

Students Conceptual Understanding Abilities Through Flipped Classroom Learning

Juwita¹, Kokom Komalasari²

1,2
The Education University, Indonesia

Abstract

The Flipped Classroom learning model has become an increasingly popular approach in the world of education, especially in response to changes in the needs and characteristics of today's students. This approach allows students to learn the material beforehand at home through various resources provided by the teacher, enabling classroom time to be used for discussing, deepening and applying the concepts already learned. This research aims to analyze in-depth how the implementation of the Flipped Classroom learning model can influence students' understanding of concepts in various subjects and disciplines. The method used in this research is qualitative research with a Literature Review approach. Data and information were collected through exploration of literature from various sources, including books and articles related to the Flipped Classroom and students' understanding of concepts. Analysis was conducted to evaluate the implementation of the Flipped Classroom in developing students' understanding of concepts and the factors influencing its success. The results of the research indicate that the implementation of the Flipped Classroom significantly contributes to developing students' understanding of concepts in various subjects. Factors such as technological readiness, designing learning content that meets students' needs, the interaction between students and teachers, and the support provided by parents play a crucial role in the success of the Flipped Classroom. These findings are expected to provide insights for educators in designing and implementing learning approaches that focus on students' deeper and sustainable understanding of concepts.

Keyword: flipped classroom; student understanding; teaching methodology; concept comprehension.

1. Introduction

In the 21st century, schools are required to develop critical thinking, communication, collaboration, and creativity skills, known as the 4C skills. These skills are closely related to students' conceptual understanding. When students deeply understand concepts, they are more capable of thinking creatively in applying new ideas, thinking critically in evaluating information, solving problems effectively, communicating clearly and persuasively, and collaborating well in teams. However, many findings indicate that students do not fully comprehend the concepts of the material they study, which results in difficulties in applying their knowledge in different situations or developing innovative solutions. This deficiency has been demonstrated through research conducted by Yuni Kartika (2018), which shows that based on test results, the average score of conceptual understanding in mathematics among 30 students is still relatively low, ranging from 40.00 to 54.99. This condition is caused by the fact that many teachers still use traditional teaching models, such as lectures, positioning

teachers as the center of the learning process. The teaching methods widely applied by teachers in schools today are still traditional (Mujiono, 2017). In this model, teachers maintain a dominant role in the classroom learning process (Nadia & Hadi, 2014). Students are required to sit quietly and listen to the information or material presented by the teacher. The one-way teaching method, where the teacher is the primary source of information and students play a passive role, is an outdated method that is no longer in line with the progress of the times (Zeki & Guneyli, 2014). Additionally, the teaching models used by teachers do not align with the students' characteristics.

To understand a particular subject matter, each student requires different amounts of study time (Mujiono, 2017). Some students can grasp the material with just one study session, while others need to read or study several times to fully comprehend the concepts. This often poses a challenge for teachers in the classroom. There are frequently students who learn more slowly and require more study time compared to their peers. This situation must be addressed by implementing a teaching model that adapts to the characteristics of the students and current developments by selecting a learning model that involves active student participation in learning activities. One way to address the low understanding of concepts is by designing an innovative learning model (Hayati & Asmara, 2021). One of the innovative 21st-century learning models is the flipped classroom model. This model reverses the traditional learning structure, where material is delivered outside the classroom through videos or reading materials, while class time is used for more interactive activities such as discussions, problem-solving, and collaborative tasks. Research by Bergmann and Sams (2012), pioneers of the flipped classroom model, shows that students engaged in this model have a better and deeper understanding of the subject matter compared to students who follow conventional teaching methods.

This research aims to analyze the implementation of the flipped classroom model on students' conceptual understanding at the secondary school level, with the hope of making a significant contribution to improving the quality of education in Indonesia.

2. Literature Review

2.1 Understanding Of Concepts

Understanding concepts is a crucial aspect of the learning process, as it enables students to enhance their abilities in every subject. Conceptual understanding consists of two terms: understanding and concept. Purwanto (in Murizal, 202:19) states that understanding is the level of ability that allows students to grasp the meaning of concepts, situations, or facts that they know. In line with this, Suharsimi (2009) defines understanding as an individual's ability to differentiate, estimate, expand, conclude, provide examples, rewrite, and predict. According to Wardhani (2008:9), a concept is an idea that allows a person to group or classify certain objects. Additionally, Dimyati (2002) mentions that a concept is an abstract idea used to categorize a group of objects.

According to Moore (2008), the seven indicators of conceptual understanding include: restating concepts in one's own words, grouping objects based on certain characteristics according to the concept, providing examples and non-examples of the concept, presenting the concept in various forms of representation, developing necessary or sufficient conditions for a concept, using, applying, and selecting certain procedures or operations, and applying the concept in problem-solving. To achieve these indicators, the learning model must be

more interactive. According to Ainurahman (2010), a teacher's ability to vary the appropriate learning models aims to create an active and enjoyable learning environment. This enables students to learn with high interest and achieve optimal learning outcomes. Therefore, it is essential for every teacher to have sufficient knowledge in implementing effective learning models. The relationship between learning models and conceptual understanding is very close, as the right learning model can help students better understand concepts. A varied learning model that meets the students' needs can make the learning process more interesting and challenging, thus facilitating students in understanding and internalizing the taught concepts.

2.2 Flipped classroom

The flipped classroom model developed by Bergmann and Sams in 2007 at a high school in Colorado incorporates learning technology, active learning techniques, and requires students to access learning materials online (Bergmann & Sams, 2012). According to Wolff and Chan (2015), the flipped classroom is a strategy that enables educators to reduce direct instruction while enhancing student interaction. Based on expert views, the flipped classroom integrates technology with the aim of creating active and efficient learning, fostering interaction among students as well as between students and teachers, thus actively involving them in problem-solving. The steps of the flipped classroom learning process outlined by Bergmann and Sams (2012) are as follows: before face-to-face meetings, students are required to independently study at home the material for the upcoming session by watching instructional videos made by the teacher or uploaded by others. During classroom instruction, students are divided into heterogeneous groups. The teacher's role is to facilitate discussions using innovative teaching methods and prepare several questions related to the material. The teacher also administers quizzes or tests to ensure that the activity is a learning process and not merely a game. In this context, the teacher acts as a facilitator in helping students understand the material and solve related problems.

The flipped classroom model is closely related to constructivist theory, pioneered by scholars such as Jean Piaget and Lev Vygotsky. Constructivist theory posits that knowledge is constructed through active interaction with the environment and through the process of internalization. In the context of a flipped classroom, students build their own knowledge as they engage in independent learning at home by watching instructional videos. This process allows students to develop an initial understanding, which is then reinforced and expanded through group discussions and problem-solving activities in class. The steps outlined by Bergmann and Sams reflect constructivist principles, where students are actively involved in their own learning process, and teachers act as facilitators guiding students in connecting new concepts with existing knowledge. Furthermore, the flipped classroom model is also associated with information processing theory, which views learning as a process of encoding, storing, and retrieving information. When students watch educational videos at home, they encode new information through visual and auditory means. Group discussions and problem-solving activities in class help strengthen the storage of information in long-term memory. Quizzes or tests administered by teachers allow students to retrieve the information they have learned, reinforcing retention and understanding. By combining independent learning and group discussions, the flipped classroom leverages the principles of information processing theory, wherein students are more likely to remember and

comprehend information when they are actively engaged in the learning process and frequently interact with the material in various contexts.

3. Material and Method

This research employs a qualitative research design using a literature review method, utilizing books and other literature as the primary research objects. According to Zed (2014:3), a literature review involves a series of research activities related to data collection from library sources, followed by reading, note-taking, and processing of the research materials. Furthermore, Sugiyono (2018: 291) explains that a literature review is associated with theoretical exploration through references related to values, culture, and norms that develop in the social situation being studied. This literature review is inherently related to academic literature. From this perspective, a literature review does not involve direct interaction with respondents in the field, as data is obtained from library sources such as books or documents, which are then read, noted, and analyzed. In this process, the researcher organizes, analyzes, and utilizes various relevant literature references regarding students' conceptual understanding abilities through the flipped classroom learning model. By exploring relevant literature, the researcher gains a deeper and broader understanding of the research focus issues.

3.1 Design Study

This research employs a literature review strategy based on scientific principles to investigate students' conceptual understanding and the application of the Flipped Classroom model. This approach involves the collection and analysis of data from various relevant scientific articles. The primary data sources for this research are scientific articles that discuss the implementation of the Flipped Classroom model in enhancing students' conceptual understanding. These articles were identified and collected using the academic search engine Google Scholar. Data collection was conducted through a literature search using the keywords "developing students' conceptual understanding through the flipped classroom model." The search focused on journal publications released between 2017 and 2024 to ensure the relevance and currency of the data.

3.2 Data Analysis

The collected data were analyzed descriptively and through observation of the article content. Descriptive analysis involves a deep understanding of the article's content, while observation is directed towards identifying common patterns and themes that emerge in the literature. The researchers conducted a comparative analysis of relevant research studies. This analysis compares independent sample variables with various variables over different periods. The aim of this analysis is to evaluate how the Flipped Classroom model is applied in various contexts and to identify factors that influence its effectiveness. Throughout this process, systematic note-taking, citation, or information retrieval mechanisms are crucial to facilitate future access to the collected information (Darmadi, 2011).

4. Result

After identifying relevant journal articles aligned with the writing purpose, the author proceeded with analyzing and comparing their contents based on the research objectives and findings they disclosed. These articles, including the works of Irna Septiani Maolidah et al. (2017), Feti Kristanti R (2019), Muhammad Abidin (2019), Yulia Janatin et al. (2019), Mujiono (2021), and Alberto Christian Silitonga et al. (2023), converge on similar research topics. These six studies predominantly focus on the implementation of the Flipped Classroom approach in

efforts to develop or enhance students' conceptual understanding across various subject contexts at the secondary school level. The syntax of the flipped classroom commences with teacher preparation, wherein instructional materials are curated for students to engage with at home, such as videos, articles, or modules. Subsequently, students access and study these materials at home, taking note of key points, posing inquiries, or completing preliminary assignments to ensure initial comprehension. Prior to class commencement, teachers assess students' understanding through brief quizzes, online discussions, or reviews of submitted assignments, while pinpointing areas that still lack clarity to be addressed during class. During class sessions, students participate in discussions, Q&A sessions, and material clarifications based on the pre-learned content, along with engaging in collaborative activities like group work, projects, case studies, or simulations that apply the learned concepts. Teachers provide guidance, support, and facilitate active learning processes for students. Following this, students reflect on their learning through class discussions, reflective journals, or presentations, while teachers offer constructive feedback and evaluate students' overall comprehension. As a follow-up, teachers assign further tasks or projects to deepen understanding and provide additional resources for students who require more support, or additional challenges for those who have mastered the material.

The initial research findings indicate that the implementation of the Flipped Classroom learning model has successfully enhanced students' critical thinking abilities across various aspects. This includes their capacity to identify and formulate questions, analyze arguments, and participate in discussions regarding explanations or challenges. Additionally, this model assists students in developing fundamental skills such as evaluating source credibility, observing, evaluating observations, and drawing conclusions. The ability to draw conclusions is also enhanced through this model, encompassing deduction, induction, and decision-making based on facts. Furthermore, students are aided in acquiring a deeper understanding of concepts by identifying relevant terms, definitions, and assumptions. Finally, the Flipped Classroom teaching model trains students in learning strategies and tactics, including decision-making, collaborating with peers, and applying logical strategies in problem-solving. The second research findings, obtained from interviews with students, indicate that those who successfully completed all indicators of mathematical understanding effectively learned through the Flipped Classroom teaching model. They experienced an enjoyable problem-solving experience with this model as it provided them with the freedom to determine problem-solving steps independently. They also felt supported by various tutors and available sources of information. In the third study conducted over two cycles in a class consisting of 25 students, the initial cycle showed that 52% of students demonstrated a sufficient mastery of geometric transformation formulas. However, the overall average score was 71.92, below the minimum proficiency standard. In cycle II, the results were satisfactory, with 80% of students showing a very high level of mastery of geometric transformation formulas. The average student score reached 90.80, well above the minimum proficiency standard. The final evaluation indicated that 100% of students achieved scores ≥ 75 in the high and very high proficiency categories. From the research findings, it can be concluded that the use of the Flipped Classroom learning model has improved students' mastery of geometric transformation formulas. The fourth research findings, namely the hypothesis test of mathematical concept understanding in the context of comparison material, showed that the t value of 3.0438 exceeds the critical t value of 2.0024 at a significance level of $\alpha = 0.05$. This indicates the rejection of the null hypothesis (H_0). Therefore, it can be

concluded that the use of the Flipped Classroom teaching model results in better improvement of students' mathematical concept understanding compared to conventional teaching methods. The fifth research findings indicate that the utilization of the Flipped Classroom teaching model benefits both teachers and students. This model allows for flexibility in learning time, which can be adjusted to various levels of student abilities and learning speeds. Teachers are responsible for providing learning materials that align with the curriculum and learning objectives. With various learning resources available on the internet, such as the Rumah Belajar website developed by the Ministry of Education and Culture, teachers can easily utilize various learning material formats according to each student's learning style. During the classroom learning process, teachers provide guidance to students to understand topics that may still be difficult to grasp. The implementation of the Flipped Classroom model allows students to prepare themselves before class, study the material independently, and in the classroom, teachers can focus on guiding students in a deeper understanding of concepts. With more direct interaction, students can ask questions and clarify their understanding, thus supporting the development of better conceptual understanding. The final analysis of the research indicates a difference in average results between the experimental class implementing the Flipped Classroom learning model and the control class using lecture methods. The control class obtained a post-test average score of 67.17, while the Flipped Classroom model obtained a score of 86.33.

The research findings above demonstrate how the implementation or adoption of the Flipped Classroom model successfully enhances students' understanding of concepts across various subjects. Students engage in self-directed learning before class and receive more individualized guidance during class. Direct interaction between teachers and students also enhances conceptual understanding. This aids students in better preparation and results in a significant improvement in academic outcomes.

5. Discussion

The implementation of the Flipped Classroom learning model has been proven to significantly contribute to enhancing students' understanding of concepts across various learning contexts. Research indicates that this model effectively fosters students' critical thinking abilities in various aspects. They are trained to identify questions, analyze arguments, and actively participate in discussions regarding explanations or specific challenges. Furthermore, they are guided to develop fundamental skills such as evaluating sources, observing, and drawing conclusions. The ability to draw conclusions is also enhanced through this model, which encompasses deduction, induction, and decision-making based on facts. Additionally, students are encouraged to deepen their understanding of concepts by identifying relevant terms, definitions, and assumptions. The Flipped Classroom learning model also trains students in learning strategies and tactics, including decision-making, collaboration, and the application of logical strategies in problem-solving. Highlighting the importance of this model in the context of mathematics education, interviews with students who have successfully completed mathematics understanding indicators reveal that they find learning more effective through the Flipped Classroom model. They enjoy the learning experience because it provides them with the freedom to determine problem-solving steps independently. Moreover, they feel supported by various tutors and available sources of information. Further emphasis on the improvement of students' mastery of geometry transformation formulas after the implementation of the Flipped Classroom model in cycle II shows a significant increase in the average scores of students. This indicates the effectiveness of this learning model in enhancing conceptual understanding. This

fourth research finding reaffirms previous findings by demonstrating that the use of the Flipped Classroom model leads to a significant improvement in students' mathematical concept comprehension compared to conventional learning models. Lastly, highlighting the benefits of the Flipped Classroom model for both teachers and students, this model offers flexibility in learning time, allowing teachers to provide learning materials tailored to students' needs and learning objectives. Students can prepare themselves before class, study materials independently, while teachers can provide more individual guidance during class sessions.

Overall, various findings from the research studies indicate that the Flipped Classroom learning model is effective in enhancing students' conceptual understanding abilities. These findings are supported by researcher Darwani, who states that students' conceptual understanding abilities taught with the Flipped Classroom model are superior to those taught with conventional methods. By providing students with the opportunity to learn independently before class and receiving individual guidance during class sessions, this model encourages the development of deeper and more comprehensive conceptual understanding.

6. Conclusion, Implication, and Recommendation

Research findings indicate that the consistent implementation of the Flipped Classroom model yields positive impacts on enhancing students' conceptual understanding across various learning contexts. Effectively fostering students' critical thinking skills, reinforcing their mathematical conceptual understanding, and enhancing fundamental learning skills and strategies, this model facilitates independent learning opportunities for students prior to class and provides individualized guidance during class sessions. The Flipped Classroom model encourages the development of deeper and more comprehensive conceptual understanding.

The implications of this finding are significant in the context of education. The implementation of the Flipped Classroom model can serve as an effective strategy for educators to enhance students' learning outcomes, particularly in developing conceptual understanding. Educators can utilize this model to facilitate more interactive learning, support the development of critical thinking skills, and increase student engagement in the learning process.

Several recommendations can be drawn from this study. Firstly, there is a need for adequate training and support for educators to implement the Flipped Classroom model effectively, enabling them to harness its full potential. Secondly, it is important to develop creative and diverse learning content to support the Flipped Classroom model, including the utilization of various online learning resources. Thirdly, fostering close collaboration between educators and students in the learning process is crucial, allowing educators to provide more individualized guidance tailored to students' needs. Lastly, further research is suggested to explore the potential and limitations of the Flipped Classroom model in different learning contexts and to deepen understanding of its long-term impact on student learning outcomes.

7. References

Abidin, M. (2019). Model pembelajaran flipped classroom sebagai upaya peningkatan kemampuan penguasaan rumus transformasi geometri. *PEDAMATH: Journal on Pedagogical Mathematics*, 1(2), 49-60.

- Adhitiya, Ervan Nur, Ardhi Prabowo, and Riza Arifudin. "Studi Komparasi Model Pembelajaran Traditional Flipped Classroom Dengan Peer Instruction Flipped Terhadap Kemampuan Pemecahan Masalah." *Unnes Journal of Mathematics Education* 4, 2015.
- Ainurrahman. 2010. *Belajar dan Pembelajaran*. Bandung: ALFABETA.
- Arikunto, Suharsimi. (2009). *Dasar– Dasar Evaluasi Pendidikan*, Jakarta: BumiAksara.
- Bergmann, J. & Sams. A. 2012. *Flip Your Classroom: Reach Every Student in Every Class Every Day*. WashingtonDC: ISTE.
- Bergmann, J., & Sams, A. (2012). *Flip your classroom: Reach every student in every class every day*. International society for technology in education.
- Darmadi, Hamid. 2011. *Metode penelitian pendidikan*. Bandung : Alfabeta.
- Dimiyati, 2002. *Belajar dan Pembelajaran*. Jakarta: Rineka Cipta.
- Hayati, R., & Asmara, D. N. (2021). Analisis Pemahaman Konsep Matematis Mahasiswa PGSD pada Mata Kuliah Konsep Dasar Matematika. *Jurnal Basicedu*, 5(5), 3027–3033.
- Hayati, Rahma. "Flipped Classroom Dalam Pembelajaran Matematika : Sebuah Kajian Teoritis." *Ruang Seminar UMP Vol. 4* (2018).
- Hendriana, Heris, Euis Eti Rohaeti, and Utari Sumarno. *Hard Skills Dan Soft Skills Matematik Siswa*. Cetakan ke. Refika Aditama, 2017.
- Janatin, Y., Putra, R. W. Y., & Hamid, A. (2019, June). Upaya meningkatkan kemampuan pemahaman konsep matematis siswa SMP dengan menggunakan pembelajaran model flipped classroom. In *Prosiding Seminar Nasional Matematika dan Pendidikan Matematika* (Vol. 2, No. 1, pp. 125-139).
- Kristanti, F. R., Isnarto, I., & Mulyono, M. (2019). Kemampuan Pemahaman Konsep Matematis Siswa dalam Pembelajaran Flipped Classroom berbantuan Android. In *Prosiding Seminar Nasional Pascasarjana* (Vol. 2, No. 1, pp. 618-625).
- M Mukhlas Sumani, *Belajar Dan Pembelajaran*, Bandung, Pt Remaja Rosda Karya: 2017.
- Maolidah, I. S., Ruhimat, T., & Dewi, L. (2017). Efektivitas penerapan model pembelajaran flipped classroom pada peningkatan kemampuan berpikir kritis siswa. *Educational Technologia*, 1(2).
- Muhamad Yasin, Jamal Fakhri, Siswadi, Rahma Faelasofi, Ahmad Safi'i, Nanang Supriadi, Muhamad Syazali, Ismail Suardi Wekke. "The Effect of SSCS Learning Model on Reflective Thinking Skills and Problem Solving Ability." *European Journal of Educational Research* 9, no. 2 (April 15, 2020).
- Mujiono, N. F. N. (2021). Flipped Classroom: Sekolah tanpa Pekerjaan Rumah. *Jurnal Teknodik*, 67-79.

- Mujiono, N. F. N. (2021). Flipped Classroom: Sekolah tanpa Pekerjaan Rumah. *Jurnal Teknodik*, 67-79.
- Mujiono. (2017b). Pengembangan E-learning Sebagai Pusat Sumber Belajar untuk Mendukung Student Centered Learning. Seminar Nasional Teknologi Pembelajaran Dan Pendidikan Dasar 2017, 49–55.
- Murizal, A., Yarman, & Yerizon. (2012). Pemahaman Konsep Matematis Dan. Model Pembelajaran Quantum Teaching. *Jurnal Pendidikan Matematika*, 1(1), 19–23.
- Nadia, Z., & Hadi, S. (2015). Pengaruh model pembelajaran guided inquiry terhadap hasil belajar IPA. *Jurnal Teknodik*, 141–155.
- Nurma, L. L. (2021). *Pengaruh Model Pembelajaran Flipped Classroom Berbantuan Media Audio Visual Untuk Meningkatkan Kemampuan Pemahaman Konsep Dan Minat Belajar Peserta Didik* (Doctoral Dissertation, Uin Raden Intan Lampung).
- Pratiwi, Dona Dinda. “Pembelajaran Learning Cycle 5E Berbantuan Geogebra Terhadap Kemampuan Pemahaman Konsep Matematis.” *Aj-Jabar*, 2016.
- Shibukawa, Sachika, and Mana Taguchi. “Exploring the Difficulty on Students“ Preparation and the Effective Instruction in the Flipped Classroom.” *Journal of Computing in Higher Education* 31, no. 2 (August 10, 2019): 311–39.
- Silitonga, A. C., & Susarno, L. H. Efektivitas Penggunaan Model Pembelajaran Flipped Classroom Terhadap Pemahaman Konsep Siswa Dalam Materi Perencanaan Dokumentasi Video Di Kelas X Smk Negeri 7 Surabaya.
- Sugiyono. (2018). *Metode penelitian kuantitatif, kualitatif, dan r&d*. Bandung: Alfabeta.
- Ulya, Mila Rofiatul, Isnarto, Rochmad, and Wardono. “Efektivitas Pembelajaran Flipped Classroom Dengan Pendekatan Matematika Realistik Indonesia Terhadap Kemampuan Representasi Ditinjau Dari Self-Efficacy.” *Prosiding Seminar Nasional Matematika 2*, Vol. 2, 2019.
- Wardani, S. (2008). Pengembangan keterampilan proses sains dalam pembelajaran kromatografi lapis tipis melalui praktikum skala mikro. *Jurnal Inovasi Pendidikan Kimia*, 2(2).
- Wolff, L. C. & Chan, J. 2016. *Flipped Classroom For Legal Education*. Singapore: Springer.
- Zed, M. (2014). *Metode penelitian kepustakaan*. Jakarta: Yayasan Pustaka Obor Indonesia.
- Zeki, C. P., & Güneyli, A. (2014). Student teachers’ perceptions about their experiences in a student centered course. *South African Journal of Education*, 34(3).