, while the independent t-test was used to compare learning results.

4 Result and Discussion

After collecting data from the research, an analysis is conducted to establish the effectiveness of the Flipped Product Based Learning learning paradigm in web programming classes. To assess the effect of the experimental and control classes on learning outcomes, a 40-question multiple-choice test linked to the web programming course was used. According to table 2, the experimental class's pretest score is 40, whereas the control class's pretest score is 42. While the maximum value is 74, the minimum value is 65. There are major variances between teaching the same content using different approaches. In the control class, the traditional model has a minimum value of 55 and a maximum value of 65.62, with an average value of 65.62. The experimental class's flipped product-based learning model has a minimum score of 65 and a maximum score of 85, with an average of 76.48.

Table 2.LEARNING OUTCOMES OF EXPERIMENTAL AND CONTROL CLASSES

	N	Minimum	Maximum	Mean	Std. Deviation
Pre_Test_Eks	35	40.00	74.00	60.0000	9.64365
Post_Test_Eks	35	65.00	85.00	76.4857	5.31021
Pre_Test_Kontrol	35	42.00	65.00	54.1429	6.60723
Post_Test_Kontrol	35	55.00	78.00	65.6286	7.01715
Valid N (listwise)	35				

Table 2 is the result of the SPSS 25 analysis of student learning results in experimental and control classes. The experimental and control classes each had 35 students. According to table 2, a difference exists between the experimental and control values.

There is a considerable difference in the experimental class after therapy.
The difference in pre-test and post-test scores between the experimental and control groups is depicted in Figure 3:

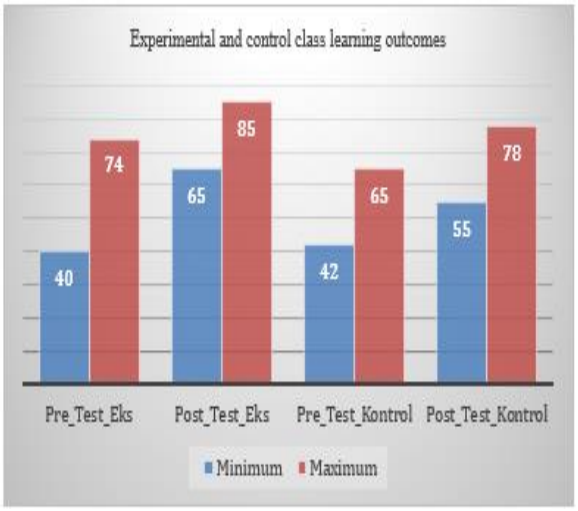

Figure 3. Graph of the difference in the pre-test and post-test scores of the experimental and control classes

The normality test was used to determine whether the distribution of data in the experimental and control classes as normal. The experimental class received a sig value greater than 0.05, indicating that the data were normally distributed. The control class has a sig value greater than 0.05, indicating that the data are also normally distributed. As a result, it is possible to deduce that the data are regularly distributed.

Table 3 NORMALITY TEST OF EXPERIMENTAL AND CONTROL CLASS LEARNING OUTCOMES

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
N_Gain_Eks	.101	35	.200*	.977	35	.646
N Gain Kontrol	.125	35	.181	.950	35	.111

Table 4 is the result of the homogeneity test output of students from the experimental and control classes to determine whether the data variance is homogeneous or not from the acquisition of pretest and posttest scores using SPSS 25. 0.005, then the data meet the assumption of homogeneity. Thus, based on table 4 it can be concluded that the variance of the research data has a homogeneous variance.

Table 4. Homogeneity test of experimental and control class learning outcomes

		Levene Statistic	df1	df2	Sig.
N_Gain_Total	Based on Mean	.024	1	68	.876
	Based on Median	.005	1	68	.943
	Based on Median and with adjusted df	.005	1	67.992	.943
	Based on trimmed mean	.018	1	68	.893

To test the truth of the initial hypothesis, a test was carried out using an independent sample t-test using SPSS software with a significant level (sig) <0.05.

Table 5
T-TEST OF EXPERIMENTAL AND CONTROL CLASS

Based on table 5 it can be stated that student learning outcomes increased significantly with sig < 0.05

5 Conclusion

According to studies from experimental and control courses, there was an increase in learning outcomes. The experimental class follows a flipped product-based learning approach, whereas the control class follows a flipped classroom style. Overall, the experimental class received an 85, while the control class received a 78. As a result, it can be said that flipped product-based learning has the potential to significantly improve student learning outcomes.

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