

INTEGRATING PEER TUTORING VIDEO WITH FLIPPED CLASSROOM IN ONLINE STATISTICS COURSE TO IMPROVE LEARNING OUTCOMES

Ramadoni^{1*}, Kao Tai Chien²

¹Universitas PGRI Sumatera Barat, Indonesia

²National Dong Hwa University, Taiwan

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ABSTRACT

Online learning has become a solution in the field of education lately. Statistics is one of the subjects students must take at the university level. Learning statistics takes work for students. Based on the author's investigation, there are three obstacles to students in online learning: the constraints of students in understanding the material, the online learning process, and the assignment process. The sample in this study is a student with an Indonesian worker background in Taiwan, where they study online at night. Since an appropriate online learning method is needed to achieve student success, this study analyzes three online learning methods: conventional online learning, conventional flipping classes in online learning, and innovative flipped classrooms in online learning. This study investigates the three learning methods' results in differences in gender, job, and age. The results obtained indicate that there are significant differences in student learning outcomes in the three sample groups. Further analysis showed that the innovation of flipped classrooms in online learning significantly differs from the other two learning methods. Based on the type of job, there are differences in student learning outcomes taught in the conventional flipped classroom in online learning. It was also seen in the analysis of combining all student learning outcomes taught with online learning that there were differences in student learning outcomes regarding the job. A household assistant is better than a factory worker because students who work as household assistants have more flexible time to watch videos and repeat them than those who work as factory workers.

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Corresponding Author:

Ramadoni,
Department of Mathematics Education,
Universitas PGRI Sumatera Barat
Jl. Gunung Pangilun, Padang, West Sumatra 25111, Indonesia.
Email: Ramadoni.100393@gmail.com

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1. INTRODUCTION

Online learning has become one of the solutions for many universities in various countries. Indonesia has legalized the distance class. By legally acknowledging online-based learning in Indonesia has many positive impacts on many students who have financial, time,

and other limitations. This online learning can make it easier for students to learn. They don't need to come into class to learn, and they can know wherever they are. Online learning is beneficial for many students who wish to continue to college but have limited costs, and they can work while in college. As in Taiwan, many Indonesian workers still have a high determination to continue their studies here. Most of them work as household assistants and workers in factories. This research needs to be conducted to determine the best learning method for overcoming students' online learning problems (learning outcomes). The students' issues include understanding the material, issues in the online learning process, and assignment problems. Researchers try to use flipped classroom learning because it is considered capable of helping students who do not have enough time and are in different places. While on the other hand, they all have a high motivation to get a bachelor's degree.

Online-based learning still has obstacles for students in understanding statistical material. Ramadoni and Hafiz (2022) said that many students have difficulty learning statistics online in terms of topics, processes, and assignments. Another study conducted by Zusmelia and Ramadoni (2017) in the city of Padang also revealed that mathematics learning was not liked by 70% of Junior High School, Senior High School, and University level students. Many students who do not like learning mathematics make many researchers who conduct experiments to solve this problem. Since we know that learning mathematics is essential to understand by all students at every level, particularly in statistical subjects, these subjects are mandatory for all undergraduate students in Indonesia. This knowledge is beneficial for research that students must do to complete their degrees. This is in line with research by Zheng et al. (2020), which revealed that three factors that influence online learning are students, instructors, and courses. And a study conducted by Viano (2018) also revealed that there are factors that influence the success of online learning, namely: learning materials, technological skills, skills for learning.

This is the background of researchers conducting experiments on Taiwan Open University students using Flipped Classroom in online learning. Flipped classroom learning is an exchange of learning process between in class and out class time. Students will learn basic knowledge by themselves in the out-class, while in-class stage, students will focus on classroom interaction (Bergmann & Sams, 2012).

Several other studies also revealed about online learning flipped classroom conducted by Wang (2019) maintains that Flipped Classroom learning can facilitate learning that is easily arranged by students, increase student involvement in learning and improve student learning outcomes. Sojayapan and Khlaisang (2020) said that group learning using the flipped classroom method could improve student learning outcomes. Zhu et al. (2020) said that flipped classrooms use shows promising results for the improvement of student learning outcomes and independent learning abilities. Murillo-Zamorano et al. (2019) maintains that flipped classrooms positively impacted students' knowledge, skills, involvement, and satisfaction in learning (Wilson et al., 2019). This study says no significant difference between flipped classrooms and didactic methods with active learning. Flipped classroom learning's weakness is students' uncontrolled learning in mathematics, especially at the learning stage outside the classrooms (Lo et al., 2018). That is why researchers want integrated peer-tutoring video activities.

Wang (2017) reveal that a good learning management system in online learning flipped classrooms will improve learning outcomes. Therefore, in this study, a design of three learning models was carried out. In this study, three sample groups were taken. The first class is taught using online-based learning in a conventional manner. Conventional classes are taught like how online teachers teach as usual, where the teacher provides a complete explanation of the material. The second class is taught using online-based learning by applying a conventional flipped classroom. Conventional flipped classroom where the

teacher provides an explanation video before class and discusses statistical questions in class. The third class is conducted using online-based learning by applying learning innovations to the flipped classroom method. The innovations carried out in the innovation flipped classroom are group learning, students make video tutoring, online discussions, learning using skype, class presentations and discussion questions.

2. METHOD

2.1. Setting and Participants

In this study, three groups of samples were performed. The first class is taught using conventional online learning (COL). The second class is taught using flipped classroom in online learning (CFCOL). The third class is conducted using innovations flipped classroom in Online Learning (IFCOL). This research was conducted in September-December 2018 for online-based learning in the conventional way of 39 students, February-May 2019 for online-based learning by applying conventional flipped classrooms to 21 students, and September-December 2019 for online-based learning by using learning innovations on the flipped classroom method for 26 students. All students in online learning are Indonesian workers in Taiwan. Sometimes, students cannot be too focused on learning when online because some are still working. Although the time taken to study is at 22.00-24.00 Taiwan time in each meeting, some people are still working. So, the solution that can solve it is in groups. With groups, students can develop their abilities, utilize the time they feel is right to learn together outside learning, and help each other in understanding the material. Online learning using Skype application is held every week nine times and face-to-face in class twice in Taipei. At this learning stage, the focus is on online learning design, where classroom learning means online learning using Skype and other steps before and after learning using Skype.

2.2. Experimental Design

This study has a learning design that is described in the experimental design are seen in [Figure 1](#) as follows.

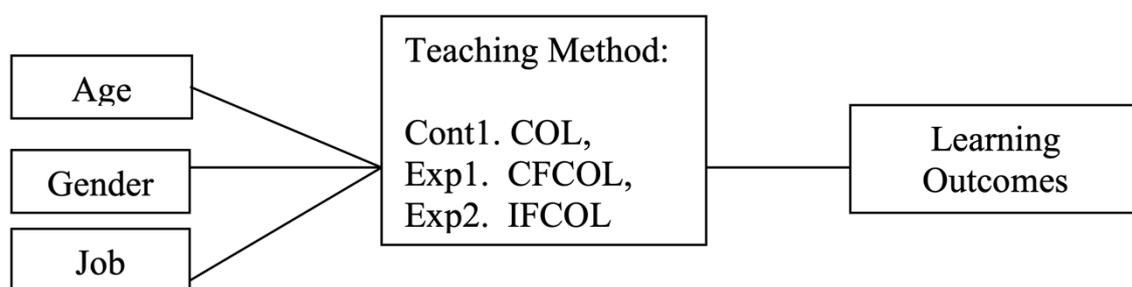


Figure 1. Experimental design

The name of experimental research is post-test only group design. In this study, it is assumed that all students have the same ability because all students in the three sample groups have never taken statistics courses, and all students are freshmen. In this study, the students' learning outcomes were taken, and differences were seen based on Age, Gender, and Job. This test was carried out against age because online learning students' age variation ranged from 20-42 years. This research examines gender because management students taught online have gender differences that are considered to have differences in learning

outcomes and learning abilities. This study also challenges in terms of jobs because the online-based learning process and work in Taiwan have different and uncertain times with each other, so researchers consider testing the differences in work important.

2.3. Instruments

In online learning, there is some equipment that students must have in learning provided by the university is Skype Application. While equipment that must be provided by students themselves in learning is laptops, smartphones, internet, textbooks, and worksheets. While some of the equipment added by researchers are videos, power points, student assessment sheets (learning outcomes, assignments, performance, activity, etc.). The final test questions given consist of 7 questions in essay form.

2.4. Research Procedures

Next explain the research procedures of learning for each method used in three classes:

- a. Online based learning in a conventional method.
 - 1) Classroom Online Learning
 - a) Explanation of the objectives and material discussed.
 - b) Explanation of material by the teacher.
 - c) Provide opportunities for students to ask questions.
 - d) Practice solves questions in textbooks in groups.
 - 2) After Learning in Online Learning Class
 - a) Students doing homework.
 - b) Online discussion using social media.
- b. Online-based learning by applying conventional flipped classroom.
 - 1) Before Learning in Online Learning Class
 - a) Students watch a video provided by the teacher.
 - b) Students make 5 important points from videos and one question.
 - c) Online discussion using social media.
 - 2) Classroom Online Learning
 - a) Explanation of the objectives and material discussed.
 - b) Explanation of important points by the teacher.
 - c) Provide opportunities for students to ask questions.
 - d) Practice solves questions in textbooks in groups.
- c. Online-based learning by applying learning innovations to the flipped classroom method.
 - 1) Before Learning in Online Learning Class
 - a) Group discussion: The teacher divides students into eight groups.
 - b) Students make a short video about the explanation of the material in each section (see [Figure 2](#)).

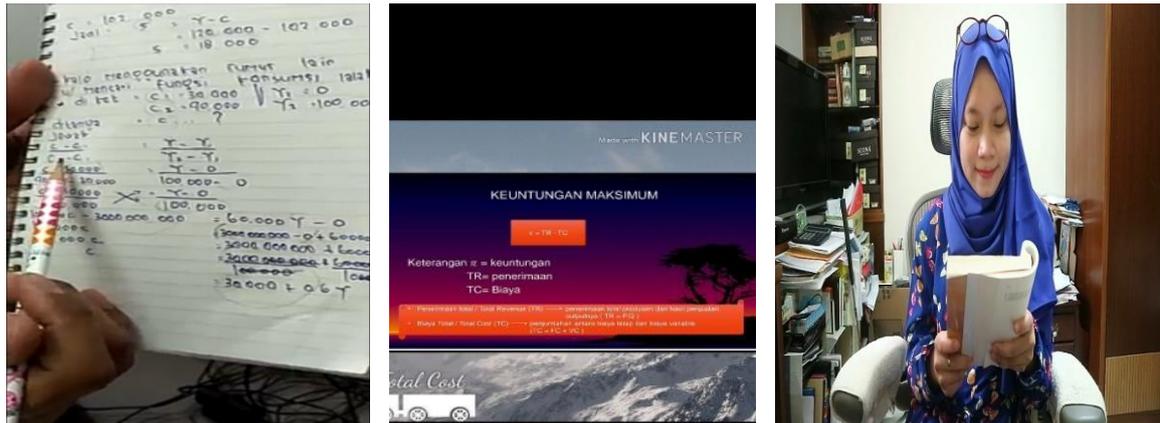


Figure 2. Students recording explanatory videos in a variety of ways

- c) The group provide 5 statistics questions with the answer.
- d) Online discussion: Each student uploads their part explanation video in the class (see Figure 3).



Figure 3. Student online discussion of less understood learning

- e) Students' feedback: Other groups must watch videos, make important points in their notebooks, and give comment about their classmate's videos (see Figure 4).

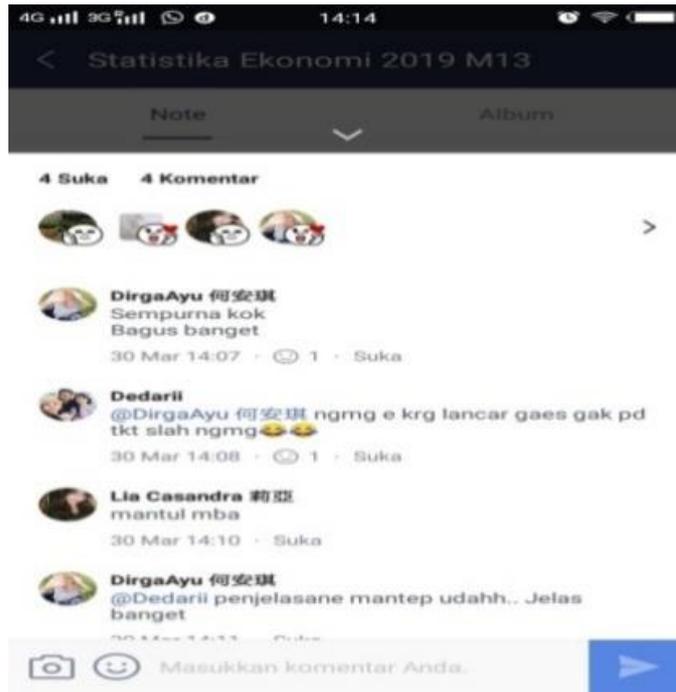


Figure 4. Students feedback from classmates videos

- 2) Classroom Online Learning
 - a) Teacher explained important parts that need to be added and emphasized (see [Figure 5](#)).

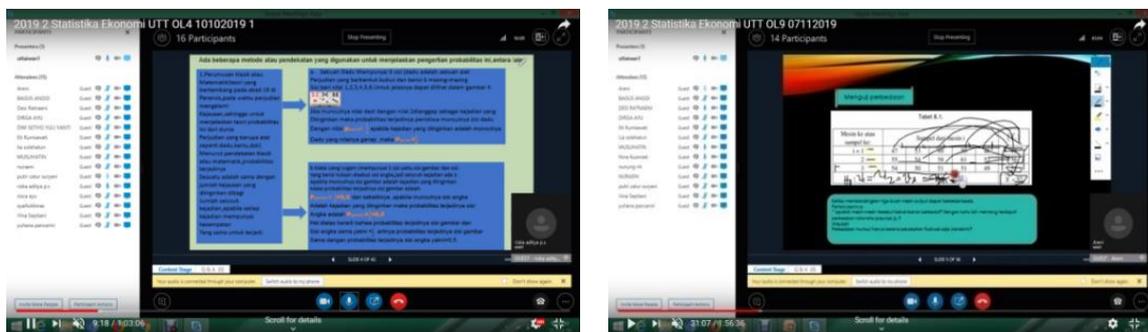


Figure 5. Teacher's explanation of important things in online learning (face-to-face online)

- b) Teacher opens the opportunity for students to convey their questions about the topic of learning.
- c) The presentation group provide 5 statistics questions given to other groups to discuss and Practice solve questions in textbooks in groups (see [Figure 6](#)).

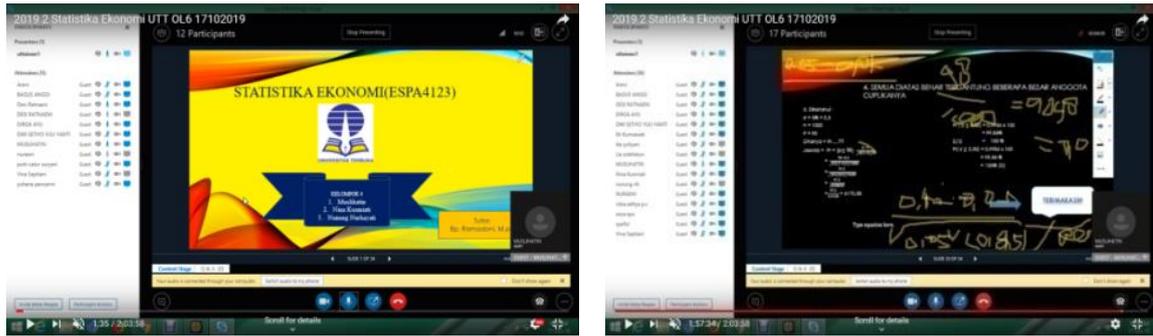


Figure 6. Students in group presentations discussing questions

3. RESULT AND DISCUSSION

3.1. Result

3.1.1. Learning outcomes of the three methods are not same

Based on the analysis conducted using SPSS with the ANOVA test, the results obtained are seen in Table 1 as follows.

Table 1. Comparison of three methods of learning in online learning

	N	MS	F	p
Method 1 (COL)	38	78.21	0.062	0.016*
Method 2 (CFCOL)	19	75.95		
Method 3 (IFCOL)	24	84.79		
Total	81	79.63		

* $p < 0.05$, ** $p < 0.01$.

Based on the Table 1, we can see that the three learning methods are significantly different. In other words, H_0 is rejected, then there is a significant difference between conventional online learning, conventional online learning of flipped classroom, and online innovation learning of flipped classroom with $\alpha = 0.016^*$. After that, the post hoc test is performed to see the differences that occur between classes, the results obtained as shown in the following Table 2.

Table 2. Post hoc test to see the comparison of each method used

	Method 1 (COL)	Method 2 (CFCOL)	Method 3 (IFCOL)
Method 1 (COL)	1.000		
Method 2 (CFCOL)	0.447	1.000	
Method 3 (IFCOL)	0.019*	0.008**	1.000

* $p < 0.05$, ** $p < 0.01$.

Based on the Table 2, we can see no significant difference between conventional online learning and conventional online learning of flipped classrooms with $\alpha = 0.447$. While learning by using online innovation, learning of flipped classroom is significantly different

from the other two methods (conventional online learning and conventional online learning of flipped classroom) with $\alpha = 0.019^{**}$ and $\alpha = 0.008^{**}$, respectively.

3.1.2. The learning outcomes of the three methods are not the same in terms of gender

Based on the analysis conducted using SPSS with the One-Way ANOVA test, the results obtained are seen in [Table 3](#) as follows.

Table 3. Differences in learning outcomes of the three methods used seen from gender

Gender	Method 1: COL		Method 2: CFCOL		Method 3: IFCOL	
	N	MS	N	MS	N	MS
Male	12	75.50	2	48.50	4	80.75
Female	26	79.46	17	79.18	20	85.60
Total	38	78.21	19	75.95	24	84.79
Gender	Method 1: COL		Method 2: CFCOL		Method 3: IFCOL	
<i>F</i>	0.558		0.000		0.725	
<i>p</i>	0.275		0.003		0.113	

* $p < 0.05$, ** $p < 0.01$.

[Table 3](#) show that in method one, the number of males is 12 people and female is 26 people, with an average of 75.50 and 79.46 respectively. The data obtained by gender in method 1 is homogeneous. There is no significant difference between males and females by using method 1 with $\alpha = 0.275$. Whereas in Method 2, there were 2 males and 17 females, with an average of 48.50 and 79.18, respectively. Data obtained by gender in method 2 is not homogeneous. And in method 3 with 4 males and 20 females, with an average of 80.75 and 85.60, respectively. The data obtained by gender in method 3 is homogeneous. And the conclusion there is no significant difference between male and female by using method 3 with $\alpha = 0.113$.

3.1.3. The learning outcomes of the three methods are not the same in terms of job

Based on the analysis conducted using SPSS with the One-Way ANOVA test, the results obtained are seen in [Table 4](#) as follows.

Table 4. Differences in learning outcomes of the three methods used seen from job

Job	Method 1: COL		Method 2: CFCOL		Method 3: IFCOL	
	N	MS	N	MS	N	MS
Household Assistant	21	79.14	11	83.09	13	85.62
Factory Worker	17	77.06	8	66.13	11	83.82
Total	38	78.21	19	75.95	24	84.79
Job	Method 1: COL		Method 2: CFCOL		Method 3: IFCOL	
<i>F</i>	0.415		0.082		0.858	
<i>p</i>	0.541		0.010 ^{**}		0.442	

* $p < 0.05$, ** $p < 0.01$.

Table 4 show that in method 1 there are 21 household assistants and 17 factory workers, with an average of 79.14 and 77.06, respectively. The data obtained based on the job in method 1 is homogeneous. And conclusion, there is no significant difference between a household assistant and a factory worker using method 1 with $\alpha = 0.541$. Whereas in Method 2, there were 11 household assistants and 8 factory workers, with an average of 83.09 and 66.13, respectively. The data obtained based on the job in method 2 is homogeneous.

And in conclusion, there is a significant difference between household assistants and factory workers by using method 2 with $\alpha = 0.010^{**}$. And in method 3 with 13 household assistants and 11 factory workers, with an average of 85.62 and 83.82, respectively. The data obtained by gender in method 3 is homogeneous. There is no significant difference between household assistants and factory workers using method 3 with $\alpha = 0.442$.

3.1.4. The learning outcomes of the three methods are not the same in terms of age

Based on the analysis conducted using SPSS with the ANOVA test, the results obtained are seen in Table 5 as follows.

Table 5. Differences in learning outcomes of the three methods used seen from age

Age	Method 1: COL		Method 2: CFCOL		Method 3: IFCOL	
	N	MS	N	MS	N	MS
<= 25 years	17	76.53	12	73.92	14	86.57
>= 26 years	21	79.57	7	79.43	10	82.30
Total	38	78.21	19	75.95	24	84.79
Age	Method 1: COL		Method 2: CFCOL		Method 3: IFCOL	
<i>F</i>	0.343		0.128		0.535	
<i>p</i>	0.371		0.456		0.062	

* $p < 0.05$, ** $p < 0.01$.

In method 1 the number of small-age students is equal to 25 years, as many as 17 people, and students of older age are equal to 26 years as many as 21 people (see Table 5). The average of each learning outcome is 76.53 and 79.57. Whereas in method 2 (see Table 5), with the number of small students equaling 25 years by 12 people and students aged greater than 26 years were 7 people. The average of each learning outcome is 73.92 and 79.43. And in method 3 (see Table 5), with the number of small students equal to 25 years as many as 14 people and students aged greater than 26 years were 10 people. The average of each learning outcomes is 86.57 and 82.30.

All data obtained based on method 1, method 2, and method 3 are homogeneous. And the conclusion there is no significant difference between students of different ages using method 1 with $\alpha = 0.371$, method 2 with $\alpha = 0.456$ and method 3 with $\alpha = 0.062$.

3.1.5. The learning outcomes of the online learning are not the same in terms of gender, job and Age

Based on an analysis of all students who study online learning based on gender classification, the results can be seen in Table 6, as follows.

Table 6. Learning outcomes by online learning viewed from gender, job and age

	Criteria	N	MS	F	p
Gender	Male	18	73.67	0.03	0.01
	Female	63	81.33		
Job	Household Assistant	45	81.98	0.05	0.03*
	Factory Worker	36	76.69		
Age	<= 25 years	43	79.07	0.08	0.63
	>= 26 years	38	80.26		

* $p < 0.05$, ** $p < 0.01$.

Table 6 show that for all students who learn by online learning based on job classification. The number of male students is 18 students and 63 female students, with 73.67 and 81.33, respectively. Data obtained by gender is not homogeneous. So, it can't be used.

Table 6 show that that the number of students who work as household assistants is 45 people and factory workers are 36 people, with an average of 81.98 and 76.69, respectively. Data obtained by a job is not homogeneous. And the conclusion there is a significant difference between students who work as household assistants and factory workers using online learning with $\alpha = 0.03^*$.

Table 6 can be analyzed for all students who study online learning based on age classification. The number of small-age students is equal to 25 years, as many as 43 people and students aged greater than 26 years are 38 people. The average of respectively 79.07 and 80.26. Data obtained based on age are homogeneous. And the conclusion there is no significant difference between students of different ages using online learning with $\alpha = 0.63$.

3.2. Discussion

In this study, online learning using conventional flipped classrooms is no different from conventional online. This is caused by the absence of control over students outside the classroom. This was also expressed by Elledge et al. (2018) that there was no difference between learning with flipped classroom and didactic learning. But students prefer learning flipped classrooms because it can increase broader knowledge by using e-learning. And learning flipped classroom can also increase student confidence. In learning with innovation, the flipped classroom has a significantly different result from the others because of students' control outside the classroom. This was also expressed by Lo et al. (2018) that in learning statistics using the flipped classroom method with a learning design outside the classroom can improve learning outcomes and develop student potential.

Flipped classroom is group learning methods. Rawas et al. (2020) argues that the design of flipped classroom learning with group is better than individual. Teaching students in group can make learning interactive and collaborative (Reynolds & Muijs, 1999). The group size is made in small numbers to prevent laziness in the group (Trytten, 2001).

Innovation flipped classroom is peer tutoring students through videos. Videos were made by students through various sources. Students has to understand the topics in depth before making a video (Eugenia, 2018). The various videos in flipped classroom provides an opportunity for students to apply and gain much knowledge (Obradovich et al., 2015). Flipped classroom learning conducted using videos, online quizzes, and group learning in class can increase student satisfaction and better learning experiences (Awidi & Paynter, 2019). Furthermore, flipped classroom that involves students in editing videos both individually and in groups can positively impact learning outcomes (Eugenia, 2018).

Students become more sensitive to the performance feedback given, and their perceptions become more realistic, constant, and stable (Dweck, 2002).

Peer tutoring flipped classrooms create better interaction between teacher and students, peer interaction, make students more creative, make learning fun, enthusiastic, make maximum use of time in class, students participate in making decisions and make conclusions (Graziano, 2017). Peers will facilitate before class to have prior knowledge (Graziano, 2017; Tsai et al., 2020). Activities in peer tutoring flipped classrooms allow students to be more involved and active in learning by utilizing technology (Nerantzi, 2020). Peer tutoring engages students and encourages learning outcomes (Schell & Butler, 2018). Peer tutoring is interactive learning activities, student-centered paradigm, play more active roles in driving instruction (Bishop & Verleger, 2013). Peer tutoring gives flexibility, in-depth, students' self-learning, interactive instruction, efficiency, practical learning, and empowers students to teach and learn from each other (Baepler et al., 2014). Peer tutoring is useful for improving students' learning outcomes, conceptual understanding, problem-solving, and decision-making (Nicol & Boyle, 2003). Peer tutoring is useful for promoting diversity in the background so that they are easy to blend in (Chubin et al., 2005).

Peer evaluation is another commonly employed peer-to-peer learning approach (Hersam et al., 2004). Peer evaluation is more widely employed in high education (Lee, 2009). Peer evaluation is useful for making students more critical thinking and learning outcomes (Boud et al., 2014).

4. CONCLUSION

The conclusions of this study are differences in student learning outcomes in the three sample groups (Conventional Online Learning, Conventional Flipped Classroom in Online Learning, and Innovation Flipped Classroom in Online Learning). Further analysis was conducted that conventional online learning and conventional flipped classroom in online learning did not differ significantly. Whereas Innovation flipped classroom in online learning differs considerably from the two other learning methods. This is due to the absence of strict control of students before learning by using conventional online learning methods and conventional flipped classroom in online learning. In conventional online learning, students are not prepared before studying in class. While using conventional flipped classrooms in online learning, students are indeed given the task to watch learning videos before learning online learning, but there is no strict control over students. This is different from students using the innovation flipped classroom method in online learning. They must make a short video of their explanations to learn and understand the material before learning. And for other students watching the video, their classmates must also provide feedback by giving comments and questions to their classmates.

If reviewed in more depth, there is no difference in student learning outcomes in conventional online learning classes, and innovation flipped classroom in online learning between the two genders. Whereas in the conventional flipped classrooms in online learning data, the data are not homogeneous, the data cannot be used. This explains that the learning outcomes of male students are no different from female students. This happens because they have the same desires, abilities, and motivation in learning. Because to study while working is their decision, they are among those who have high awareness in their studies. Furthermore, there are differences in student learning outcomes in conventional flipped classrooms in online learning seen from students' jobs. Whereas in the conventional online learning and innovation flipped classroom, online learning classes are not different between the two jobs. Student learning outcomes using conventional online learning are no different

because they study in class as usual and do homework after online class, so no time effect affects the learning outcomes of both types of jobs. On the other hand, students using conventional flipped classrooms in online learning methods that work as household assistants have more flexible time at work, so they have more time watching videos and repeating them. The learning outcomes are better than students who work as factory workers. Where students who work as factory workers cannot watch videos during work. This is different from the learning of flipped classroom innovation when time is no longer a differentiator between the learning outcomes of the two types of jobs because students are required to make videos, provide comments and questions to their classmates' videos. Therefore, students are sure to understand the subject matter and are matured in the classroom. So, students using the flipped classroom innovation method utilize the time they must understand the subject matter.

When we search into it further, we can see that there is no difference in student learning outcomes in students' three methods based on age differences. It shows students using the three methods even though they are of different ages but still have the same abilities, wills, and motivations. Because with their desire to learn while working it indicates an immense desire from them to study again. Moreover, there are differences in student learning outcomes in all Taiwan Open University students with online learning in student jobs. This is because students who work as household assistants are more flexible than students who work as factory workers. While seen from the difference in the age of students, there is no difference. This is because they have a very high will and motivation in learning even though, on the other hand, they must work. While in terms of gender, the data cannot be used because the data are not homogeneous, so it can't be used.

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