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Flipped Classroom in Mutation Chapter Learning: Studies in Student Learning Outcomes

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Abstract

Flipped Classroom is one of the innovations in the learning process, along with the development of technology. Research aim is to find the effect of flipped classroom to the students' biology learning achievement especially in the mutation concept. This research is an experimental research with the type of research Quasy Experiment Design which aims to determine the effect of the flipped classroom learning model toward the student learning outcomes on material mutation at SMAN 9 Makassar. The independent variable of this study is the application of the flipped classroom learning model and the conventional learning model, while the dependent variable is the learning outcomes of students on material mutation. The population of this study were all students of class XII MIA SMAN 9 Makassar totaling 180 students, while the sample of this study was XII MIA 4 as a control with a total of 30 students and class of 30 students. The research data were obtained by giving a learning achievement test on mutation material in the form of pretest and posttest. Data analysis technique was carried out by covariate analysis (Anakova). Based on the results of the analysis, P = <0.001 is smaller than α = 0.05 It can be concluded that (1) the learning outcomes of students taught using the flipped classroom learning model have grades in the very good category; (2) the learning outcomes of students taught without using the flipped classroom learning model have grades in the poor category; (3) there is an influence of the flipped classroom learning model on the biology learning outcomes of students at SMAN 9 Makassar.

Key words: flipped classroom, learning outcomes, learning model, mutation.

INTRODUCTION

Education occupies a high position in efforts to improve the quality and skills of life. Education is a conscious and planned effort to create learning conditions and learning processes so that students actively increase their potential in the form of religious spiritual strength, personality, self-control, intelligence, skills and noble morals. Education can advance a nation and form individuals who are better and useful for themselves, other people, religion, nation and society (Kurniawati, 2022).

Through education, it is hoped that we can create the nation's next generation with intelligent and qualified individuals, a generation that can make the best use of existing progress. Without education, there will be no progress. Therefore, education is very important and must be given to all citizens from an early age so that a country can develop quickly. Developed countries are countries that prioritize the education of their citizens (Fitri, 2021). Indonesia is a country that cares about the provision of education. However, currently various kinds of educational problems in

Indonesia are the biggest challenge in realizing quality education (Kurniawati, 2022).

The problem that is widely discussed is related to the low quality of education which is reflected in the low average learning outcomes of students (Halim & Labulan, 2019). There are various causes of problems in the education system. Examples are weak education management, incomplete facilities and infrastructure, low quality of teachers and weak learning evaluation standards. Apart from this, there are still various other problems in the learning process (Fitri, 2021).

Interaction in the learning process has educational value because students are required to achieve the learning objectives that have been created previously. Through this objective, it is hoped that students will be able to understand and master the material provided. However, various problems often occur in the learning process, such as the use of monotonous learning models. Monotony means there is no change and innovation, in other words, this model is simply implemented without any differences in the delivery of material to students, while the learning model used greatly influences students' learning outcomes. Therefore, in the learning process teachers must use creative and innovative learning models to attract the interest of students who can then achieve the expected learning outcomes (Kurniawati, 2022).

Problems related to low learning outcomes due to the use of monotonous learning models also occur at SMAN 9 Makassar. The results of research by Afsani, et al. (2016) showed that only 38% of students completed the minimum completion criteria score of 75. The results of observations and interviews with biology teachers also showed that students tend to be passive so that learning becomes boring with learning models that are still considered traditional.The learning model used is conventional with a monotonous lecture method in biology learning. Learning process is still centered on the teacher so that students are unable to think critically and learn individually. Therefore, this research was conducted at SMAN 9 Makassar school.

A learning model can influence student learning outcomes. The better the model and learning process applied, the more student learning outcomes will improve (Supartin, 2022). Along with advances in technology, many learning models have been developed (Darmawan, et al., 2022). One option that can be used is to use a learning model to provide space for students to improve all their potential and abilities. The learning model that can be used is the flipped classroom model (Choiroh, et al., 2018). This model uses learning media that is accessed online by students which can support learning material. More emphasis is placed on utilizing time in class so that learning becomes of higher quality and can increase knowledge and understanding of concepts (Riyanti & Dedy, 2021).

Flipped classroom is proved to be an effective learning model for preparing students before face-to-face learning in class. It is hoped that students will have initial knowledge and abilities (cognitive entry behavior), be better prepared, be more active and more interactive in

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learning. The teacher's function is as a transmitter of information (transfer of knowledge), turning into a facilitator of learning through assignments and designing challenging activities for students (Patandean & Richardus, 2021).

Flipped classroom also puts responsibility on students to continue learning. Students do not just sit still and passively during the learning session, because the teacher does not act as a material provider but only as a facilitator. Using this model will increase interaction between students and teachers. Apart from that, students also cannot miss lessons due to their absence from class because with this model students can learn anytime and anywhere (Yousefzadeh & Adghar, 2015). Students can collaborate with friends to explore new ideas and knowledge about the subjects studied through discussion forums (Jdaitawi, 2019).

Providing content that students can learn before learning in class, students' curiosity and needs to master knowledge are met and satisfied. Providing a variety of learning media will meet the different learning styles of students. Therefore, it is hoped that the flipped classroom can encourage interest in mastering knowledge (Baslimi & Syafriadin, 2022). Learning models and media are very useful for fostering student activity, interest in learning and learning outcomes (Sudirman, et al., 2023). The flipped classroom has provided increased interest and learning outcomes for students (Farman & Chairuddin, 2020). The learning outcomes obtained by students after carrying out learning activities are indicated by the test scores given by the teacher at the end of the subject (Sihotang, et al., 2020).

Flipped classroom aims to motivate students during learning. Apart from that, the use of existing technology will make it easier to deliver material in the learning process and make the learning process more interesting (Darmawan, et al., 2022). The flipped classroom learning model is inverted classroom learning, namely changing the learning conditions that are generally done in class to now be done at home and those that are generally done at home to be done in class. Students can access material anywhere and anytime. The activity carried out is studying material using digital media such as WhatsApp groups.

Learning via the internet, both synchronously and asynchronously, can increase student interaction with teachers and other students in learning. Taking advantage of online learning opportunities allows students to improve their skills and provides important opportunities to further broaden participation in learning (Palupi, et al., 2022). Flipped classroom in the learning process, students study the subject matter first at home before class starts. Teaching and learning activities in class include doing assignments, discussing material or problems that students do not understand when studying independently at home.

The effect of the flipped classroom on student learning outcomes is also supported by various previous research results (Aycicek & Tugba, 2018; Alten et al., 2019). Students in classes using the flipped classroom achieved learning outcomes that were rated significantly

higher than students in classes taught using the conventional model. Apart from that, the same opinion was also expressed by Putra & Nurul (2022) who stated that the flipped classroom had an effect on student learning outcomes in Biology material.

Based on the review that has been explained, there are three problems that are the focus of this research. First, what are the learning outcomes of students taught using the flipped classroom learning model at SMAN 9 Makassar? Second, what are the learning outcomes of students who are taught without using the flipped classroom learning model at SMAN 9 Makassar? Third, is there an influence of the flipped classroom learning model on students' biology learning outcomes at SMAN 9 Makassar?

METODE

This type of research uses The type of research carried out is a quantitative quasi-experimental research. Form of experimentThis has a control group, but it cannot function fully to control external variables that influence the implementation of the experiment. Quasi experimental does not determine groups randomly (Sugiyono, 2019).

The time of the research was carried out on 23 February – 20 March 2023. This research was carried out at SMA Negeri 9 Makassar which is located on Jl. Karunrung Raya No.2, Karunrung, Rappocini District, Makassar City, South Sulawesi.

A population is a group of subjects or objects that have certain characteristics determined by researchers to study and draw conclusions. The population in this study was all MIA students at SMAN 9 Makassar, totaling 180 students. Sample selection in the research was carried out using non-probability sampling techniques. Non-probability sampling is a sampling technique that does not provide equal opportunities for each member of the population to be selected as a sample.

The consideration for determining the sample was the similarity of biology teachers. Based on the experience and considerations of the teacher, the two sample classes used were determined and deemed to have equivalent student characteristics and abilities. This research uses purposive sampling, namely a sample selection technique that is carried out with certain considerations (Darwin, et al., 2021). The sample taken in this research was 60 students, with the sample selection results being 30 students from class XII MIA 5 as the experimental class and 30 students from class XII MIA 4 as the control class.

The initial implementation of the research was carried out pre-experimentally to familiarize students, especially the experimental group, with learning using a flipped classroom, where in this pre-experiment students were accustomed to learning independently and discussing in groups. After the pre-experiment, a pre-test was carried out in the experimental and control classes. Then the learning process was carried out using the flipped classroom model in the experimental class, while in the control class the conventional learning model was used.

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The teaching and learning process with the topic of mutation material in this research was carried out in 3 meetings. The first meeting is 2 hours of class (2 x 45 minutes), discussing the meaning and types of mutations. The experimental class is taught using the flipped classroom model, students will work on worksheet and group discussions related to problems that are not yet understood in material that has previously been studied at home. The control class is taught using a conventional model, namely the learning model applied by biology teachers so far when teaching in the classroom. The application of this model makes students hear material from the teacher using the lecture method and are given assignments to do at home.

The second meeting is 2 hours of class (2 x 45 minutes), the topic of mutagens. The experimental class is taught using the flipped classroom model, students will work on worksheet and the teacher provides stimulus questions to stimulate class discussion. The control class is taught using a conventional model, students hear material from the teacher using the lecture method and are given assignments to do at home.

The third meeting is 2 hours of class (2 x 45 minutes), discussing the dangers and benefits of mutations. The experimental class is taught using the flipped classroom model, students will discuss and answer the problems contained in the worksheet in groups then present in front of the class. The control class is taught using a conventional model, students hear material from the teacher using the lecture method and are given assignments to do at home. In the final stage of the research, an evaluation was carried out. The evaluation stage involves giving a posttest to students at the end of the learning process in the experimental class and control class, to determine student learning outcomes after the learning activities.

The instrument used in this research is a learning outcomes test which is made in objective form in the form of 30 multiple choice questions. Each question consists of five alternative answers, namely A, B, C, D, and E in accordance with the concept of mutation material. The instrument is designed based on the level of the cognitive domain which is measured using the new operational verbs of Bloom's taxonomy.

The data collection technique used in this research is a test technique. The test technique used is an objective test consisting of items that are answered by selecting one of the alternative answers available or filling in the correct answer. The test was carried out twice, namely pretest and posttest.

Data analysis was carried out using prerequisite tests which were carried out using normality tests and homogeneity tests. The normality test is carried out to determine whether the data obtained in the research comes from a normally distributed sample or not. Once it is known through the normality test that the research data is normally distributed, homogeneity testing can then be carried out. The homogeneity test is a test of whether the variations in two or more

distributions are the same. The homogeneity test functions whether the two population groups are homogeneous or heterogeneous (Aulannisa, et al., 2021). After the data is detected as normal and homogeneous, an inferential test is carried out to test whether the hypothesis can be applied to the population. Hypothesis testing was carried out using the Anacova test to test the effect of implementing the flipped classroom on student learning outcomes.

RESULT AND DISCISSION

The results of descriptive statistical analysis have described the learning outcomes of students in the experimental class and control class which are presented in Table 1. Research results are presented in graphical, tabular or descriptive form. Analysis and interpretation of these results are required before they are discussed.

Table 1. Descriptive Statistics of Student Learning Outcome Test Scores

Descriptive statistics	Experiment		Control	
	Pre	Post	Pre	Post
Maximum	47	97	50	63
Minimum	27	77	30	43
Mean	37.6	86	38.7	52.4
Median	38.5	87	40	53
Mode	43	87	43	53

Table 1 shows descriptive statistics on student learning outcomes, the scores between pretest and posttest in classes taught using the flipped classroom experienced a higher increase compared to classes taught with the conventional model. Data on learning outcome tests for classes taught using the flipped classroom and conventional classes are grouped based on the cognitive learning outcome categories listed in the figure 1.

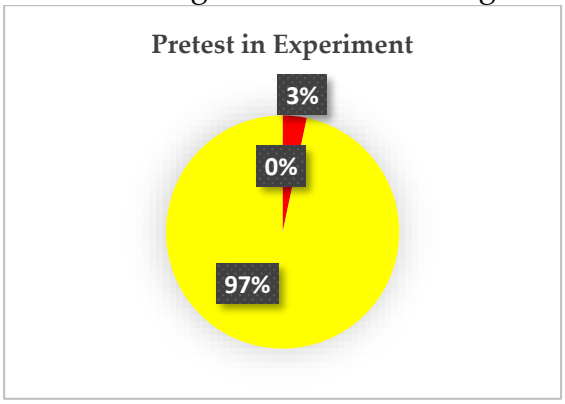

Figure 1. Category of the cognitive learning outcomes in the experimental pretest

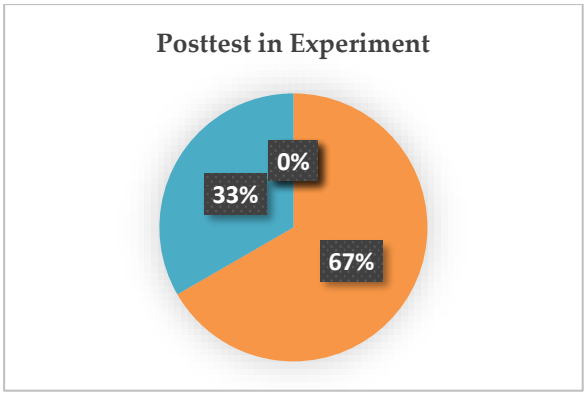

Figure 2. Category of the cognitive learning outcomes in the experimental posttest

Figures 1 and 2 show that the learning outcomes of students in conventional classes have experienced a high increase. Before (pretest) the treatment was given, there were 3% of students who were in the poor category and 97% in the very poor category and no students reached a score of 75. After being given the treatment (posttest) the student learning outcomes score was 67% in the category very good and 33% of students are in the good category and all students in the experimental class passed 75.

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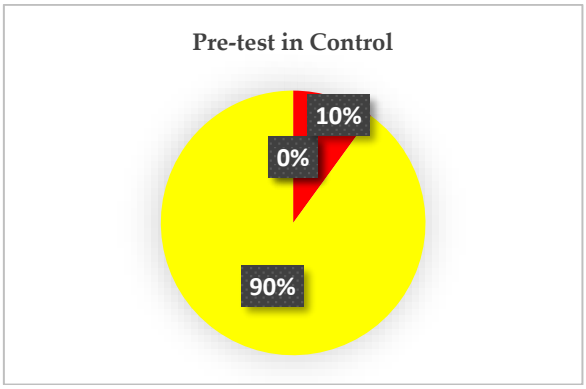

Figure 3. Category of the cognitive learning outcomes in the control pretest

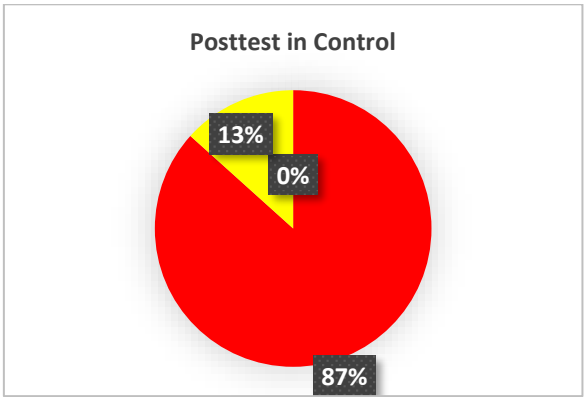

Figure 3. Category of the cognitive learning outcomes in the control posttest

Figures 3 and 4 show that the learning outcomes of students in the control class experienced a low increase. Before (pretest) the treatment was given, there were 10% of students who were in the poor category and 90% in the very poor category and there were no students who reached a score of 75. After being given treatment (posttest) the students' learning outcomes were obtained at 87% in the category less and 13% of students were in the very poor category and all students in the control class did not reach 75.

Based on inferential statistical tests on the normality test using the Klomogrof-Smirnov test in the SPSS 29 program, it produces a value of 0.143 in the control class and 0.236 in the experimental class. The significance value obtained is > 0.05 so it can be concluded that the data is normally distributed. The inferential statistical test on the homogeneity test using the Homogeneity of Variance test in the SPSS 29 program produced a significance value of 0.586. The significance value obtained is > 0.05 so it can be concluded that the sample comes from a homogeneous population. Hypothesis testing using the one-way ancova test produces a significance value of <0.001. The significance value obtained is <0.05 so it can be concluded that there is a significant influence of the flipped classroom on student learning outcomes.

Based on the descriptive tests and inferential tests that have been carried out, it can be concluded that there are differences in learning outcomes in mutation material. The flipped classroom learning model has a positive and significant influence on improving student learning outcomes compared to using conventional learning models. The flipped classroom makes classroom learning more effective and can minimize the use of limited time in class. Apart from that, all students taught with this learning model pass the standard score.

Based on the data obtained in this research, it shows the differences between the control class and the experimental class and there is an increase in pretest and posttest scores. Based on table 1, it can be seen that there was an increase in student learning outcomes after learning was carried out in both the experimental and control classes. However, the increase in student

learning outcomes in the experimental class was higher than the learning outcomes of students in the control class. Apart from that, the posttest results of students who studied using the flipped classroom learning model achieved a score of 75 in the good and very good categories, while those in the control class did not reach the KKM in the poor and very poor categories.

The role of the learning model used by teachers in the classroom is very important to optimize student learning outcomes (Wahana, et al., 2019). A learning model can influence student learning outcomes. The better the model and learning process that is applied, the more students' learning outcomes will improve (Supartin, et al., 2022). Implementing the flipped classroom learning model with the help of WhatsApp can influence student learning outcomes. This can be seen from the increase in cognitive abilities after implementing the flipped classroom learning model.

Flipped classroomaims to motivate students during learning. Apart from that, the use of existing technology will facilitate the delivery of material in the learning process and make the learning process more interesting (Supartin, et al., 2022). Students can access material anywhere and anytime. The activity carried out is studying material using digital media such as WhatsApp groups (Sinta, et al., 2022). Flipped Classroom: In the learning process, students study the subject matter first at home before class starts. Teaching and learning activities in class include doing assignments, discussing material or problems that students do not understand when studying independently at home. The influence of the flipped classroom model on learning outcomes is of course inseparable from the flipped classroom syntax itself.

The flipped classroom syntax begins with learning preparation activities. Learning media that can be used in learning can be in the form of PowerPoint modules, e-books, and so on, so that students can study material from various sources (Saida, et al., 2019). The teacher sends learning media to the WhatsApp group that has been prepared for students so they can study independently at home to increase their knowledge before entering class. The learning media shared on the WhatsApp group is in the form of power points and electronic modules with mutation material, discussions regarding types of mutations, types of mutagens and the dangers and benefits of mutations. The use of learning media has a positive influence on student learning outcomes by generating motivation. Students will be encouraged to learn to achieve their goals (Mohamad, et al., 2022). Teacher preparation in learning has a positive influence on student learning outcomes (Suheri & Waskito, 2021).

The next stage is accessing materials and activities. Students' readiness in the learning process using the flipped classroom model is also taken into account. Every student can access the internet and browse social networks easily and allows the dissemination of information to occur quickly (Muna, et al., 2022). Students can study independently at home by accessing material that has been shared by teachers in the WhatsApp group. When in class,

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students have mastered the material and are able to solve problems through discussion. Student activities by accessing material in groups are a form of student learning readiness. The material accessed is related to types of mutations, types of mutagens and the benefits and dangers of mutations. Student learning readiness is the initial condition of a student in learning activities which makes him ready to receive learning material so that later he can provide responses or answers to gain knowledge, improve skills, improve attitudes (Santika, et al., 2017).

The third step is giving group assignments. Flipped classroom is a student-centered learning model where in class students have discussions with their group friends in working on assignments and solving problems. Each student is expected to be more active and contribute to their respective groups so they can solve a problem together. Assignments are given in the form of worksheet which will be carried out by each group consisting of 6 groups with 5 students each. Worksheet with mutation material contains questions in essay form that need to be discussed with the group.

Next, a discussion was held to monitor group assignments. Discussion is the process of exchanging information, opinions and experiences to gain a better understanding of something or to prepare and finalize a joint decision. Each person is expected to make a contribution to the group so that the group can progress from one thought to another and obtain more perfect shared understanding (Agustina, et al., 2018).

Testing the results of group work is the next stage. After the group discussion, a presentation was held. This presentation aims to test the results of group work that have been discussed together. The presentation increases students' understanding and attention to learning because they can interact with other groups to share knowledge. This is in line with research which states that presentations can increase students' activeness, understanding, mastery and attention to lessons. Presentations provide opportunities for students to be actively involved in learning activities. Students can freely interact with each other and share knowledge (Sulvia, et al., 2019).

The final step in the flipped classroom is evaluation. Evaluation is carried out to measure the extent to which each student understands material related to mutation in achieving learning objectives. Students are assigned to make conclusions to measure the extent of students' understanding regarding mutations, especially mutation events around them. Students' ability to make conclusions is an attempt to describe or explain something that has been observed based on previous understanding and knowledge briefly, clearly and accurately. Students' ability to make conclusions is very important for students in increasing their understanding of learning (Rahmayani & Wirawan, 2022).

CONCLUSION

Based on the results of data analysis and the discussion that has been presented, conclusions can be drawn: (1) the learning outcomes of students taught using the flipped classroom learning

model have grades in the very good category; (2) the learning outcomes of students taught without using the flipped classroom learning model have grades in the poor category; (3) there is an influence of the flipped classroom learning model on the biology learning outcomes of students at SMA Negeri 9 Makassar.

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BRIEF PROFILE

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