The Effect of Flipped Classroom Learning in Enhancing Mathematics Learning Outcomes of Blind Students During The Pandemic

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Article Info	Abstract
	This study aims to analyze the effect of Flipped Classroom learning on the mathematics learning outcomes of blind students during the Covid-19 pandemic. This type of research is Quasi-Experimentals with Nonequivalent Control Group Designs. The population used in this research is the blind students of class V and class VI of SLBN ABD Kedungkandang Malang city with 12 students. Samples were taken using a saturated sampling technique. The experimental class uses the Flipped Classroom learning model for class VI students, and the control class uses a direct learning model as a comparison, namely for class V students. The data results show Normal and Homogeneous with the resulting significance value > 0.05. Then the final test is the independent sample t-test to determine whether there is a difference in the average of the two unpaired samples from the data. Depending on the first decision by observing the column value Sig.t count (2-tailed) or P-value, required if the value of Sig. t-count 0.05, then H_0 is accepted, and if the value of Sig. t-count 0.05, then H_0 is rejected. From the second decision, H_0 is rejected, and H_0 is not enough to be accepted. The results showed that learning mathematics with the Flipped Classroom learning model for blind students in the covid-19 pandemic had a more positive effect than the results of learning mathematics in a direct learning class or without any treatment with the Flipped Classroom model.

INTRODUCTION

In 2020, there was a Covid-19 pandemic that hit Indonesia. The pandemic period has an impact on all aspects, including education. One of the government policies related to this case is online learning during the pandemic in the form of distance learning (PJJ) [1]–[3]. According to Jaelani [4], students are expected to get complete understanding in their class in online education with media. This hope must also be felt by students with special needs, especially blind students. Blindness is a condition where a person loses the sense of sight to have a limitation in daily life, such as teaching and learning activities [5]. Hearing and touching skills are the principal capital for a blind person to learn.

Based on the result of an interview from one of the students of SLBN ABD Kedungkandang Malang City Class V conducted by the researcher, information was obtained that these students had difficulty learning mathematics during this pandemic because a blind student in their learning activities usually needs more attention from the teacher at the school. Mathematics learning is skilled at counting and mathematics that must be learned, such as fractions, tables, two-dimensional figures, measurements, lines, etc. So these materials need the student's sense of sight [6]–[8].

Teachers at the school did find it difficult when online learning because they did not directly interact with their students but had to teach remotely. Therefore, it takes media that can be used easily by blind students to learn mathematics even though they are not at school or studying at

home, that is by using the Flipped Classroom method of teaching media. The principle that must be considered by the teacher when giving learning to blind students in the media must be tactual and also voiced [9], for example, such as natural model objects, the use of braille writing, and embossed images, while for media that sounding voice such as radio, tape recorder, and others.

The flipped classroom is a student learning process with material explanations given outside class hours, with homework assignments being activities carried out at school [10]. The concept of Flipped Classroom is an activity usually carried out in class, students will be carried out at the student's home, and student assignments from the teacher to be done at home will be completed in class [11]. So, the Flipped Classroom learning model is an activity to reverse teaching and learning activities at school with activities at home.

With the Flipped Classroom method, the media must be able to contribute generously to visually impaired students by emphasizing the audio. Applying the Flipped Classroom learning model can increase creativity, motivation, and liveliness of learning [12]. In that case, the Flipped Classroom method is very suitable for the visually impaired online learning process because it is easy to use. Using the Flipped Classroom method, the blind students will more easily understand the material's content from the book without reading because it can be accessed through the sense of hearing. The Flipped Classroom audio model is very suitable for Indonesians who don't like reading books but still get information from the material in the book by listening and can help blind students understand the content of the material in the reading book [13].

Based on these problems, the formulation of this research is how is the effect of learning the Flipped Classroom model and the mathematics learning outcomes of blind students in the Covid-19 pandemic? Knowing the influence and learning outcomes of visually impaired students applying the Flipped Classroom learning model can help them overcome current online learning problems, especially mathematics learning that requires special attention. That is the goal of this research, which is expected to overcome various difficulties of blind students in learning mathematics. In addition, it is also likely to be able to analyze the effect of mathematics learning outcomes on blind students with Flipped Classroom learning on Covid-19.

The innovation of this video learning is expected to be useful for students, teachers, and researchers. For students, this research is expected to help students learn mathematics material and feel a new learning experience with the Flipped Classroom model. For teachers, it is hoped this research can be used as a reference in applying the Flipped Classroom learning model suitable for blind students to improve mathematics learning outcomes and their learning motivation.

METHOD

The type of research used is a quasi-experimental design with the Nonequivalent Control Group Design [14], as described below:
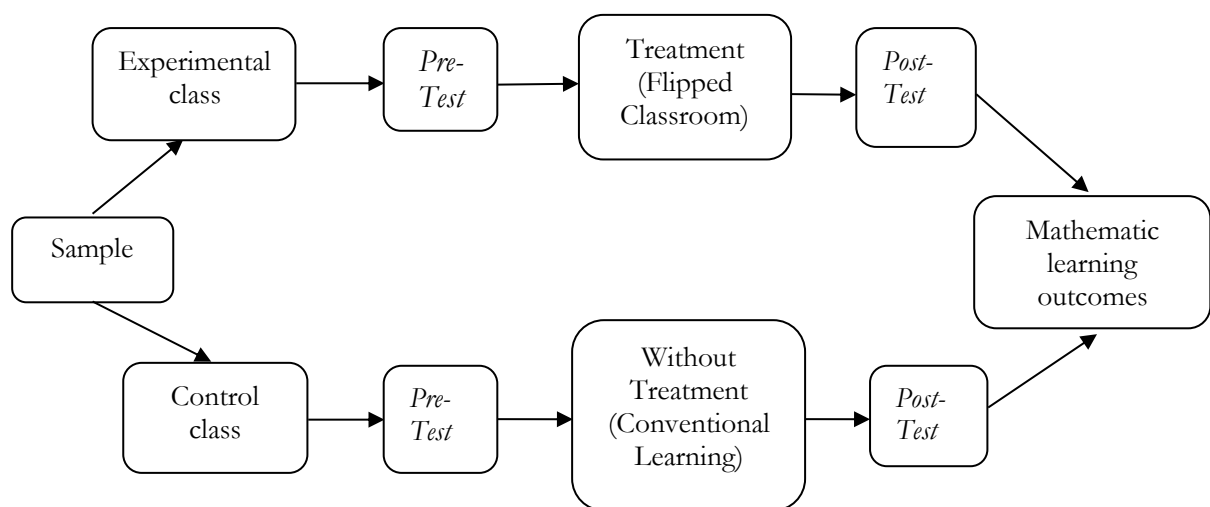
Figure 1. Nonequivalent Control Research Design

In a quasi-experimental, the researcher accepts the subject's condition as simply as possible. This was done because of the consideration that the issue was already in their respective class, and it was not possible to re-randomize the subject selection.

This research uses the experimental class with Flipped Classroom learning treatment and the control class with direct learning or without Flipped Classroom learning treatment. The dependent variable in this research is the mathematics learning outcomes of blind students as measured through a description test. In comparison, the independent variables of this study are the Flipped Classroom learning model in the experimental class and direct learning or without the Flipped Classroom treatment in the control class.

This research was implemented from August 4 to August 7, 2021, in the even semester of the 2020/2021 academic year. This research was implemented in the experimental and control classes for four learning meetings. The pre-test was given at the first meeting on August 4, 2021, then the second and third meetings on August 5 to August 6, 2021, conducted learning, and the last meeting was conducted post-test and giving questionnaires to students. Post-test was given to determine whether there was a difference in the average material mastery of mathematics between the control and experimental classes.

The population of this research was blind students from Class VI and Class V. The total population was 12 people who were divided into two classes. In selecting the sample, this research used a saturated sampling technique. The first class consists of 6 students, and the second class consists of 6 students. Because the Flipped Classroom learning model design requires the formation of groups to discuss the previous material that has been given, the course chosen for the application of the Flipped Classroom learning model is class VI, which consists of 6 blind students.

The data collection instrument in this research is in the form of a test with description questions to measure the mathematics learning outcomes of blind students. The data from the research results are presented in tabular form, then analyzed using statistical tests to determine the difference in the average learning outcomes of mathematics between the control class and the experimental class. The test used is the Normality Test with Kolmogorov-Smirnov, the Homogeneity Test with the Gain score, and the last test after normal and homogeneous data is the

independent sample t-test, which is used to determine whether from the data there is a difference in the average of the two samples that are not in pairs.

RESULT AND DISCUSSION

The results of learning mathematics for blind students are measured by giving a test in the form of description questions after attending two meetings. Learning outcomes are impressions that can lead to changes in individuals due to their activities in learning [15]. Thus, a person's self undergoes changes when they have learned. The Experimental Class and Control Class Statistics Test results are presented in Table 1.

Table 1. The Statistical Test Results of an Experimental Class and Control Class

Class	$\overline{X}$	X_{min}	X_{max}	Std. Deviation
Experiment	93,33	80	100	8,165
Control	83,33	70	100	10,328

Based on the data in Table 1, it can be seen that the average mathematics learning outcomes of blind students in the experimental class who received the Flipped Classroom learning model were higher than the control class who received direct learning. Flipped Classrooms could increase student satisfaction and increase creativity themselves [16]. Based on this explanation, it is indicated that the experimental class has a better mastery of mathematical material than the control class.

To determine whether the difference in the average of the two classes is significant or not, it is necessary to do a statistical test. Before deciding the type of test to be used, it is essential to carry out a prerequisite test in a normality test and a homogeneity test. Normality test results are presented in Table 2.

Table 2. Normality Test Result

Class		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Result	Pre-Test of Experimental Class (FC)	0.183	6	0.200	0.960	6	0.820
	Post-Test of Experimental Class (FC)	0.293	6	0.117	0.822	6	0.091
	Pre-Test of Control Class (Conventional)	0,254	6	0.200	0.866	6	0.212
	Post-Test of Control Class (Conventional)	0.202	6	0.200	0.853	6	0.167

In Table 2, the Normality Test is carried out to determine whether the data is normally distributed or not. Normality test using the Kolmogorov-Smirnov Test with the helped by SPSS 25 software. From the data obtained, the significance value is > 0.05. Then the variable is normally distributed.

Because the data is normally distributed, the Paired Sample t-test and Independent Sample t-Test tests are carried out to find out the answers to these problems. The paired sample t-test was carried out with pre-test and post-test data for the experimental class (FC model) and then the control class's pre-test and post-test (conventional model) data. The results of the Paired Sample t-Test are presented in Table 3.

Table 3. The Result of *Paired Sample t-Test*

		Paired Differences					t	Df	Sig. (2-tailed
		Mean	Std. Dev	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pre and Post-Test of Experimental Class	-58,333	11,690	4,773	-70,602	-46,065	-12,223	5	0.000
Pair 2	Pre and Post -Test of Control Class	-51,667	14,720	6,009	-67,114	-36,219	-8,598	5	,000

In Table 3, namely Pair 1 data, the Sig (2-tailed) value is 0.000 < 0.05; therefore, it can be concluded that there is a difference in the average mathematics learning outcomes of blind students for pre-test and post-test in the experimental class. (Flipped Classroom model). Meanwhile, based on the data, the value of Sig. (2-tailed) the result is 0.000 <0.05. It can be concluded that there is a difference in the average mathematics learning outcomes of the remaining blind for the pre-test for the control class and the post-test for the control class.

Then after knowing the interpretation of the result of the paired sample t-test, data analysis was carried out in the form of the Homogeneity Test. Homogeneity test results are shown in Table 4.

Table 4. Homogeneity Test Result

		Levene Statistic	df_1	df_2	Sig.
Post Test	Based on Mean	0.000	1	10	1.000
	Based on Median	0.000	1	10	1.000
	Based on Median and with adjusted df	0.000	1	9.494	1.000
	Based on trimmed mean	0.000	1	10	1.000

Based on the output data test presented in table 4, it was found that the significance value (2-tailed) of the result is 0.001 < 0.05, it can be seen the average difference in the mathematics learning outcomes of blind students between the experimental class and the control class. So, it can be concluded there is an effect of the Flipped Classroom Model on the mathematics learning outcomes of blind students in the covid-19 pandemic.

After the data is declared regular and homogeneous, the last test is the independent sample t-test, which determines whether there is a difference in the mean of the two unpaired samples. Test results independent sample t-test is presented in Table 5.

Table 5. The Result of the Independent Sample t-test

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Diff | Std. Error Diff | 95% Confidence Interval of the Difference | |
									Lower	Upper
Result	Equal variances assumed	0.000	1.000	4,812	10	0,003	23,333	4,932	12,317	34,350
	Equal variances not assumed			4,719	9,918	0,001	23,333	4,844	12,305	34,362

And the data in table 5, namely the independent sample t-test, is known as the value of Sig. *Levene's Test for Equality of Variances* is 1.000 > 0.05. This shows that the data variance between the flipped classroom (experimental class) and the comparison class (control class) is the same or homogeneous. The first row guides the interpretation of the table above: Equal variances assumed or called the two identical population variants. The level of the difference in the mean of the two classes is shown in the Mean Difference column. Because the result is positive, the experimental class (flipped classroom treatment) has a higher average than the control class (class without Flipped Classroom treatment).

According to Sujarweni (2015), to be able to make a retrieval from the first decision by observing the calculated Sig.t (2-tailed) or *P-value* column, it is required if the Sig value. t-count $\geq$ 0.05, then H_0 is accepted, and if the value of Sig. t-count $\leq$ 0.05, then H_0 is rejected. Because the data presented the importance of Sig. the Equal Variances guide t-count value Assumed line, the Sig.t count value is 0.001 < 0.05, which means that H_0 is rejected and H_1 is accepted.

Depending on the second decision, use t-count and t-table with the following criteria: 1) H_0 is accepted if the value of $t < t_{1-a}$; 2) H_0 is rejected if the value of $t \geq t_{1-a}$. It is known that the t-count value is 4.719 and t-table (67; 0.025) = 1.996, and because t-count > t-table, then H_0 is rejected and H_0 is not enough to be accepted. So, it can be concluded that the results of learning mathematics with the Flipped Classroom learning model for visually impaired students during the covid-19 pandemic had a positive effect on mathematics learning outcomes indirect learning or without Flipped Classroom model treatment.

Talan & Gulsecen stated that the Flipped Classroom could increase student satisfaction and creativity in themselves [17]. Learning the Flipped Classroom model makes students more responsible when studying on their own so that the learning outcomes of students who use the Flipped Classroom learning model are higher than those of students who study traditional models [18]. This research shows that the conventional method, the Flipped Classroom learning model, can significantly improve mathematics learning achievement [19] and is also very beneficial for increasing learning achievement at various levels of education in the cross-scientific field [20].

Several factors cause the mathematics learning outcomes of blind students in the covid-19 pandemic who receive the Flipped Classroom learning model treatment better than the direct learning model. From the Flipped Classroom learning model process in a class, the application of

the learning process is reversed, and the activities during the delivery of material in the course are switched to discussing and doing exercises. Meanwhile, they usually do exercises outside the classroom or at home are replaced by watching videos from the teacher that have been given before the meeting to understand the material for the upcoming meeting at the school where students and teachers meet face-to-face or online.

This research was carried out from the Flipped Classroom Learning process in two main activities: inside and outside the classroom. Activities at the school are: discussing material that has not been understood by blind students when studying outside the school and exploring the material through exercises. In the classroom, there are five steps of activities, that are: 1) Giving a pre-test as a warm-up or pre-test; 2) discussing with friends; 3) presenting the result about the understanding level of the material; and 4) closing the lesson; 5) giving post-test and questionnaires to students.

While learning the Flipped Classroom model, the activities implemented outside the classroom are: 1) The teacher prepares a special learning video for blind students by emphasizing the audio intonation so that students can understand the material. The video was made by recording the teacher's voice explaining material such as direct classroom learning. 2) The teacher gives a video to students with the technique of giving a video that the teacher has uploaded through the website fortunanetra.simplesite.com, and the link is shared via the student's *WhatsApp group*. From this link, students can visit a web page that contains several mathematics learning videos and watch them directly on the page or download them. 3) Students watch the video at their respective homes or wherever they are before the class starts. From this stage, students are expected to be able to understand the material that has been explained in the video.

The stages of the Flipped Classroom implementation consist of five steps as follows. In the first step in learning the Flipped Classroom model class, students start by giving a pre-test as a student's initial understanding of the material of the learning video. Giving this pre-test is very important to motivate students to watch the video first before learning begins in the class. After completing the pre-test, the teacher conveys the results of the pre-test of the previous meeting to students with the goal that blind students can be encouraged to pursue higher scores in the next meeting. According to Filgona, conveying the assessment results to students makes students more motivated to be enthusiastic and become independent students [21].

The second step is a discussion. After the pre-test, the teacher allows students to ask some questions about the material that had not been understood in the previous teacher's video. The teacher opens a discussion session with the students. At this point, it is vital to implement, so students understand the mathematics subject matter at the meeting. Other friends were also allowed to answer questions from friends who did not understand the material from the video. This is a motivation for students to understand the material at the next meeting and be able to answer questions from their friends who do not understand the material.

The third step is for students to do the exercises. After there were no questions from other students, the teacher discussed with the blind students without dividing them into several groups because of the limited number of blind students in the class. The teacher only directs the discussion in the class. Then the teacher gives an exercise to strengthen students' understanding of the material. Students accustomed to working on activities during learning or while studying will find it easier to solve questions on the next test [22], [23].

The fourth step is to present the discussion results in an online class. After completing the exercises, one of the representative students gave the results of their discussion. The teacher opens a question session if there are students who want to ask questions or refute the answers from their friends who are presenting.

The final step is closing the learning activities. The teacher and students review the learning process carried out and make conclusions about the previous material. Then the teacher directs students to watch videos that have been uploaded on the web page for the next meeting and motivates students to try to get satisfactory test results.

The implementation of the Flipped Classroom learning model described above can contribute to the mathematics learning outcomes of blind students. This happens because, in the process of learning activities, the Flipped Classroom model provides enough time for students to understand the mathematics subject matter at home. Students can repeatedly play if the material is not understood until they know it. This is different from direct learning classes. The teacher explains the material once and does not repeat it. The teacher can only replicate certain parts when students ask. Repetition of the material should not be possible because of the limited time of the learning. Learning the Flipped Classroom model is one of the reasons students' mathematics learning outcomes are better than direct learning.

Before holding a meeting in a virtual class or online via zoom meeting, students in the Flipped Classroom learning model class have brought provisions from understanding the material studied in the class. This is a superior difference from a direct learning class. In natural learning class, students start the learning with knowledge of the material that they may in little understanding level, maybe even do not know at all. This is because of the characteristics of students who do not want to learn first before the class begins. Students can understand the material when the teacher explains it in style. Students who enter the course with sufficient material understanding are better than students who bring less or no material sense. From this statement, it becomes one of the causes of differences in mathematics learning outcomes for students in the Flipped Classroom learning model class with students in the direct class learning model.

Another factor is the presence of a video that emphasizes audio intonation, which is explicitly given for blind students and can be played back and forth until they understand the material. This learning model can help students understand learning material because they can access it repeatedly [24]. In addition, students are happier because they can access the learning materials anytime and anywhere [25]–[27]. This cannot be done by students in the direct learning model class.

Despite the many advantages, the implementation of the Flipped Classroom learning model in this research also encountered obstacles. The first obstacle is that students have difficulty downloading videos because the size of the capacity is too large and makes the students have to watch on the web page using the student data package. And also, some students have inadequate gadgets to play videos.

Another obstacle experienced by students is difficulty understanding explanations on the video that cannot be understood—for example, not understanding the material at the 15th minute. After the students played back, they still didn't understand, so they felt confused for the next minutes. In this condition, some students state that they prefer to be taught in the direct class because if there is an explanation that they do not understand in a sentence, they can ask the teacher at the moment.

CONCLUSION

From the research and statistical tests that have been done, it can be concluded that the Flipped Classroom learning model affects the mathematics learning outcomes of blind students in the covid-19 pandemic. This effect is because the learning process of the Flipped Classroom model gives students more time to understand the overall material, and the presence of the video makes students play it back if they feel they forgot about the previous material. Generally, the Flipped Classroom learning model consists of activities in the classroom and outside. Both activities are equally important and must be run optimally to obtain satisfactory results. Although it has several advantages, the Flipped Classroom learning model also has the potential to have several obstacles to solving these problems. The teacher's role is needed in handling the issues that can hinder the class.

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