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THE IMPLEMENTATION OF THE FLIPPED CLASSROOM LEARNING MODEL ON STUDENTS' MATHEMATICAL UNDERSTANDING ABILITY

Ojah Siti Nurfaojah[1], Sulis Wahyuni[2], Irmawati Liliana Kusuma Dewi[3], Tri Nopriana[4]
[1,2,3,4] Prodi Pendidikan Matematika, Universitas Swadaya Gunung Jati, Cirebon, Indonesia

*Corresponding author: ojahsiti19@gmail.com

Abstract
This study was conducted to demonstrate the suitability of the flipped classroom learning model for students' mathematical understanding abilities. This research employed a qualitative descriptive approach, utilizing questionnaires and the author's own experiences as supporting data. The researcher found in the field that students had never previously experienced learning using the flipped classroom model. This fact further motivated the researcher to investigate whether this model is feasible to use or not. The subjects of this study were junior high school students. The reason for choosing these subjects was due to the limited research time and the easier implementation of the learning model, as the material is still relatively simple, thus enabling the acquisition of students' mathematical understanding abilities more effectively and efficiently. The data collection technique in this study involved tests in the form of questions, for which the material had been previously explained in detail by the researcher. The results of this study indicate that students still do not understand the procedures of this model, resulting in the learning model not being utilized optimally. Additionally, factors such as students' prior knowledge and an inadequate school environment contributed to the research outcomes being less than expected.
Keywords: Filpped Calssroom, Mathematical Understanding Ability

INTRODUCTION

Mathematics is a subject taught at every level of education. From elementary school to higher education, whether in general schools, vocational schools, science, social studie, language, or religious schools, mathematics is presented within the same scope of material. The difference lies only in the depth of the material and the basic competencies expected. However, even though it is taught gradually throughout a student's education, mathematics remains a subject considered difficult by the majority of students (Ela Priastuti Mirlanda, 2020).

Mathematics, as one of the subjects favored by some students, also has specific learning objectives. One of the key aspects contained in mathematics learning is the concept. As facilitators in learning, teachers should hold the view that the materials taught to students are not merely for memorization but, more importantly, for understanding the concepts

presented. By understanding, students can better grasp the concepts of the subject matter itself, rather than just memorizing it (Astriana, 2019).

From the explanation above, the essence is that mathematics is a science that everyone must master at least at a basic level, which is studied in school. Mathematics is a learning subject widely applied in daily life, as almost all human needs are directly related to mathematical knowledge. Because mathematics learning is quite complex and requires deep concentration and understanding, mathematics teachers must be more creative in delivering the learning materials so that students do not feel bored or afraid to study mathematics.

One learning model that teachers can apply as an effort to deliver mathematics material is the flipped classroom learning model. According to Johnson (2013), the flipped classroom learning model is a student-centered learning model aimed at increasing learning effectiveness. The flipped classroom utilizes technology to support learning materials that can be accessed anytime and anywhere, while classroom time is used by students to collaborate with peers on projects, practice skills, and receive feedback on their progress (Muhammad Fauzan, 2021).

According to the Ministry of Education and Culture, the flipped classroom learning model is a model where students study the material at home before learning in class, following assignments given by the teacher. This method is also used by teachers when students are absent from class for certain reasons. The teacher can create videos of the lessons and provide them to absent students. According to Damayanti & Sutama (2016), the flipped classroom model is a student-centered learning model aimed at increasing learning effectiveness. The flipped classroom model reverses the activities between classroom and home learning (Karimah, 2018).

Thus, it can be concluded that the flipped classroom learning model is an inverted learning model, where students first practice and learn independently outside the classroom. Then, the teacher delivers the learning material in class by re-explaining the material already provided, reconfirming parts that students have not understood. Once all students understand, they are given exercises to reinforce their understanding of the material taught.

The steps of learning using the flipped classroom model are:

1. The teacher prepares and provides a medium (such as a learning video or digital book) for students to watch and study at home;
2. Students watch the video and study the instructions given by the teacher through the video to familiarize themselves with the concepts that will be taught in the next meeting;
3. In class, students complete assignments based on the instructions previously given (through the video). Here, students can focus more on difficulties in understanding the material or their ability to solve problems related to the material;
4. The teacher acts as a facilitator who assists students in completing these assignments (Noritha Fentiana Murafer, 2021).

Understanding is the process of human thinking related to abstract or physical objects, such as people, situations, or messages, where a person can use a concept to model the object in question. Mathematical understanding is students' knowledge of concepts, principles, procedures, and their ability to use problem-solving strategies for a given problem. A person who has mathematical understanding means that they know what they have learned, the

steps taken, and can use concepts both within and outside the context of mathematics (Tommy Tanu Wijaya, 2018).

According to Jihad and Haris (2019) in (Harry Dwi Putra, 2018), the ability to understand includes indicators such as restating a concept; classifying objects according to certain properties based on the concept; providing examples and non-examples of the concept; presenting the concept in various mathematical representations; developing necessary and sufficient conditions of a concept; using, utilizing, and choosing certain procedures or operations; and applying concepts to solve problems.

Therefore, from the explanation above, it can be concluded that mathematical understanding ability is a thinking pattern related to knowledge of concepts, principles, or procedures by using certain strategies to solve problems effectively according to applicable procedures.

The researcher chose the flipped classroom learning model because they wanted to observe this learning model, and the facts in the field show that the flipped classroom model has never been used by teachers or students as a learning model for mathematics material. It is hoped that the researcher can apply this flipped classroom model as a learning tool that can help both students and teachers in solving problems related to the mathematics material studied, and subsequently benefit the continuity of teaching and learning activities in the future.

Furthermore, the variable linked by the researcher is students' mathematical understanding ability. It is expected that by combining these two variables—the flipped classroom learning model and students' mathematical abilities—students' learning motivation, as well as their love and interest in studying mathematics, will increase. The researcher strongly hopes that by applying the flipped classroom learning model, students will find it easier to understand the material than usual, and their mathematical understanding abilities will develop further.

METHOD

This research is a qualitative descriptive study. The variables examined in this study are the flipped classroom learning method and students' mathematical understanding ability. The subjects of this research were junior high school students. The reason for choosing this subject group was due to the limited research time and the easier application of the learning model, as the material to be covered was still relatively simple, which is expected to result in a more effective and efficient development of students' mathematical understanding abilities.

With this study, it is hoped that students can more easily understand the material delivered because they have already studied the material beforehand, thereby increasing students' interest in learning mathematics. The subjects in this study consisted of 5 students from the eighth grade, all of whom were female.

The data collection technique used in this research was a test consisting of questions for which the material had been thoroughly provided by the researcher in advance. The test consisted of 2 essay questions and 6 short questions related to each variable. The questions were adapted from the Gramedia website. The instrument for the flipped classroom learning model questions was adapted from Noritha Fentiana Murafer (2021), and the instrument for the mathematical understanding ability questions was adapted from Yuyun Rahayu (2018). The following is the instrument table.

Table 1. Indicators of the Flipped Classroom Learning Model

Indicator	Statements
Explanation of the flipped classroom learning model and its application	1
Combining video-based learning media and the flipped classroom learning model	2
Student understanding of the material presented using the flipped classroom learning model	3

Table 2. Indicators of Mathematical Understanding Ability

Indicator	Statements
Understanding of the SPLDV material using the GeoGebra application	1
Solving SPLDV problems using the GeoGebra application	2
Motivation for learning mathematics	3

The tools or data used in this research consist of the researcher who is also the writer. The researcher conducted direct observation in the field to collect as much data as possible, which was then analyzed to produce a descriptive conclusion. The data collection techniques used by the researcher were: 1) participant observation, 2) interviews, and 3) documentation.

The procedures carried out by the researcher consisted of three stages: 1) the preparation stage, 2) the implementation stage, and 3) the final stage. The steps in the preparation stage included: 1) preparing a soft book, learning videos, and the instruments to be used; 2) providing the material to be discussed in class in advance through the Classroom application; 3) ensuring that everything was well-prepared. The implementation stage included: 1) delivering and re-explaining the material that had been provided so that students could better understand the content; 2) giving exercises that had been prepared; 3) administering a questionnaire in the form of a Google Form to measure students' knowledge and to assess the proper implementation of the flipped classroom-based learning model. The final stage included: 1) analyzing the data obtained from the tests given to the students; 2) describing the results of the data analysis to produce a conclusion that answers the research questions; 3) compiling the research report.

RESULTS AND DISCUSSIONS

This research was conducted at a junior high school located in Cirebon Regency. Based on the research questions previously presented, the discussion and analysis of the answers will be carried out to determine whether the flipped classroom-based learning model is effective and can improve mathematical understanding skills, thereby enabling the learning process to be conducted effectively and thoroughly.

The research subjects consisted of 5 students. The data for this study included direct observations conducted by the researcher and questionnaire responses collected via Google Forms to support the data processing. The following table presents the percentage summary

that can conclude whether the flipped classroom-based learning model is effective in improving students' mathematical understanding skills.

Table 3. Question 2: Implementation of the Flipped Classroom Model

Subject	Total	Question	Persentage (%)				
			SA(1)	A(2)	U(3)	D(4)	SD(5)
Students	5	I prefer to study the material first and then study it further in class with the teacher.	0	40	60	0	0

Based on Table 3, it was found that 40% of the students preferred to study independently first and then learn in class with the teacher, while 60% expressed hesitation toward the flipped classroom learning model. This indicates that students have low self-confidence and a lack of independent learning skills.

Table 4. Question 1: Implementation of the Flipped Classroom Model

Subject	Total	Question	Persentage (%)				
			SA(1)	A(2)	U(3)	D(4)	SD(5)
Students	5	Learning media using videos makes me more enthusiastic about learning mathematics.	0	20	80	0	0

Based on Table 4, it was found that only 20% of students liked the instructional videos, while the remaining 80% expressed hesitation about using them. This indicates that many students have not embraced technological advancements and still prefer an authoritarian learning system in the classroom.

Table 5. Question 3: Implementation of the Flipped Classroom Model

Subject	Total	Question	Persentage (%)				
			SA(1)	A(2)	U(3)	D(4)	SD(5)
Students	5	Learning using the flipped classroom model helps me understand the material better than just studying directly in class.	0	80	20	0	0

Based on Table 5, 80% of the students better understood the material using the flipped classroom-based learning model, while 20% expressed hesitation in understanding the material through this model. This indicates that more students comprehend the material when using the flipped classroom learning model.

Table 6. Question 1: Students' Mathematical Understanding

Subject	Total	Question	Persentage (%)				
			SA(1)	A(2)	U(3)	D(4)	SD(5)

Students	5	I feel I understand the material better using the flipped classroom learning model than just studying directly in class.	20	40	40	0	0

Based on Table 6, 20% of the students understood the material well using the flipped classroom-based learning model, 40% of the students had a moderate understanding of the material using this model, and the remaining 40% expressed hesitation toward the flipped classroom learning model. This indicates that more students feel they better understand the material when using the flipped classroom-based learning model.

Table 7. Question 2: Implementation of the Flipped Classroom Model

Subject	**Total**	**Question**	**Persentage (%)**				
			SA(1)	**A(2)**	**U(3)**	**D(4)**	**SD(5)**
Students	5	After learning using the flipped classroom learning model, I can easily solve the problems given.	0	80	20	0	0

Based on Table 7, 80% of the students found it easier to solve problems using the flipped classroom learning model, while the remaining 20% expressed hesitation in solving the problems. This means that more students were helped by the flipped classroom learning model.

Table 8. Question 3: Implementation of the Flipped Classroom Model

Subject	**Total**	**Question**	**Persentage (%)**				
			SA(1)	**A(2)**	**U(3)**	**D(4)**	**SD(5)**
Students	5	I am more enthusiastic about learning mathematics and am not afraid of learning mathematics.	0	20	80	0	0

Based on Table 8, 20% of the students felt more enthusiastic and were not afraid to learn mathematics, while the remaining 80% expressed hesitation in studying mathematics after participating in learning using the flipped classroom-based learning model.

The results of the study indicate that the implementation of the flipped classroom learning model on students' mathematical understanding abilities has not been optimal. Most students still do not fully understand the procedures for applying this model, which results in the learning process not being utilized to its fullest potential. This is evident from the low student participation in pre-learning activities and their lack of readiness when attending classroom sessions. Additionally, students limited prior knowledge about the flipped classroom concept also poses a major obstacle in implementing this model. Another factor affecting the research outcomes is the unsupportive school environment. The lack of adequate supporting facilities, such as internet access and technological devices, makes it

difficult for students to follow the material provided online before face-to-face meetings in class. This condition impacts the effectiveness of the flipped classroom model in enhancing students' mathematical understanding.

The findings of this study show that the success of implementing the flipped classroom model heavily depends on students' readiness and a supportive learning environment. This model requires students to engage in independent learning through materials provided before face-to-face instruction, thus necessitating a good understanding of the procedures and objectives of the model. The lack of socialization and training regarding the flipped classroom causes confusion among students, preventing them from fully benefiting from this learning approach. Moreover, external factors such as limited technological facilities and insufficient school support also act as barriers. This aligns with previous research stating that the implementation of digital learning requires adequate infrastructure and digital literacy among students and schools. Therefore, before applying the flipped classroom model, thorough preparation is needed both in terms of students' knowledge and the availability of school facility. Overall, this study's results do not show a significant improvement in students' mathematical understanding due to internal and external challenges encountered during the implementation of the flipped classroom model.

CONCLUSION

Based on the results and discussion presented above, it can be concluded that the flipped classroom learning model is less effective in improving mathematical understanding skills when applied to students at this school. Several issues were found in the field, as follows: 1) The school environment and inadequate facilities and infrastructure caused students' knowledge and skills to lag slightly behind those of students in other schools; 2) A lack of student motivation and enthusiasm in participating in the learning process resulted in the material being delivered ineffectively and not meeting expectations; 3) The delivery of material needs to be more varied and continuously developed so that students do not feel bored during teaching and learning activities, thereby fully achieving the desired outcomes. From the research findings and conclusions, the researcher offers several suggestions that are hoped to serve as motivation for students, educators, and the school to improve teaching and learning activities for better implementation. The researcher's recommendations are as follows:

Students should increase their learning motivation, which is also a shared responsibility of educators and the school to enhance students' enthusiasm in receiving learning materials. The researcher hopes that in the future, improvements can be made so that students can better enhance their mathematical understanding skills. Furthermore, the researcher expresses sincere gratitude to all parties who were willing to participate in this research process.

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