

Implementation of *Project Based Learning* by *SolidWorks* Application in Online Learning during the COVID-19 Pandemic

Bastian Rikardo Parhusip^{1,*}, Taufik Wisnu Saputra², I. Marko Ayaki³

¹Pendidikan Teknik Mesin Fakultas Teknik Universitas Negeri Manado

²Pendidikan Teknik Mesin Fakultas Teknik Universitas Negeri Solo

³Pendidikan Teknik Mesin Fakultas Keguruan dan Ilmu Pendidikan Universitas Palangka Raya

*Corresponding author: bastianrikardo@unima.ac.id

Received May 22, 2021; Revised June 28, 2021; Accepted July 07, 2021

Abstract The objective of this study is to see an overview or analyze: (1) student learning activity during the pandemic through online learning using the University's LMS. (2) See the improvement of students' drawing skills in Drawing Machine II courses by using Solidworks application. This research was conducted using Quasi Experiment method and qualitative descriptive. Quasi Experiment design applied in this study is One group Pretest-posttest design. Data analysis techniques in this study using the help of spss application /software statistics version 25 for Mac. The purpose of the data analysis technique is to see improved learning outcomes of Drawing Machine II by implementing the Project Based Learning model using the Solidworks application. The data analysis in this study uses non-parametric statistical analysis. The non-parametric statistics used in testing the average comparison hypothesis are independent t-test samples, with wilcoxon test techniques. The results achieve that: (1) The implementation of Project based Learning by using Solidworks in online learning during the Covid-19 pandemic is proven to increase student activity, as evidenced by the observation of activeness, readiness, and giving rise to ideas or ideas above 90% ("Very active" category). (2) Implementation of Project based Learning by using Solidworks in online learning is proven to improve university student skills/psychomotor knowledge. This is indicated by the value based on the table output "Independent Samples Test" can be known that the significance value of $0.00 < \alpha$ (0.05), then the H 1 hypothesis is accepted and it can be concluded that there is a significant difference between the average pretest and posttest learning outcomes.

Keywords: *E-learning, engineering drawing, mechanical drawing, learning management system*

Cite This Article: Bastian Rikardo Parhusip, Taufik Wisnu Saputra, and I. Marko Ayaki, "Implementation of *Project Based Learning* by *SolidWorks* Application in Online Learning during the COVID-19 Pandemic." *American Journal of Educational Research*, vol. 9, no. 7 (2021): 431-434. doi: 10.12691/education-9-7-6.

1. Introduction

Education is one of the things that can not be separated from the goal of the Indonesian nation is to improve the quality and quality of human resources that are superior and competitive. Education is very important in helping a person to achieve his success and goals, (Gejdoš & Prachárová, [1]) said that the goal of education is to shape children into active and creative beings. According (Sistem Pendidikan Nasional [2]) pasal 1 ayat 1 tentang sistem pendidikan Indonesia, "Pendidikan merupakan salah usaha sadar dan terencana untuk mewujudkan suasana belajar dan proses pembelajaran agar peserta didik secara aktif mengembangkan potensi dirinya untuk memiliki kekuatan spiritual keagamaan, pengenalan diri, kepribadian, kecerdasan, akhlak mulia, serta keterampilan yang diperlukan dirinya, masyarakat, bangsa dan Negara".

Mechanical Engineering Education is one of the departments in the faculty of engineering Manado State University. In the process of studying in the majors there are many courses that must be completed by students to be qualified to become undergraduates. The department of mechanical engineering education emphasizes the skills and competencies of students in the field of Machining, with the reason that graduates can be absorbed in the job market, especially as educators in vocational high schools.

Learning from home and working from home became government policy during the Covid-19 pandemic, learning from home is certainly not an easy thing for an educator. Where all material governance and classroom governance changed drastically, when learning is done online it turns out that not all courses can be applied online. One example is the course of drawing machine II. The course of drawing machine II is a practicum course that is basically carried out in a drawing laboratory or drawing studio.

In the online learning applied today, the author takes concrete steps so that learning can still run well, students remain active and productive at home and the competence of students' drawing skills increases. The achievement of knowledge learning in this course is that students are able to master the process of making work drawings in accordance with international standards, the achievement of general skills is that students are able to apply and improve skills in accordance with the demands of industry 4.0, and the achievement of special skills is that students are able to design and design a product that is useful for the solidworks-based community environment and apply it as society service.

The steps applied to be able to achieve the above learning achievements become a challenge for the author, where the author should be able to turn the student's home into an image studio or drawing laboratory. learning content and media must be modified in such a way that students can take lessons online.

Based on some obstacles that occurred in the learning environment during the Covid-19 pandemic, the authors modified the learning system and learning methods, namely machine drawing learning II by using Solidworks Software. Solidworks is a modern design assisted computer program or also called Computer aided design (CAD). The program allows students to mathematically create the correct solid model of an object, which can later be stored in a database. Solidworks can be used to simulate and predict the final result of a single drawn product and also contains the information needed to inspect and assemble the product (Onwubolu, [3])

Implementation of Solidworks in Machine Drawing courses, performed using *Project based learning* model. Project Based Learning is a learning activity that emphasizes the results of learning in the form of a product, where the result of learning is a product. products in the form of Ideas, writings, objects, and articles. project based *learning* model is a learning model that uses the project as the core of learning activities (Hosnan, [4]). In online learning activities, students learn independently with the help of youtube and online learning is conducted through the Learning Management System (LMS) at the university. This LMS is a place for students to ask questions, collect assignments and learn through video conferences.

The purpose of this study is to see an overview or analyze the: 1) student's active learning during the pandemic through online learning using lstudent learning activity during the pandemic through online learning using the University's Learning management system. 2) Seeing the improvement of students' drawing skills in the course Drawing Machine II.

2. Research Method

This research was performed by quasi-experimental and descriptive qualitative method. Experimental research according to the authors is: an experiment conducted and accompanied by one treatment or action, then assessed using an instrument to see, analyze, evaluate and test hypotheses. According to (Sugiyono, [5]) Descriptive research is research conducted to determine the value of independent variables, either one or more variables

(independent) without making comparisons or connecting between variables with each other, qualitative data is data expressed in the form of words, sentences, and images. in this study conducted by involving the entire population of the. The experimental class consisted of 22 students. The quasi-experimental research scheme applied in this study is *one group pretest-posttest design*.

Table 1. Research Design: One Group Pretest-Posttest Design

Pretest/ Initial value	Treatment	Posttest/ final value
T ₁	X	T ₂

Quasi experiment research scheme chosen for consideration of the Phenomenon or Pandemic Covid-19 that going, which resulted in all learning being done online. This scheme is an experimental study in which the initial stage of data collection in the form of midterm exam results, then given treatment with the application of Project Based Learning learning model with the help of Solidworks software for seven meetings and in the posttest conducted at the end of the semester exam.

This research was conducted in the course of Drawing Machine II in the department of Mechanical Engineering education Faculty of Engineering Manado State University. The research time was conducted in the even semester of the 2019/2020 school year. The subjects studied in this study were the entire population of Drawing Machine II class A (5332223) which amounted to 22 peoples. Since all populations are taken and used as research samples, this study is a Population study (Suharsimi, [6]).

The data collection techniques used in this study are: 1) The test, used to measure student drawing learning outcomes, is given in the form of Perspective drawings, two-dimensional drawings and Jobsheets. Pretest results are obtained from the results of the midterm exams of students at the 8th meeting, and the posttest results are taken from the results of the final exam of the semester at the 16th meeting. 2) Non-test, which is an observation sheet of students' online learning activities in the form of research work (technical drawings) and activeness of students in working on and collecting project tasks that are seen directly in the Learning Management System of Manado State University. The validity of the instruments used in this study is the validity of the construct (Sukardi, [7]), explain that the validity of the construct is an instrument that is constructed based on aspects that will be measured in accordance with the relevant theory, then further consulted to experts. The validity of a construct is an illustration that shows the extent to which the measuring instrument shows results that fit the theory (Ihsan, [8]).

Data analysis techniques in this research using spss statistical application/software help version 25 for Mac. The purpose of data analysis techniques is to see improved learning outcomes of Drawing Machine II by implementing a *solidworks* application-assisted *project based learning* model. Data analysis in this study using non-parametric statistical analysis. Non-parametric statistics used in testing the average comparison hypothesis are independent tests of *t-test samples*, with techniques *Wilcoxon Test*, significance (α) of 0.05. The

hypothesis in this study is $H_0 =$ There is no difference in the average study outcomes of students in the pretest and posttest groups and $H_1 =$ There is an average difference in the results of the study masiswa pretest and posttest group.

3. Results and Discussion

3.1. Students Activities

1) Student Readiness

During the learning process, observations from researchers showed that 90% of students were ready to take part in the lesson. Judging from the presence of students, the readiness of practical tools in the form of Computers and Solidworks applications that have been installed on each student's computer. There are 10% of students who are not ready to take drawing lessons online due to inadequate network factors, economic factors so that students do not have computers. The follow-up given by the researchers to anticipate 10% of students who are not ready to take lessons is to form small groups, so that students can share drawing props with each other.

2) Take online lessons enthusiastically.

In online learning activities, researchers found that 90% of students are very enthusiastic in taking lessons. Judging from the response of students when asking questions, answering questions and discussing with colleagues during the lesson.

3) Students' timeliness in completing assignments

Evaluate from the results of student study in the form of assignments, 100% of students who in the sense of 22 students collect assignments on time and observation results show that the results of the assignment competent students

4) Bring ideas and ideas to online learning.

During online learning, students always come up with ideas for their independent assignments, some students ask to create energy-efficient car design drawing projects to be included in national-level contests.

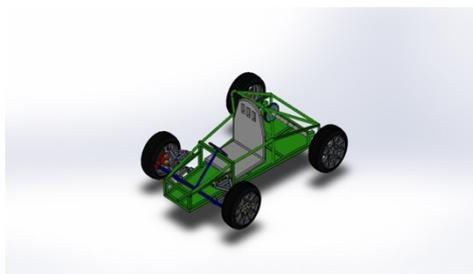


Figure 1. Student Group Image Results

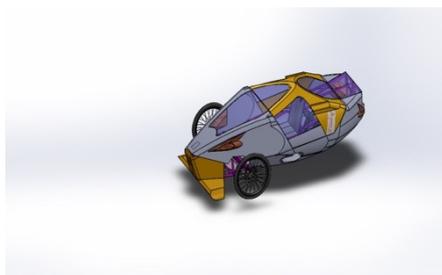


Figure 2. Student Group Image Results

3.2. Student Practicum Learning Outcomes

The results of students' practicum study can be seen in the explanation below. Technical implementation of research on PTM students class A second semester in the department of Mechanical Engineering Education faculty of engineering Manado State University that is by carrying out learning using the model of Learning Project Based Learning assisted By *Solidworks* Software. Pretest grades are obtained from the results of the midterm exams of students. Experiments or *treatments* are conducted on online learning using the Learning Management System of Manado State University by applying a Project based learning model. Each meeting is given one project as a student assignment. Tutorials using *Solidworks software* are provided through video tutorial writers that students can see on youtube accounts. Students learn from video conferences available in the *Learning Management System* as well as video tutorials that the author has provided. Online learning lasts seven meetings.

1) Normality Test Of Students Practicum Learning Outcomes

Table 2A. Test Of Normality

Tests of Normality						
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	,213	21	,014	,933	21	,155
Postest	,205	21	,021	,931	21	,144

Table 2B. Descriptives Test Of Normality

Descriptives				
			Statistic	Std. Error
Pretest	Mean		71,19	2,286
	95% Confidence Interval for Mean	Lower Bound	66,42	
		Upper Bound	75,96	
	5% Trimmed Mean		71,30	
	Median		75,00	
	Variance		109,762	
	Std. Deviation		10,477	
	Minimum		50	
	Maximum		90	
	Range		40	
	Interquartile Range		18	
	Skewness		-,060	,501
	Kurtosis		-,409	,972
Postest	Mean		85,48	2,096
	95% Confidence Interval for Mean	Lower Bound	81,10	
		Upper Bound	89,85	
	5% Trimmed Mean		85,78	
	Median		90,00	
	Variance		92,262	
	Std. Deviation		9,605	
	Minimum		65	
	Maximum		100	
	Range		35	
	Interquartile Range		18	
	Skewness		-,336	,501
	Kurtosis		-,700	,972

Based on the output Table 2 "Test Of Normality" it can be known that the significance value of *kolmogorov smirnov kolmogorov* normality test for both pretest and posttest variables is greater than α (0.05) with test statistics for the variable pretest 0.213 and variable posttest 0.205 so that it can be said that both variables are normally distributed, so it can be said that the data has met the assumption of normality. From the output table descriptive statistics can also be seen that the average value of posttest variable is 71.9 lower than the pretest variable of 85.48. From the standard deviation can also be seen that for both variables have a low standard deviation means that the data does not deviate too much from the average.

2) Homogeneity test Of Students Practicum Learning Results

Table 3. Test of Homogeneity of Variances

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
Hasil Belajar	Based on Mean	,122	1	40	,728
	Based on Median	,011	1	40	,916
	Based on Median and with adjusted df	,011	1	39,810	,916
	Based on trimmed mean	,121	1	40	,730

Based on the output Table 3 "Test of Homogeneity of Variances" it can be known that the value of homogeneity test results of student practicum study is greater than α (0.05) with *levene* test statistics 0.122 so it can be said that the diversity of data on student practicum learning outcomes is the same or homogeneous so that the data of student practicum learning results have met the assumption of homogeneity.

3) Hypothesis Test

Table 4. Group Statistics

Group Statistics					
		N	Mean	Std. Deviation	Std. Error Mean
Hasil Belajar	Pretest	21	71,19	10,477	2,286
	posttest	21	85,48	9,605	2,096

Based on Table 5 output "Independent Samples Test" it can be known that the significance value is $0.00 < (0.05)$ means the H1 hypothesis is accepted. It can be concluded that there is a significant difference between the average pretest and posttest learning outcomes. Furthermore, the results of the output table "Independent Samples Test" can be known that t count is negative which is -4,606 which means that the value of the first group study results (pretest) is lower than the value of the second group study results (posttest), so it can be concluded that the value of student posttest learning outcomes is better than the pretest.

Table 5. Output Independent Samples Test

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
Hasil Belajar	Equal variances assumed	,122	,728	-4,606	40	,000	-14,286
	Equal variances not assumed			-4,606	39,702	,000	-14,286

4. Conclusions and Suggestions

Based on the results of discussion and analysis of data, it can be concluded that: (1) Implementation of Project based Learning by using Solidworks in online learning during the Covid-19 pandemic is proven to increase student activity, as evidenced by the observation of activeness, readiness, and bring up ideas or ideas. (2) Implementation of Project based Learning by using Solidworks in online learning is proven to improve student skills/psychomotor knowledge.

References

[1] Gejdoš, M., & Prachárová, I. (2020). FRÖBEL'S BOOK "THE EDUCATION OF MAN" AND ITS PEDAGOGICAL LEGACY.

International Journal of New Economics and Social Sciences, 11(1).
 [2] Sistem Pendidikan Nasional. (2003). Undang-Undang No.20 Tahun 2003. *Departemen Pendidikan Nasional*.
 [3] Onwubolu, G. C. (2017). Introduction to SOLIDWORKS. In *Introduction to SOLIDWORKS*.
 [4] Hosnan, M. (2014). Pendekatan Saintifik dan Kontekstual dalam Pembelajaran Abad 21. In *Ghala Indonesia*.
 [5] Sugiyono. (2018). Metode Penelitian Kuantitatif, Kualitatif dan R&D. In *Ke-26*.
 [6] Suharsimi, A. (2013). Prosedur Penelitian: Suatu Pendekatan Praktik (Edisi Revisi). *Jakarta: Rineka Cipta*.
 [7] Sukardi. (2013). Metodologi penelitian pendidikan: kompetensi dan praktiknya / Sukardi. In *I. PENDIDIKAN - METODOLOGI PENELITIAN, Metodologi penelitian pendidikan: kompetensi dan praktiknya / Sukardi*.
 [8] Ihsan, H. (2015). VALIDITAS ISI ALAT UUKUR PENELITIAN: KONSEP DAN PANDUAN PENILAIANNYA. *PEDAGOGIA Jurnal Ilmu Pendidikan*.

