

The implementation of STAD model assisted worksheets to improve students' activities and understanding in learning biology

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ABSTRACT

This study aims to apply the Student Teams-Achievement Division (STAD) learning model assisted student worksheet to increase learning activities and understanding of concepts in biology, especially the principle of trait inheritance material. Class action research consisting of two cycles, each cycle consisting of three encounters is used in this research method. Research instruments are in the form of pre-cycle questionnaire sheets, learning outcomes evaluation sheets, student activity observation sheets, and teacher activity observation sheets. Evaluation sheet of learning outcomes to determine the improvement of understanding of concepts in the material of the principle of inheritance of traits. Student and teacher activity sheets are used to view the interactions that occur between teachers and students. Descriptive statistics are used in the analysis data to see student learning outcomes and increased student activity. The results of the study concluded that the understanding of student concepts and the increase in learning activities. The percentage of learning activities in cycle I and cycle II respectively averaged 50.95% and 81.21%. The percentage of learning outcomes in cycle I and cycle II respectively averaged 64.61% and 84.31%. The percentage of students who completed cycle I and cycle II respectively was 44.44% and 80.56%. So it can be concluded that the learning with STAD model assisted worksheets can improve students' activities and understanding on the material of the principle of inheritance of traits.

Keywords: concept understanding, learning activities, STAD, students' worksheet

INTRODUCTION

Changes that occur in learning biology, which was originally teacher-centered learning became student-centered learning. The quality of learning will be optimal if the learning process is student-centered, not teacher-centered (Jayawardana, 2017). This is in line with Permendikbud No. 70 of 2013 which states that the 2013 Curriculum was developed by perfecting teacher-centered learning patterns into student-centered learning, and Government Regulation number 32 of 2013 Article 19 states that the Learning Process in educational units is held in a challenging, motivating, interactive, fun, inspiring way for students to participate actively, and provide sufficient space for student development, initiative, creativity, and independence following the talents, interests, and psychology of students.

In this paradigm, both learning activities and students' understanding of concepts have not been able to be improved in a lesson. There are several influencing factors, including many teachers who apply the lecture method, a lack of variation in the learning process, and a lack of educator skills as a bridge in student-centered learning. For example, in learning activities with group discussions, there is a tendency for students who like to tell stories/ chat more to talk about things in their "world" than to understand the material that is the subject of group discussions. This is following research conducted by Lestari & Irawati (2020) revealed that the teacher-centered teaching and learning process had an impact on students not having the motivation to learn and had an impact on low student learning outcomes.

Student Teams-Achievement Division is an acronym for STAD which means the achievement division of student teams/ groups. Johns Hopkins University witnessed the development of this model by Robert Slavin and his colleagues. The most important feature of STAD is the team. At each point, the emphasis is on doing the best to help each member, doing the best for the team, and of course making the team members (Slavin & E, 2009).

STAD is a cooperative learning model that emphasizes the importance of communication between students to help and motivate each other in mastering learning material to achieve maximum achievement. This model is also one of the simplest cooperative methods and is the best model for beginning teachers who are new to the cooperative approach. (Sudana & Wesnawa, 2018). The STAD learning model places students in different small teams. The students work together to help their friends understand the material in the group discussion. What is exclusive to this model is that students are rewarded for group performance, thus encouraging collaboration between groups again (Jacobsen et al., 2009). Research conducted by Handayani (2015), states that STAD-type cooperative learning provides a process for students to learn interpersonal life skills and develop the ability to work collaboratively, a behavior that most organizations specifically desire to support the concept of cooperation. In addition, research conducted by Hidayah (2019) concluded that the application of the STAD-type cooperative learning model assisted by concept maps can increase the activity and results of students' biology learning in genetic material for the twelfth grade of IPA 2 at SMAN 2 Siak Hulu.

According to Al-Tabany & Badar (2017), STAD has cooperative steps consisting of six steps or phases namely conveying goals and motivating students, presenting/ delivering information, organizing students in study groups, guiding work and study groups, evaluating, and giving awards.

For learning activities using the STAD model to look more interesting and not monotonous, teaching materials are needed in the form of student worksheets. Worksheet is a learning media that can optimize learning activities and students' understanding of concepts becomes more optimal. In addition, worksheet is one of the learning tools that are often used in the learning process in the classroom by teachers (Firdaus & Wilujeng, 2018). Research carried out by Umbaryati (2016) confirmed the importance of worksheet in learning through a scientific approach to be able to facilitate student creativity to find a concept and develop various scientific skills to overcome student learning barriers. This is in line with research by Marrysca & Ekawati (2016) state that the application of the cooperative learning type STAD assisted by character worksheets can increase student learning activities and students' cognitive abilities.

The role of worksheet in learning is important because students can easily understand the material provided by the teacher. According to Prastowo (2013) worksheet functions, namely (1) as teaching materials that can minimize the role of educators, but activate students more, (2) as teaching materials that make it easier for students to understand the material provided, (3) as teaching materials that are concise and rich in assignments for practice, and (4) facilitate the implementation of learning to students. According to Pratito (2020) the benefits of worksheet are (1) increasing student activity during the learning process, (2) developing skills and training student skills, (3) obtaining notes on the material to be studied through activities, (4) adding information about concepts through student learning activities systematic.

This research is action research by applying the STAD learning model assisted by student worksheets. Action Research is research conducted through classroom action by teachers or researchers to improve or improve the quality of learning and improve the professionalism of

educators in handling the learning process (Fitria et al., 2022; Nurdin, 2016; Susilowati, 2018). The worksheet used is contains instructions, work steps, and a sequence of material that students must master in stages starting from factual to conceptual, formal to non-formal, and easy to difficult to help students understand the learning material being studied. This worksheet is used as a learning resource for students which is equipped with questions for remedial and enrichment materials. Worksheet can also provide very good student responses, namely, students are more active, interested, and not bored in the learning process (Utami et al., 2016).

Material on the principle of inheritance in Biology learning will be more interesting and can increase student activity if it is done interactively between students, and between students and teachers. Learning activities are expected to increase students' understanding of concepts in understanding the material principles of inheritance. The purpose of this study is to increase understanding of concepts in Biology material and learning activities using the Student Teams-Achievement Division (STAD) learning model with the help of Student Worksheets.

METHOD

SMA Negeri 22 Jakarta was chosen in research the consideration that the researchers came from schools that know the condition of the development of education in schools to achieve research objectives. The research was conducted from August to November 2019. The twelfth grade of MIPA 4 students consisting of 36 students with a composition of 18 female students and 18 male students were selected as the subject of this study. Then the researcher chose the twelfth grade of MIPA 4 on the consideration that the average grade for that class was lower than the other classes.

The sampling technique in this study used a nonprobability sampling technique, namely purposive sampling. Classroom Action Research using two cycles was applied in this research method. The data sources in this study are

qualitative data and quantitative data, which are as follows: (1) pre-cycle data obtained by giving questionnaires about students' interests and habits in Biology lessons, (2) student activity data obtained from observations of researchers and collaborators during implementation the actions of each cycle by using instruments to observe student activities during teaching and learning activities, (3) data on understanding concepts is obtained from student learning outcomes by giving written tests (descriptions) after the actions are carried out.

Qualitative and quantitative data are used in data collection. The qualitative data used are (1) a pre-cycle questionnaire to find out students' interests and habits in Biology lessons, (2) observations by collaborators to observe learning activities during the implementation of actions carried out by students and teachers (3) giving questionnaires to students to find out their responses students directly understand Biology material through the STAD model using student worksheets. Quantitative data is used to determine the level of students' understanding of concepts in learning the principles of inheritance of living things based on Mendel's laws. The aspect assessed is cognitive (knowledge and understanding of concepts).

The test is used to measure students' understanding of concepts using item questions or descriptive problem instruments. While non-tests are in the form of questionnaires in the pre-cycle to find out students' interests and habits in Biology lessons, observation sheets are used to observe the implementation of Biology learning activities through the STAD model with student worksheets media and guides interviews to find out students' attitudes or opinions about Biology learning through the STAD model with the media of student worksheets.

Quantitative data obtained were analyzed using the formula Sudjana (2013) as follows:

$$\bar{X} = \frac{\sum x}{n}$$

Notes:

\bar{X} = Mean

$\sum x$ = The total score

n = Number of students

The percentage of student learning success is calculated using the following formula:

$$P = \frac{\text{Σstudents who pass the study}}{\text{total students}}$$

To analyze qualitative data about student response questionnaires at the beginning of the pre-cycle, the processing is done by counting the number of "Yes" and "No" answers from all the items on the questionnaire sheet. The data that has been collected using a questionnaire response sheet is processed by following the steps below (Bungin, 2010).

$$\text{The percentage of answers} = \frac{\text{the answer frequency}}{\text{the number of respondents}}$$

Table 1. Guidelines for interpreting student responses

Percentage	Category
0-1%	None
2%-25%	A small portion
26%-49%	Less than a half
50%	A half
51%-75%	More than half
76%-99%	A big portion
100%	All

The data collected in each observation or observation activity from the implementation of the research cycle was analyzed descriptively using the percentage technique to see trends that occur in Biology learning activities. The formula used to analyze the observed data is as follows (Al-Tabany & Badar, 2017)

$$AP = \frac{P}{\Sigma P} \times 100\%$$

Notes:

AP = Percentage

P = Number of students who carry out the activities

ΣP = Number of students

Table 2. Guidelines for interpreting student activity criteria.

Activity (%)	Criteria
76 - 100	Very good
51 - 75	Good
26 - 50	Good enough
≤ 25	Not that good

Performance indicators to measure the success of this classroom action research show an

increase in student learning activities based on observations of the implementation of learning activities in cycle I and cycle II. In addition, there was an increase in learning outcomes based on the average value of the daily assessment cycle I and cycle II. At least 75% of the 36 students (27 students) get a score ≥ of the KKM set at SMAN 22. The Minimum Successful Criteria (KKM) score in the material The principle of inheritance of living things based on Mendel's law is 75.

The indicators of student activity that are measured are (1) expressing opinions when discussing in their groups, (2) asking the teacher during discussions/learning takes place, (3) asking colleagues in groups during discussions, (4) explaining each other among group members until all members understand the material, (5) the willingness of representing the group to come forward presenting the results of group work and (6) expressing their opinions during discussions between groups.

RESULTS AND DISCUSSION

Pre cycle

Before carrying out classroom action research, the teacher first sought information about students' opinions about Biology learning in class through an analysis of a questionnaire given to the twelfth grade students of XII MIPA 4. The results of the questionnaire showed that 30 students (83.33%) liked Biology learning activities in class, 25 students (69.44%) did not like the lecture method, and 26 students (72.22%) stated that the value of Biology learning outcomes was not as expected. Based on the results of a questionnaire on students' responses to Biology learning, information was obtained that students tended to dislike individual assignments and the lecture method. Students only pay attention to the material provided by the teacher through power point presentation media. Then do the assignments individually contained in the student handbook. Students become passive, less enthusiastic, and have low learning activity.

Cycle 1

Cycle I was held on 4 and 9 September 2019. The results of observations on the implementation of the cycle I carried out by collaborators and teachers found the following: (1) some students communicated with their friends when the teacher gave material, (2) there were still many students who are not concentrating by opening other textbooks, (3) several groups are seen waiting for each other to start discussions among group members, there are some students who dominate in their groups. (4) students are generally hesitant and embarrassed to ask friends in their groups, (5) some students talk about other things that have nothing to do with biology learning material during group discussions, and (6) some students do not bring biology handbooks. An overall observation of student activity at each stage of activity in cycle I can be seen in Table 3.

Table 3. Percentage of student activity in cycle I

No	Activity stages	Percentage of student activity	Category
1	Opening	46,29%	Good enough
2	Main Activity	36,42%	Good enough
3	Closing	70,14%	Good

The results of observations of student activities are quite good in the preliminary stage and core activities, while the closing stage is in a good category. Even though the preliminary stage was quite good, the teacher only conveyed the objectives of learning, had not motivated students, and made students interested in the material to be studied. Stimulation from outside students and the will that appears in students greatly influence motivation. Learning motivation that comes from outside will have a major influence on the emergence of intrinsic motivation in students (Emda, 2018).

In the core activities, most of the students did not make the best use of worksheet. This was possible because each group only received one worksheet to work on together. Discussions between team members have not been carried out properly. Students are still less active in expressing opinions and asking colleagues in the group. Most students still talk about other things

that have absolutely nothing to do with learning material. There are even students who walk around visiting other groups. Many students still do not dare to come forward to represent their groups in presenting the results of their group work. The same thing also happened when giving responses or comments on the work of other groups. Only a few students have the confidence to provide responses or comments on the work of other groups.

In cycle I, it was seen that the teacher only went around monitoring discussion activities but had not maximized motivation for students to dare to give opinions and ask questions to colleagues in their groups and to the teacher. This needs to be corrected for the next activity in cycle II. The teacher also seems to give less assistance to individuals and seems to still give less appreciation to students. The teacher did not discuss the quiz questions given due to time constraints. The award given by the teacher is only in the form of applause and thumbs up. The teacher should reward team achievements by informing group/team scores and individual scores. Rusman (2018) confirm that in one of the stages of learning with the STAD type the teacher gives awards or group success by calculating individual scores and group scores.

These student and teacher activities have an impact on student learning outcomes to measure understanding of concepts in the Principles of Inheritance material. 64.61 is the average acquisition value of student learning outcomes in cycle I. This value is still below the specified minimum criteria, which is 75. The percentage of completeness of student learning outcomes is 44.44% (16 people) and students who have not yet completed are 55.56% (20 people). Table 4 shows the percentage of student learning completeness in cycle I.

Table 4. Percentage of student learning completeness in cycle I

No	Learning results	Number of students	Percentage
1	Successful	16	44.44%
2	Unsuccessful	20	55.56%
Total		36	100%

At this stage of the first cycle, it has not shown the expected results from the use of the STAD-type learning model with the help of worksheet. From the results of observation, evaluation, and reflection, the research continued to cycle II.

Cycle II

Cycle II was held on September 23 and 25 2019. The categories for each stage in cycle II were very good. In the preliminary activities, students were seen to actively respond when the teacher gave apperceptions, responded to questions given by the teacher, and paid attention when the teacher conveyed the learning objectives. Students pay close attention to the video being shown and make statements regarding the video.

In the core activities of student activities, the discussion in the team has been carried out properly. Students already know and understand the STAD learning model better. This can be seen that they are used to doing it and it does not feel like something new anymore because in cycle I the STAD-type model has been applied. All students have used student worksheets as learning materials. Most students dare to express opinions when discussing in their groups, explain to each other between group members so that all group members understand the discussion material contained in the worksheet.

The closing activities were carried out well. Most students answered the quizzes honestly and diligently. The teacher has given teamwork awards to each group. The award given by the teacher is based on the predicate obtained by calculating individual scores and group scores. Following the agreement between the teacher and students, the prize given by the teacher is the score obtained by each group used as the value of the task/skill for completing the worksheet.

Table 6. Comparison of the average grades and mastery of student learning in cycle I and cycle II.

Stages	Minimum criteria	Average score	Number of successful students	Successful (%)	The highest score	The lowest score
Siklus I	75	64,61	16	44,44	100	7
Siklus II	75	84,31	29	80,56	100	25

An overall observation of student activity at each stage of activity in cycle II can be seen in Table 5.

Table 5. Percentage of student activity in cycle II.

No	Stages of activity	Percentage of student activity	Category
1	Opening	81.02%	Very good
2	Main activities	81.35%	Very good
3	Closing	81.25%	Very good

After carrying out the implementation of learning and observing activities by collaborators, a daily assessment of cycle II was carried out. 84.31 is the average value of students in cycle II. The acquisition of this value has increased from the average value of student learning outcomes in cycle I. Figure 1 shows a comparison of the average student scores in cycle I and cycle II.

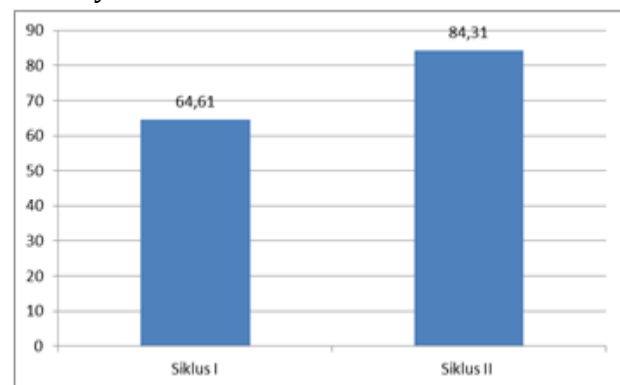


Figure 1. Comparison of the average student scores in cycle I and cycle II.

The number of students who succeeded in cycle II was 29 people (80.56%) while those who had not completed it were 7 people (19.44%). When compared to cycle I the number of successful students has increased and students who have not succeeded are fewer. Table 6 shows a comparison of the average grades and success/completeness of student learning in cycle I and cycle II.

In cycle II the STAD learning model with the help of student worksheets effectively increases student activity and understanding of concepts. Based on the percentage of student learning activities and learning activities by teachers in cycle II as a whole it is categorized as very good. This activity has increased from cycle I. During the learning process, the teacher makes sure that students are directly involved in the learning process. Students as the main actors, and teachers only as facilitators are no longer the main source of learning. The teacher also motivates and guides students in learning activities, so that student activity increases even better.

Learning is more meaningful in this second cycle because the student worksheets are also very helpful for students and educators in teaching and learning activities. Each student gets an worksheet so that group discussions become more active in learning. The worksheet made by the teacher has been adapted to the characteristics of the students and the learning activities they face. The work steps and questions contained in the worksheet facilitate students to connect the principle concepts of inheritance with the everyday problems of students' lives. This is in line with the results of the study by Cahyani & Ambarwati Reni (2019), which stated that STAD Type Cooperative Learning and worksheet for the Mollusca sub-material could be carried out very well.

Increased learning activities have an impact on students' understanding of concepts. Learning outcomes in cycle II experienced growth when compared to cycle I. Likewise, the number of students who completed Cycle II was also more than Cycle I. Teachers and collaborators argued that the application of the Student Teams Achievement Division (STAD) learning model assisted worksheets can improve understanding of concepts and learning activities on the material of the Principles of Inheritance (Mendel's Law).

From the results of the questionnaire given to students regarding the Student Teams-Achievement Division (STAD) learning model using student worksheets, most students stated

that it was very fun and interesting because they could work with friends and could understand the material being discussed. Most students think that this method makes it very easy to understand the concept of the material Principles of Inheritance because there are steps to solving problems so that they can work quickly and precisely. Regarding cooperation in groups, most students think that this method is very helpful for giving opinions, working together, and practicing group and individual responsibility. This is in line with research conducted by Nikmah et al., (2016), STAD-type cooperative learning emphasizes the cooperation of students in groups in solving a problem to achieve learning goals so that students discuss with each other.

CONCLUSION

Based on the results and discussion of this classroom action research, it can be concluded that cooperative learning of the Student Teams-Achievement Division (STAD) model using student worksheets can improve learning activities and students' understanding of concepts. This can be shown by the average percentage of student learning activities in cycle I and cycle II respectively, namely 50.95% and 81.21%. Likewise, students understanding of concepts experienced an increase in the average percentage of learning outcomes in cycle I and cycle II respectively, namely 64.61% and 84.31%.

Based on the researchers' observations and the research results obtained while carrying out classroom action research, the researchers provide the following suggestions: (1) teachers must continue to develop student worksheets following developments in the world of education as teaching materials that help the learning process run well and understood by students, (2) the use of varied learning models must be continuously carried out and improved to create fun learning for students.

The limitations of this study are (1) students who get the lowest scores are the same students in each action cycle. These students did experience an increase in the number of cognitive scores, but still below the minimum criteria, and

(2) student worksheets had not gone through the validation process by expert validators.

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