

Application of Flipped Classroom to Student Learning Outcomes in Object Oriented Programming Courses

Sri Ilyen¹ and Wakhinuddin²

^{1,2}Universitas Negeri Padang

Abstract— Productive Subjects of Object Oriented Programming have the 2nd densest learning hours after web programming. For this reason, 21st century learning models and approaches are needed that are able to overcome the complexity of these subjects. From these conditions the Flipped Classroom model is one of the 21st century learning models that can be used in PBO subjects. Because in this model, students have broad flexibility to study learning materials independently, make a list of questions, before being discussed in school (concepted). The type of research in this study is a quasi-experimental research with a quantitative approach. The results of the study stated that the flipped classroom model could improve student learning outcomes.

Keywords— flipped classroom, learning, student, OOP, object oriented programming, courses.

INTRODUCTION

The concept of Society / Society 5.0 is a concept where humans are centered on humans themselves (human centered), technology becomes part of humans themselves (based technology) and the internet no longer acts as a means of sharing information, but to live life. Society 5.0 has emerged as a form of development of the Industrial Revolution 4.0 which is considered to have the potential to degrade human roles. So that the virtual world and the real world are integrated with the help of technology such as AI, robots, IoT and others in serving human needs. Thus, citizens can feel comfortable and enjoy life (Polat & Erkollar, 2021).

However, this results in disruption (Hasrul et al., 2019). Afriyanto (In Dito & Pujiastuti, 2021), stated that the education sector was one of the sectors most affected by the two revolutions. The revolution disrupted various human activities in various fields, not only in the field of technology, but also in other fields such as economics, social, politics and of course, which also underwent major changes in the field of education. The meaning of disruptive here is a condition in which certain fields are required to innovate according to the times, so that they are able to meet not only current needs, but even predict and anticipate future needs.

Meanwhile, Zhou et al (In Polat & Erkollar, 2021), conveyed that there are five major challenges that will be faced in the Revolutionary Era 4.0 & Society 5.0, namely aspects of knowledge (education), technology, economy, social, and politics. This means that the world of education is faced with more complex challenges, in preparing its students to be able to compete in the Revolutionary Era 4.0. The biggest challenge is felt in vocational education at the high school level or known as Vocational High School (SMK). This is because the

competency standards of SMK graduates are prepared for experts in the vocational field, independent, and ready to enter the world of work (Permendikbud No. 5 of 2022).

According to (Redhana, 2019) In order for graduates to be able to excel and be competent in the 21st century (disruption of revolution 4.0 & society 5.0), 21st century skills are needed. Based on this, the Indonesian Ministry of Education and Culture in curriculum development, adopts 21st century skills or known as 21st Century Skills (Trilling & Fadel, 2009). As depicted in the image below.

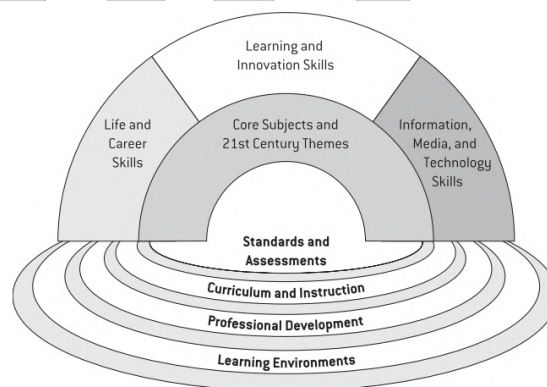


Figure 1: Rainbow of 21st Century Learning

Currently, the Ibn Sina Vocational High School is implementing the second option, namely a simplified emergency curriculum. In implementing this emergency curriculum, SMKS Ibnu Sina Batam reduces basic competencies for each subject and focuses on essential competencies and prerequisite competencies for continuing learning at the next level. This means that in this emergency curriculum, education units are given the freedom to simplify the 2013 curriculum independently. One of the productive subjects that has been simplified is the Object Oriented Programming Subject, in Class

XI, Department of Software Engineering. This is caused by:

1. The complexity of learning materials.
2. Short learning time.
3. The existence of Industrial Work Practice activities in semester 2, causes 2 semesters of material to be accelerated in 1 semester.

This can be seen in the following picture of the Software Engineering Department Curriculum Spectrum:

Table 1: RPL Curriculum Spectrum

MATA PELAJARAN	KELAS					
	X		XI		XII	
	1	2	1	2	1	2
A. Muatan Nasional						
B. Muatan Kewilayahan						
C. Muatan Peminatan Kejuruan						
C1. Dasar Bidang Keahlian						
1. Simulasi dan Komunikasi Digital	3	3	-	-	-	-
2. Fisika	3	3	-	-	-	-
3. Kimia	3	3	-	-	-	-
C2. Dasar Program Keahlian						
1. Sistem Komputer	2	2	-	-	-	-
2. Komputer dan Jaringan Dasar	5	5	-	-	-	-
3. Pemrograman Dasar	3	3	-	-	-	-
4. Dasar Desain Grafis	3	3	-	-	-	-
C3. Kompetensi Keahlian						
1. Pemodelan Perangkat Lunak	-	-	4	4	-	-
2. Basis Data	-	-	4	4	4	4
3. Pemrograman Berorientasi Objek	-	-	8	8	8	8
4. Pemrograman Web dan Perangkat Bergerak	-	-	8	8	13	13
5. Produk Kreatif dan Kewirausahaan	-	-	7	7	8	8
Jumlah C	22	22	31	31	33	33
Total	46	46	48	48	48	48

From the picture above, it can be seen that Productive Subjects (C3) Object Oriented Programming (PBO) have the 2nd densest learning hours after web programming. For this reason, 21st century learning models and approaches are needed that are able to overcome the complexity of these subjects. From these conditions the Flipped Classroom model is one of the 21st century learning models that can be used in PBO subjects. Because in this model, students have broad flexibility to study learning materials independently, make a list of questions, before being discussed in school (concepted). According to Muzyka & Luker(In Pinontoan & Walean, 2020), Flipped Classroom as a situation where students get an understanding (exposure) of learning materials before class and face-to-face active learning. This indirectly fosters a student center learning pattern so that it can foster student independence, anticipate the complexity of learning materials and the limited learning time at school.

Pinontoan & Walean (2020), stated that the application of Flipped Classroom-Google Classroom had a positive effect on increasing the average score of learning outcomes and students' learning motivation scores. This means that in addition to fostering learning

independence, overcoming complexity, overcoming time constraints and improving learning outcomes, it can also increase student motivation in learning. According to the opinion of(Handoko & Waskito, 2018), flip classroom is a change of position from activities in class to activities at home. Students understand the subject matter from the teacher online at home, through online learning platforms, then in offline meetings the lecturer/teacher guides students to do exercises, discussions, presentations, or work on certain projects.

Besides that,(Farida et al., 2019), stated that Flipped Classroom is defined as the art of teaching that positions students to learn learning materials at school through audio/video media at home. Meanwhile, face-to-face activities are used in group discussions/questioning activities. Graham Brent(In Zuardi Atmadinata, et al 2019), stated that Flipped Classroom is a strategy that utilizes technology in providing additional learning materials so as to be able to support these learning materials for students and can be accessed online. So, in Flipped Classroom learning materials are studied independently at home first through video media, modules/handouts, etc., assisted by online platforms (LMS, Google Classroom, etc.). Then discussed, presented/practiced offline at school. SMKS Ibnu Sina Batam applies the Flipped-Classroom Model to object-oriented programming (PBO) subjects.

The choice of PBO subjects was due to the complexity of the subject matter. While learning time (practice & theory) in schools is very limited, the lack of independence of students in learning PBO is evidenced by the scores of students in PBO subjects which are much below the KKM. In addition, several studies have been conducted (Muslimawati et al., 2019), shows that Flipped Classroom learning is proven to be able to improve student learning outcomes. As research has been done by Fulton (2012) that the fipped classroom model can increase PBO learning outcomes by 73.8% in Bryon High School. Astri Pratiwi, et al (2017) conducted a study which showed that learning using the Flipped Classroom model had an effect of 27.04% on the learning outcomes of students in class XI MIPA SMA Negeri 8 Pontianak on the solubility material. Meanwhile, Jonathan D. Tune, et al (2013) conducted a study that showed an increase in student test performance on kidney physiology material.

METHOD

The type of research in this study is a quasi-experimental research with a quantitative approach. Experimental research intends to determine the effect of treatment on

the object of research under controlled conditions (Sugiyono, 2015). While the technique used is a quasi-experimental design category of non equivalent control group design. The non equivalent control group design is an experimental design with no random selection for determining the experimental and control groups (Sugiyono, 2016).

The reason the researcher uses a quasi-experimental design category is the non-equivalent control group design category because the research subject already has a natural group formed, for example, a group of students in one class, so that in the field of education, research activities are not required to select respondents randomly.

In the implementation process, the researcher gave an initial test (pre-test) and a final test (post-test) to determine learning outcomes in the experimental group and the control group. The learning process is carried out differently where the experimental group uses the Flipped Classroom model while the control group uses the conventional model.

The student's ability test before treatment (pre-test) and after treatment (post-test) aims to determine how high the influence of the applied learning model can improve student learning outcomes in the experimental group and control group.

The Flipped Classroom Learning Model with a Problem Based Learning (PBL) approach is an independent (free) variable X. This variable affects the surrounding dependent variables, namely independence and student learning outcomes. The steps for implementing this learning model include:

- a. Orientation (preparation), in this stage students are given direction by the teacher first, about Flipped Classroom learning activities (inverted class). Both out class and inn class activities. In out class activities (at home). Uploading video/module material that is shared through the Google Classroom platform. Then students watch the video and study the material in the module independently at home. After that students make some important questions to be discussed at school.
- b. Organizing Students, the teacher divides several groups to work on tasks in the form of solving a case, which is related to everyday life. then students search for and collect data, tools or problem-solving materials through discussion activities.
- c. Guiding the investigation, the teacher monitors the activities of student involvement in collecting data/investigation materials.

- d. Developing and presenting the work, the teacher monitors the discussions carried out by the students or the coding practice activities carried out by the students.
- e. Analyzing and evaluating the problem-solving process, the teacher guides group presentations, then together the students conclude, make a summary.

Learning outcomes are variables that are affected by the application of the flipped classroom learning model. The learning outcomes in this study are the final test scores or scores obtained by students in PBO subjects.

The test used to measure student learning outcomes is an object test in the form of objective questions with a grid of questions attached in the appendix. Learning outcomes can be seen from learning activities and scores from the assessment of student learning activities.

Normality is intended to determine the data that has been collected is normally distributed or taken from a normal population. The normality test in this research is using the liliefors formula (Sudjana, 2005: 466). The liliefors method uses raw or unprocessed basic data in the frequency distribution table.

The data is changed in Z value so that it can be calculated on the area of the normal curve as the probability is sought for the difference with the probability being distinguished from the empirical cumulative probability.

Biggest difference than with Lilliefors table. Normality testing in this study was carried out with the help of the IBM SPSS 28.0 application.

Homogeneity is used to test whether the two data are homogeneous, by comparing the two variances. Homogeneity test is used to test whether in a t-test model the data is homogeneous or not. To simplify the calculations, researchers used the help of the SPSS 28.0 program. for windows, with the following criteria:

- 1) if the significant value < 0.05 then the data has a variant that is not homogeneous
- 2) if the significant value > 0.05 then the data has a homogeneous variance.

RESULTS

Based on the data processing of pbo learning outcomes of students who were taught using the flipped classroom learning model in the experimental class and conventional learning models in the control class.

Table 2: Results of Data Analysis of Learning Outcomes

	Descriptive Statistics						
	N Statistic	Minimum Statistic	Maximum Statistic	Sum Statistic	Mean Statistic	Std. Error	Std. Deviation Statistic
Hasil Belajar Kelas Eksperimen	24	33	95	1706	71.08	3.576	17.520
Hasil Belajar Kelas Kontrol	24	33	90	1440	60.00	4.020	19.693
Kemandirian Tinggi Kelas Eksperimen	12	108	129	1401	116.75	1.826	6.326
Kemandirian Rendah Kelas Eksperimen	12	83	108	1198	99.83	1.953	6.767
Kemandirian Tinggi Kelas Kontrol	12	108	120	1362	113.50	1.177	4.079
Kemandirian Rendah Kelas Kontrol	12	74	106	1133	94.42	2.838	9.830
Valid N (listwise)	12						

When viewed from the learning outcomes in the analysis of learning outcomes above, the experimental class obtained a higher score than the control class. This can be seen in the average value (Mean) of the two classes, namely for the experimental class 71.08 while the control class is 60.00 with the same number of students, namely 24 students in each class. Furthermore, for students who have high learning independence, the average value is also higher than students who have low learning independence, it can be seen from the average value in the high learning group in the experimental class, which is 116.75 while the average value in the high learning group in the control class is 113, 50 and from this table it is also seen that the learning model and independence also influence learning outcomes, meaning that students who have high learning independence who are taught using the Flipped Classroom model get higher results compared to students who have high learning independence who are taught by the learning model. conventional. The learning outcomes of the experimental class and the control class for the high and low groups have been previously divided into

groups with high learning independence and low learning independence. The division of learning independence groups in the experimental class can be seen in the appendix.

Based on the Kolmogorov-Smirnov normality test, the PBO learning outcomes test data whose learning was using the Flipped Classroom model and the conventional learning model were tested for normality at a level > 0.05 . The results showed that students whose learning using the Flipped Classroom model and conventional learning models were normally distributed, because the significance value or probability value in the experimental class learning outcomes was $0.11 > 0.05$, while the control class was $0.131 > 0.05$, so it can be concluded that learning outcomes data used in this study were normally distributed.

Homogeneity test was conducted to determine whether the two groups of data had homogeneous variance or not. The results of the homogeneity test of the research data were obtained using the help of SPSS version 26 with the results as shown in table.

Table 3: Homogeneity Test of Learning Outcomes

		Levene Statistic	df1	df2	Sig.
Hasil Belajar PBO	Based on Mean	1.927	1	46	.172
	Based on Median	2.167	1	46	.148
	Based on Median and with adjusted df	2.167	1	42.350	.148
	Based on trimmed mean	2.022	1	46	.162

Based on table 4.9, it can be seen that the value of Based On Mean Significance for learning outcomes is 0.172 which means > 0.05 , it can be taken a decision

CONCLUSIONS

Based on the research objectives and research hypotheses that have been carried out on students of

that the student learning outcomes data obtained in this study are homogeneous or have the same variance.

class XI Software Engineering SMKS Ibnu Sina Batam regarding the Effect of Application of the Flipped Classroom Model on Improving Results and Learning Independence of SMKS Ibnu Sina Batam

Students in PBO Learning are as follows, There is a positive and significant influence between the variables of the application of the Flipped Classroom (X1) model on the PBO learning outcomes (Y2) for

the XI students of Software Engineering SMKS Ibnu Sina Batam. Thus it can be stated that the application of the flipped learning model can improve student learning outcomes.

REFERENCES

- [1] Dito, S. B., & Pujiastuti, H. (2021). Dampak Revolusi Industri 4.0 Pada Sektor Pendidikan: Kajian Literatur Mengenai Digital Learning Pada Pendidikan Dasar dan Menengah. *Jurnal Sains Dan Edukasi Sains*, 4(2), 59–65. <https://doi.org/10.24246/juses.v4i2p59-65>
- [2] Farida, R., Alba, A., Kurniawan, R., & Zainuddin, Z. (2019). Pengembangan Model Pembelajaran Flipped Classroom Dengan Taksonomi Bloom Pada Mata Kuliah Sistem Politik Indonesia. *Kwangsan: Jurnal Teknologi Pendidikan*, 7(2), 104. <https://doi.org/10.31800/jtp.kw.v7n2.p104--122>
- [3] Handoko, H., & Waskito, W. (2018). Blended Learning: Konsep dan Penerapannya. In *Blended Learning: Konsep dan Penerapannya*. <https://doi.org/10.25077/car.64.60ab>
- [4] Hasrul, M. I., Suhariato, J., Lubis, R. A., & Marbun, M. (2019). Revolusi Industri 4.0 dalam Dunia Pendidikan dari Sisi Pembelajaran Berbasis Blended Learning. *Prosiding Seminar Nasional Teknologi Pendidikan Pascasarjana UNIMED*, 1, 290–293.
- [5] Muslimawati, Z. Z., Surahman, E., & Ramdani, D. (2019). Pengaruh Model Pembelajaran Flipped Classroom Terhadap Hasil Belajar Peserta Didik Pada Materi Sistem Ekskresi The Effect Of Flipped Classroom Learning Model Toward Student ' S Learning Outcomes In Excretory. 208–212.
- [6] Pinontoan, K. F., & Walean, M. (2020). *Edcomtech*. 51–60.
- [7] Polat, L., & Erkollar, A. (2021). Industry 4.0 vs. Society 5.0. In *Lecture Notes in Mechanical Engineering* (Issue September). https://doi.org/10.1007/978-3-030-62784-3_28
- [8] Redhana, Wayan. 2019. "Mengembangkan Keterampilan Abad Ke-21 Dalam Pembelajaran Kimia" *Jurnal Inovasi Pendidikan Kimia*, Vol 13, No 1, 2019, halaman 2239 – 2253.
- [9] Sudjana. (2005). *Metode Statistika*. Bandung: Tarsito
- [10] Sugiyono. (2015). *Metode Penelitian Pendidikan Cet. 22*. Bandung: Alfabeta.
- [11] Trilling and Fadel. 2009. *21st century skills: learning for life in our times*. Jossey Bass: USA