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Flipped Classroom Assisted with Schoology Applications to Support Student Metacognition Skills

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Abstract: Metacognition skills are critical in regulating and supporting student learning, and metacognition is one of the key factors contributing to the success of student learning. Therefore, it is crucial to develop students' metacognition skills throughout the learning process. The purpose of this research is to identify the effectiveness of the LMS (Schoology) assisted flipped classroom learning model in improving students' metacognition skills. This study used a quasi-experimental design consisting of a control group and an experimental group of grade 10 high school students, with each group consisting of 30 students. The experimental group was taught using a flipped classroom model with the help of the LMS, while the control group was taught using a teacher-centered approach. Data collection involved administering a questionnaire on metacognition skills, and data was analyzed using descriptive analysis techniques and independent sample t-test. The results of the analysis showed that the post-questionnaire score in the control group was 53.55% and in the experimental group was 77.58%, demonstrating that the LMS-assisted flipped classroom model contributes to improving students' metacognitive skills.

Keywords: Biology; Flipped-classroom; LMS; Metacognition

Introduction

The 21st century is a time where there have been many changes and advances that have had an impact on human life, requiring individuals to have various abilities/skills to compete both nationally and internationally. Changes and progress in the 21st century certainly impact various fields, especially education. Educators and students face several challenges to survive in this era.

Facing the challenges of the 21st century in the field of science and technology, students must have the skills to guarantee their ability to compete in the globalization era (Turiman et al., 2012). P21 (Partnership for 21st Century Learning) develops a learning framework in the 21st century which explains that students are required to have skills, knowledge and abilities in the fields of technology, media and information, learning and innovation skills as well as life and career skills (P21, 2019).

To redesign the knowledge, skills, and character qualities required for the 21st century, an educational meta-layer is urgently needed. This would allow students to reflect on what they have learned, internalize the development of their mindset, and learn to adjust their learning and behavior based on the goals they want to achieve (Gro & Trilling, 2015). The ability to self-reflect on the cognitive processes of each individual is unique and plays an important role in human consciousness (Murti, 2011). This ability is called metacognition skill.

Metacognition is a term that was first introduced by John Flavell in 1970, which means "thinking about thinking (Flavell, 1979). Metacognition has become a graduation standard, which can improve students' higher-order thinking skills (Herlanti et al., 2017). Improving students' metacognitive abilities certainly requires a series of learning processes that can support it, and the role of teachers is very important in designing the learning process including selecting learning

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strategies or models. Metacognition is very important for learners of all ages. This leads to questions about how to develop metacognitive abilities and habits in the classroom, whether it is done at the elementary, secondary, undergraduate or graduate level (Martinez, 2016).

The learning pattern of science in Indonesia is mostly focus on concepts and lacks attention to improve metacognitive abilities. This leads to a low cognitive ability of students because they are not trained to understand their own cognitive abilities, also known as self-assessment, and are less capable of utilizing their cognitive abilities (Djamahar et al., 2019). Improving students' metacognition abilities in the learning process, of course a series of supporting learning strategies is needed. One of the current educational trends applying the flipped classroom model in the learning process.

This means that the delivery of material content is not carried out in the classroom, but the delivery of teaching materials is carried out through online before and outside of class. Then, learning in the classroom is carried out with various activities such as discussions, doing assignments, solving a problem, and others. This model provides various types of activities that can have an impact on students' metacognition (Limueco & Prudente, 2019).

The implementation of the flipped classroom model certainly requires supporting technology. The technology in implementing the flipped classroom model that chosen by the researcher is Schoology application. Schoology is an innovative platform built based on the inspiration of the social media site "Facebook", with aim of serving education. Schoology is supported by various forms of media such as videos, audios, and images that can attract students' interest. Schoology directs student to apply the use of technology in learning. With various advantages, therefore, the researcher wants to reveal the effectiveness of the flipped classroom learning model assisted by the Schoology application on students' metacognitive abilities. The most common reason why students are interested in this model is because they learn through videos, have the opportunity to learn at their own pace, and its' flexibility and mobility (O'Flaherty & Phillips, 2015). Therefore, the selection of technology that supports the flipped classroom model must be appropriate and in accordance with learning needs.

The concept of flipped classroom is that inquiry-based and investigative activities will be carried out in class, while students learn the lesson content provided by the teacher at home and bring that knowledge into the classroom (Hidayah & Mustadi, 2021).

Several researchers have studied the flipped classroom model. For example, a study by Karabulut-Ilgu et al. (2018) stated that the effectiveness of flipped learning is not only on academic achievement but also on improving cooperation and thinking among students, and can change students' attitudes towards learning and teacher-student interactions. The flipped classroom model can motivate students to work harder (Alkhoudary & AlKhoudary, 2019). With the flipped classroom model, maximum learning outcomes can be achieved (Nouri, 2016). Through the flipped classroom model, students can be more active participants in the learning process (Campillo-Ferrer et al., 2021).

Research on the flipped classroom model in the learning process has yielded positive results, but these studies have not discussed in detail the technological support used in the flipped model. Therefore, researchers took the initiative to examine the use of the Schoology application in a flipped classroom to support students' metacognition skills. From the results of this study, it will provide information and contributions in the field of education, especially related to information technology learning models that are effective in supporting students' metacognition awareness. One of the media that can be used by teachers in maximizing flipped classroom learning is the Schoology application. Schoology is a Learning Management System (LMS), or an online program that allows teachers to compile and deliver learning materials to students.

The definition of Schoology according to Aminoto et al. (2014) is a website that combines E-learning and social networking. The concept of Shcoology is similar to Edmodo, but in terms of E-learning, Schoology has many advantages. Creating an online learning system using Schoology is also more profitable than Moodle, because it doesn't require hosting.

Based on the background, the formulation of the problem in this study is: Is the flipped classroom model assisted by the schoology application effective in increasing students' metacognition awareness in biology subjects? The aim of this research is to find out the effectiveness of the flipped classroom model assisted by the schoology application in increasing students' metacognition awareness in biology subjects.

Method

This study adopted a quasi-experimental research design to determine the effectiveness of the flipped classroom model aided by the Schoology application on students' metacognitive skills. The research subjects in this study were 60 tenth-grade students in one of the public high schools in Makassar city. Thirty students were taught with the Flipped Classroom model as the experimental group, while the other thirty students were taught with traditional teaching methods as the control

group. The measurement tool used in this study was a metacognitive skill questionnaire consisting of eight indicators with 52 statement items.

Each class was given a pre and post questionnaire to determine whether there was a difference in the improvement of metacognitive abilities. The pre-questionnaire was conducted before the learning process began, while the post-questionnaire was conducted after the learning process was completed. The data analysis technique used was descriptive statistics and independent sample t-test analysis.

The indicators used to measure metacognitive skills were: procedural knowledge, declarative knowledge, conditional knowledge, information management strategies, error-checking and correction strategies, planning, monitoring comprehension, and evaluation (Schraw & Dennison, 1994; Erskine et al., 2009). The interpretation of student metacognitive skill data can be seen in Table 1.

Table 1. Criteria for Interpreting Metacognition Score

Score Range (%)	Interpretation
0 – 20	Very Poor
21 – 40	Poor
41 – 60	Fair
61 – 80	Good
81 – 100	Excellent

In the control class, the applied learning process was the traditional teaching model where students receive learning materials with a teacher-centered strategies. This is a common learning pattern that is often applied by teachers. In the experimental class, the learning process uses the flipped classroom model where students read the learning materials online through the Schoology application before the classroom meeting. Then, in the classroom, students work on a series of activities or assignments given by the teacher. This learning model pattern reverses or exchanges the activities that are usually carried out in traditional teaching.

Result and Discussion

Data on metacognitive skills were obtained from students in one public school in Makassar city, in the 10th grade, divided into experimental and control groups, each consisting of 30 students. The instrument used was a metacognitive skills questionnaire and the data were analyzed descriptively and using independent sample t-test. Data were collected before (pre-questionnaire) and after the learning process (post-questionnaire).

The average score of students' metacognitive skills in biology was obtained from the scores of Class X A (control group) and Class X B (experimental group). Based on the results of descriptive analysis of data in the control and experimental groups, there was an increase in the average scores of students' metacognitive skills before and after the learning process. The average increase in metacognitive skill scores for the experimental group was higher than the average increase in scores for the control group. The average scores in the control and experimental groups can be seen in Table 2.

Table 2. The Average Scores of Metacognitive Skill

Group	Before Learning Process		After Learning Process	
	Pre Questioner (%)	Category	Post Questioner (%)	Category
Control	40.73	Fair	53.55	Fair
Experiment	40.45	Fair	77.58	Good

Based on the average score of students' metacognitive skills before the learning process in the control and experimental groups, there was no significant difference and both were in the "fair" category. After the learning process, students in the control group obtained an average metacognitive skill score of 53.5%. There was an increase in the average score of metacognitive skills in the control group, but it remained in the "fair" category. Meanwhile, in the experimental group, the average score of students' metacognitive skills before the learning process was 40.45%, which was in the "fair" category. After the learning process, the average score of students' metacognitive skills in the experimental group was 77.58%, which was in the "good" category. Based on this data, it is clear that the improvement of metacognitive skills in the experimental group is greater than that in the control group, indicating that the implementation of the flipped classroom model with the help of LMS can improve students' metacognitive skills.

The number of students who achieved the categories of very poor, poor, fair, good, and excellent in metacognitive skills before and after the learning process were shown in Figure 1 and 2.

For the control group before the learning process, the number of students who were in the poor category was 15 people and the number of students who were in the “fair” category was 15 people. Then, after the learning process, the number of students in the “fair” category was 23 people and in the "good" category there were only 7 people. Student achievement in the experimental group can be seen in Figure 2.

In the experimental group, before the learning process, the number of students who acquired metacognition skills in the "poor" category was 14 people and in the "fair" category were 16 people. Then,

after the learning process, the number of students who acquire metacognition skills in the "good" category is 24 people and 6 others are in the “excellent" category. This shows that the LMS-assisted flipped classroom model can support the improvement of students' metacognition skills during the learning process. Students' metacognitive abilities must be developed so that they can determine their learning methods, class performance and improve their academic achievement. (Jaleel et al., 2016). Flipped classroom learning allows students to master material according to student learning styles, available time, and their speed (Erlinda, 2018).

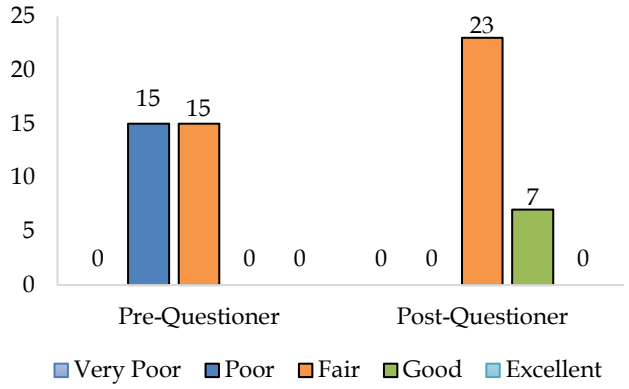

Figure 1. Graph of students' metacognition achievement in the control group based on categorization

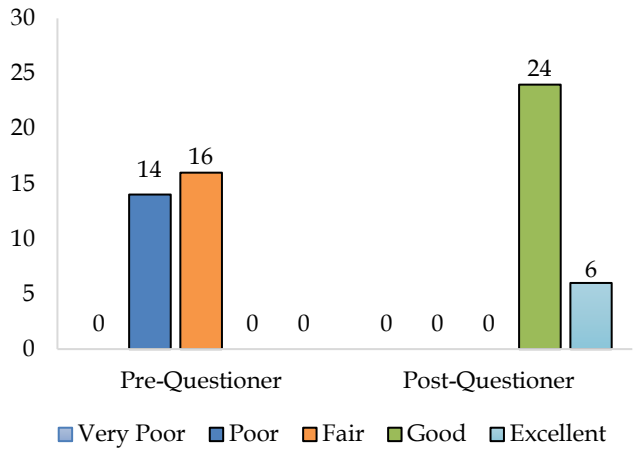

Figure 2. Graph of students' metacognition achievement in the experimental group based on categorization

In this study, there are 8 indicators to measure metacognitive skills, namely procedural knowledge, declarative knowledge, conditional knowledge, information management strategies, strategies for checking and correcting errors, planning, monitoring and understanding and evaluation. Students' metacognition scores based on indicators of students' metacognition skills in the control and experimental groups could be seen in the graph below.

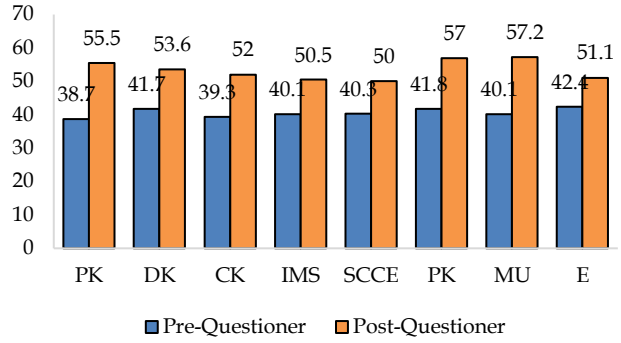

Figure 3. Improving students' metacognition skills for each indicator in the control group.

Information: PK = Procedural Knowledge, DK = Declarative Knowledge, CK = Conditional Knowledge, IMS = Information Management Strategies, SCCE = Strategies for Checking and Correcting Errors, P = Planning, MU = Monitoring and Understanding, E = Evaluation.

Based on Figure 3, there is an increase after the learning process in the control group. The average score increase for each indicator is approximately 13%. This shows that traditional learning in this case using the Student Centre approach does not have a significant effect on increasing students' metacognition skills.

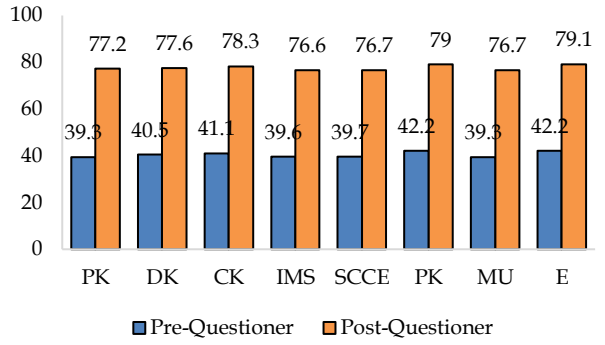

Figure 4. Improving students' metacognition skills for each indicator in the experimental group

Information: PK = Procedural Knowledge, DK = Declarative Knowledge, CK = Conditional Knowledge, IMS = Information Management Strategies, SCCE = Strategies for Checking and Correcting Errors, P = Planning, MU = Monitoring and Understanding, E = Evaluation

Based on data on students' metacognition skills in the experimental group showed a greater increase compared to the control group. The average increase in students' metacognition skills for each indicator in the experimental group reached about 37%. The average

percentage of increasing students' metacognitive skills shows that the flipped classroom learning model assisted by the achoology application can help improve students' metacognitive skills. The flipped classroom model provides space for students to solve difficult concepts where teachers and peers support each other in learning (Smallhorn, 2017). In implementing the flipped classroom effectively, the teacher needs to consider several things, such as choosing the types of activities and materials for online and face-to-face learning sessions in the classroom (Mubarok et al., 2019).

The results of the independent sample t-test analysis on the value of students' metacognition skills in the control and experimental groups could be seen in the table below.

Table 3. Analysis of Independent Sample T-Test Pre-Questionnaire Scores

Score of Post Test	N	Mean	SD	Sig.(2 tailed)
Control	30	40.73	3.44	0.759
Experiment	30	40.45	3.66	

Table 4. Analysis of Independent Sample T-Test Post-Questioner Scores

Score of Post Test	N	Mean	SD	Sig.(2 tailed)
Control	30	53.55	8.82	0.000
Experiment	30	77.58	4.80	

Based on Table 3, the results of the independent sample t-test for the metacognitive skills of students before the learning process either control or experimental groups yielded a significance value (2-tailed) of 0.759, which means that there is no difference of metacognitive skills' students between the experimental and control groups. Data in table 4 which shows the results of the independent sample t-test for the students' metacognitive scores after the learning process and obtained a significance value (2-tailed) was 0.000. It indicated that there is a difference in the metacognitive scores of students between the experimental and control groups. The flipped classroom learning model with LMS assistance can enhance students' metacognitive awareness. Active learning and the use of technology in the flipped classroom model can help improving knowledge and cognitive control abilities (Shih & Huang, 2018; Hsieh et al., 2017). This model also enables improved performance, motivation, and self-directed learning skills of students (Kvashnina & Martynko, 2016).

Conclusion

Based on the results of data analysis and discussion, it can be concluded that there are differences in students' metacognition skills in the control group and the experimental group. Students in the experimental group who were taught using the schoology-assisted flipped classroom model experienced a greater increase in metacognition skills scores than the control group. This shows that the flipped classroom model with the help of LMS (schoology) can contribute to improving students' metacognition skill.

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Author Contributions

Nurdiyanti conceptualized the research idea, designed of methodology, analyzed data, management and coordination responsibility. Muhammad Wajdi conducted a research and investigation process, literature review and provided critical feedback on the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results

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