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The Effect of the Google Classroom-Based Flipped Model on the Learning Outcomes of Machinery Theory in the Covid-19 Pandemic

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Abstract. This study investigates the implementation of the Google Classroom-based flipped classroom model for teaching machining theory during the COVID-19 pandemic in the Department of Mechanical Engineering Education, Faculty of Engineering, State University of Medan, which impedes learning activities. In accordance with the current situation and conditions of the covid-19 pandemic, an alternative and appropriate solution is required, namely the application of the flipped classroom model based on the google classroom to improve student learning outcomes in the machining theory course. The flipped classroom model can assist students in achieving learning objectives in a manner that is considered simple. Through the Flipped classroom, lecturers at the Department of Mechanical Engineering Education, Faculty of Engineering, State University of Medan can utilize online learning to facilitate students' access to and study of course materials. It is crucial to conduct research on this issue for this reason. This research has three objectives: (1) to examine the learning outcomes of students who use the flipped classroom learning model assisted by Google Classroom in the treatment class; (2) to examine the learning outcomes of students who use the conventional learning model in the comparison class; and (3) to determine the effect of using the flipped classroom learning model assisted by Google Classroom on the learning outcomes of machining theory. The type of research employed is quasi-experimental. Class A and B students enrolled in the Mechanical Engineering Education Study Program at the Faculty of Engineering, Medan State University, during the even semesters of 2020/21 comprised the population of this study. Researchers used cluster sampling (cluster random sampling) to select two classes from the population and determine the treatment class and comparison class. The data was derived from the results of observations and assessments of learning outcomes. In this study, descriptive and inferential statistical analysis were used to analyze the data. The results of the descriptive statistical analysis indicate that online learning methods result in higher average student learning outcomes (80,05) than traditional learning methods (64,45). On the basis of the results of an inferential statistical analysis, it is possible to conclude that the learning outcomes of machining theory attained by students using the flipped classroom learning model supported by Google Classroom are superior to or have a positive impact on the learning outcomes attained by students using conventional learning models.

Keywords: Machining Theory, Flipped Classroom, Google Classroom

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1. Introduction

Corona Virus Disease 2019 (Covid-19), which originated in Wuhan, Hubei Province, China, has rapidly spread around the globe. The World Health Organization (WHO) even declared this incident a global pandemic on March 11, 2020 [1]. This necessitates self-quarantine at home to break the chain of virus transmission. This circumstance impedes the operations of numerous sectors, including the education sector. According to UNESCO data, 39 countries have implemented school closures at the present time. More than 233 million students are affected by the coronavirus in China, which has by far the largest number of affected students. As for other nations, 61 in Asia, Africa, the Middle East, Europe, North America, and South America had imposed restrictions on learning activities in schools and universities, specifically online learning, as of March 13.

Currently, the digital era is expanding, and so is the use of technology in this era. E-learning is one of the applications of technology in the field of education. Numerous educators and students possess smartphones and/or computers. This makes it easy for them to access information anywhere and at any time, removing space and time restrictions. E-learning is a web-based application that allows educators and students to interact in a virtual classroom. E-learning is designed to bridge the gap between instructors and students, particularly in terms of time, space, conditions, and circumstances [3]. E-learning is a method of education that utilizes Internet technology. Additionally, the principles of simplicity, individuality, and speed must be considered. Therefore, the learning principles and communication must be designed similarly to conventional learning. E-learning or online education can make the learning process interactive for both teachers and students [4].

For State University of Medan (UNIMED), the aforementioned conditions have been met. This is evident from the 2015-2019 UNIMED strategic plan (Renstra), which places significant emphasis on the use of information and communication technology (ICT) to enhance the quality and relevance of graduates. As evidenced by the various supporting devices and applications developed at UNIMED, the Medan State University also fully endorses the use of information and communication technologies for educational purposes. On the hardware side, UNIMED consistently develops data center procurement as learning support and application support, which includes blade servers, load balancer storage, environment monitoring systems, fire systems, network monitoring systems, and network devices such as routers, switches, and rack servers [5].

Specifically, the results of the initial observations conducted on UNIMED professors revealed the same conclusion. All lecturers (100%) stated that they had and used the syllabus as a guide when delivering lectures; 90% stated that they had prepared teaching materials in the form of handouts and PowerPoints; This is consistent with the equipment they use in their lectures, namely laptops and LCD projectors (83%); Similarly, the majority of lecturers (80%) reported employing a strategy that combines a student- and teacher-centered approach. Conversely, 90% of respondents stated that the lecture model they used was fully face-to-face, while 10% stated that it was a combination of face-to-face and online.

Online or online learning (on a network) is conducted through a variety of applications that can support the learning process, beginning with face-to-face applications like zoom, google meet, and other online media platforms like google classroom, WhatsApp group, etc. The Google classroom application was selected to aid students and instructors in conducting online lectures. Google Classroom is an application in the form of a learning management system that can be accessed via email, making it convenient to use. Google classroom was released officially in August 2014. Google classroom is an application that makes it possible to create online classrooms. Google Classroom can be used for distributing assignments, collecting assignments, and even evaluating submitted assignments. In addition, Google Classroom offers a discussion forum so that instructors can initiate class discussions that can be responded to and commented on, similar to Facebook commenting [6].

E-learning is the name given to the education system based on the cyber world [7]. In the meantime, it is viewed from the perspective of the lecturers' readiness to use e-learning. In general, it can also be described as complete. This is evident by the fact that 93 percent of them already have computers connected to the internet and 87 percent of lecturers have laptops. Similarly, when they are in the office, they have access to a computer with Internet connectivity. All lecturers (100%) reported using computers for lecture purposes, despite the fact that only 60% of them used the internet for lectures and 80% used the internet to supplement learning resources. According to the attitudes of lecturers toward the use of e-learning, only 87% of lecturers are aware that the internet is a very rich source of learning for lectures; in fact, only 60% agree that the internet is an effective medium for lectures. Slightly more lecturers (73%) concur that the Internet can be an effective medium for lectures.

Courses in machining theory are productive courses that teach machining competency material to students who wish to master these competencies in a standard or correct manner. The machining skills consist of turning, milling, drilling, flat and cylinder grinding, scraping, sawing, and filing, among other techniques. This activity can take place if it is supported by a number of important factors, including aspects of practical facilities, practical materials, sequences of learning activities or learning implementation plans, job sheets/operation sheets/instruction sheets, teachers, technicians, students, and other factors.

Practicum is an activity that offers numerous chances to investigate and experiment [8]. According to this perspective, practicum activities are geared toward tasks such as the installation and maintenance of tools, observation, repair, and testing of installation or repair results so that students can gain insight into work practices. Through practicum, students will gain hands-on experience working and operating machines that they have learned about in theory.

The relationship between theory and reality in practice cannot be avoided, or theory consists of provisions that can be implemented [9]. This statement suggests that practicum is an activity to practice a skill that is supported by theoretical knowledge. Another possibility is that the concept appears simple and sound in theory, but is fraught with practical difficulties. Through the practicum, we will be able to comprehend the connection between theory and reality. Practical activities will also provide experience that cannot be gained through theoretical study.

Learning machining theory is the provision of machining theory to students as a support for the implementation of machining practices, so that students can carry out the practices according to the correct procedure. In PS-PTM, learning of machining practice is centered on the lecturer as the source of machining practice material delivery. Due to the limited time available for practical implementation, there is still a lack of material submitted for practical preparation. As a result of having to re-record the information presented by the teacher, students become bored with lecture-centered learning and the absence of learning media. In the implementation of the practice, there are still a significant number of students who do not correctly apply practical procedures, such as work safety and taught theory. Therefore, we require an appropriate learning model for the machining theory course's learning process.

The flipped classroom learning model, also known as reverse learning, is one of the suitable learning models for the application of online learning, as determined by observations and literature reviews. Where the teacher prepares home-study materials for the students. With Google Classroom, flipped classrooms have a number of benefits, including the ability for teachers and students to communicate directly in one scope (virtual classroom). Educators can provide practice questions, learning or supporting materials (e-books, articles, learning videos, etc.), and easily initiate discussions with students. Students can also collect answers to practice questions to be assessed directly by educators and discuss privately. Thus, it is anticipated that learning machining theory will be more effective.

This study's objective is to determine the impact of using flipped classroom with Google Classroom to teach machining theory. The results will be used to evaluate e-learning in the Mechanical Engineering Education Study Program (PS-PTM).

2. Method

This is a quasi-experimental study that aims to approximate the information that can be obtained through actual experimentation under conditions that do not permit the control or manipulation of all relevant variables.

In this study, there are two types of variables: the dependent variable and the independent variable. In this study, the independent variable is the flipped classroom learning model supported by Google Classroom and traditional learning, and the dependent variable is the student learning outcomes in the machining theory course. This research was conducted at PS-PTM, Faculty of Engineering, State University of Medan for class A and class B students in the 2019/2020 odd semester.

Cluster random sampling will be utilized to select a single class. This research employs a Post Test Only Control Group Design. This design was chosen because it was not possible to alter the existing class during the experiment. The data on learning outcomes were then analyzed in order to test hypotheses.

3. Results and Discussion

3.1 Descriptive Statistical Analysis Results

Table 1. Descriptive Figures Learning Outcome Measurement Class Treatment of Machining Theory.

Statistical	Statistical Value
Mean	72,08
Modus	75,8
Maksimum	92,0
Minimum	52,0
Number of samples	34
Standar Deviation	9,60

Table 2. Descriptive Figures Learning Result Score Comparative class on machining theory.

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Statistical	Statistical Value
Mean	63,44
Modus	64,5
Maksimum	81,0
Minimum	45,0
Number of samples	35
Standar Deviation	8,45

3.2 Inferential Statistical Analysis Results

After using the PSPP statistical application to analyze the learning outcomes of each class's machining theory, the following table is obtained.

Table 3. Group Statistic.

	group	N	Mean	Std. Deviation	S.E. Mean
final_test	Treatment	34	80,05	9,60	1,64
	comparation	35	64,45	8,92	1,51

According to the above table, there are 34 students with learning outcomes in the treatment group (class), while there are 35 students in the comparison group. The mean or average value of student learning outcomes for the intervention group is 80.05, compared to 64.45 for the control group. Consequently, descriptive statistics indicate that there is a difference between the treatment group and the comparison group in terms of the average learning outcomes of the students. In addition, the following table must be interpreted to demonstrate whether the difference is statistically significant or not.

Table 4. Independent Samples Test.

		Levene's Test for Equalityof Variances		t-test for Equality of Means						
		F	**Sig.**	**t**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**Lowe r**	**Upper**
tes_akhir	Equal variances assumed	0,29	0,595	3,88	67,00	0,000	8,64	2,23	4,19	13,08
	Equal variances not assumed			3,87	66,33	0,000	8,64	2,23	4,18	13,09

According to the Independent Samples Test table, the value of Sig. Levene's Test for Equality of Variances is 0.595 > 0.05, indicating that the data variance between the treatment group and the comparison group is identical. So that the interpretation of the table above is guided by the values in the row table titled "Assuming equal variances," or the two population variants are identical. In the Mean Difference column, the magnitude of the average or mean difference between the two groups is displayed. Since it is positive, this indicates that the first group (treatment class) has a higher mean score than the second group (comparison class).

Examining the Sig value column to make the initial decision. required t count (2-tailed) or P_{value}

If Sig. t count ≥ 0,05 then $H0$ is accepted
If Sig. t count < 0,05 then $H0$ is rejected [11]

Given that Sig. t arithmetic is governed by the Equal Variances Assumed line, the value of Sig. t count is 0.0001. Consequently, since Sig. t count is less than 0.05, either H_0 or H_1 must be rejected.

For the second decision making using t_count and t_table the test criteria are: (1) H_0 is accepted if $< t < t_{1-\alpha}$; and (2) H_0 is rejected if $t \geq t_{1-\alpha}$. It is known that t-count = 3.88 and t-table (67, 0.025) = 1.99601, because t-count > t-table, then $H_0$is rejected or there is not enough evidence to accept H_0. So, in conclusion, the learning outcomes of machining theory using the flipped classroom learning model assisted by Google Classroom are better (positive influence) compared to learning outcomes using conventional learning.

4. Conclusion

This study concludes that the flipped classroom learning model assisted by Google Classroom that is applied to the machining theory course is effective, as evidenced by the results of PS-PTM students at the Faculty of Engineering at the State University of Medan who are taught machining theory using the flipped classroom learning model assisted by Google. The classroom is superior to the learning outcomes of PS-PTM students, the Faculty of Engineering, and the State University of Medan taught with conventional learning models.

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