"LEARNING OUTCOME IMPROVEMENTS OF APPLIED ELECTRONIC CIRCUITS COURSE WITH STUDENT TEAM ACHIEVEMENT DIVISION"

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ABSTRACT:

The purpose of this study was an effort to improve student learning outcomes in the Applied Electronic Circuit course by applying the cooperative learning model Student Team Achievement Division. This research is a Classroom Action Research (CAR) with its design taken from research that has been carried out by Kemmis and Mc Taggart. The main concept of this study consists of four sequential components, which are planning, action, observation and reflection. The study was conducted in two cycles in September 2018 to December 2018 at Telkom University. The subjects of the research were EL-39-G1 class of the Applied Electronics Circuit consisting of 32 people. The research result showed that student learning outcomes experienced a significant increase. This is also confirmed by the passing percentages that has increased. Improvement of learning outcomes and passing percentage occurred due to a good discussion process in the assignment of most groups. In addition, by giving practice questions that vary continuously. This makes students become challenged to solve problems and not get bored, so the results of learning will be more meaningful for students.

INTRODUCTION

One of the things that can improve the development of a nation is the quality of human resources. The quality of human resources is very dependent on the quality of their education. The purpose of education is tasked to achieve a change in the learner's behavior after the process of learning [1]. This purpose can be realized alongside the activities of learning and achieving results. These results are known as learning outcomes.

Learning outcome is a change in a learner's cognitive, affective, and psychomotor behaviors [2]. Cognitive behavior involves mental activities (in relation to the brain) that correlate with 6 levels of learning which are: memorizing, understanding, application, analysis, synthesis, and scoring. Affective behavior relates to the attitude and scores that comes in five levels, which are: acceptance, response, appreciation, organization, and characterization. Psychomotor behavior relates to the skill or ability to apply the experience of learning which means it is the continuation from cognitive and affective learning outcome [3]. Cognitive behavior is the focus of this study.

Learning outcome is commonly used by lecturers to find out how far a student has finished the learning activities that corresponds to the

materials given by the lecturers. However, learning outcome according to its usage is a reference to motivate students to get accustomed to learning diligently whether it is individual or group work [19].

Learning outcome can be used as evaluation towards the purpose of education. With learning outcome as evaluation, the hope is that it will give a satisfactory quality for institutions. Evaluation is done by a lecturer towards the learning outcome to measure the level of achieved competence towards a student, as well as progress report, and to improve on the learning process [4].

According to Permendikbud Number 104 Year 2014, the assessment of learning outcome forms a process of information gathering about the learning achievement of a student with factors that include competence of spiritual and social attitude, competence of knowledge, and competence of skill which is planned and done systematically, during and after the learning process. Therefore, it can be stated that learning outcome evaluation is one of the stages done by lecturers to obtain information about a student's understanding towards a material that has been given during the learning process to measure whether through tests, non-tests, or observations.

Learning outcome evaluation is also done in Applied Electronic Circuit courses. This course is mandatory in the third semester for students studying in Telkom University's Electrical Engineering study program. The Evaluators which directly evaluates the learning process are lecturers. The reality that has happened is that the pass percentage of the 2017/2018 academic year is 38% of which the students did not meet the minimal criteria for comprehension of the subject. This percentage of learning outcome is not detached from the factors that influence it. Lecturers are insisted to manage the method of lectures with the

variance of students' study methods in mind during the learning process. This is confirmed with an average test result pre-cycle of which is 30,63. On another note, the method of learning which is applied by lecturers during the lectures are conventionally lecturer-oriented. This conventional model results in passive students, lack of communication or discussion between students and lecturers. With this research, it is expected that there would be change in the learning process, namely by placing the students as a subject during the lecture and lecturers not as a primary source of lecture but as a facilitator and motivator that can help the students [5].

LITERATURE REVIEW

Arranging sequences of lectures that vary is important for lecturers in order to create lectures which have meaning. Meaningful lectures is a measuring tool for whether students receive output that consists of favorable slearning outcomes, of which requires a lecturer's competence in designing a lecture model that has meaning during the lectures [6]. Preference and usage of lecture models which are suitable and appropriate will support the attainment of learning outcomes. However, in reality, certain models of lectures cannot be applied in certain subjects. Some models can be used to improve learning outcomes, among them are inquiry learning model [7], problem-based learning [8], and cooperative learning [5]. These learning models can involve every student without the need to differentiate every student in order for them to be actively engaged during lectures. This research focuses on applying cooperative learning model. Cooperative learning is a form of lecture where the students learn and discuss in small groups, usually consisting of 4 – 6 students. This model allows the students to discuss, interact, solve problems, and carry out assignments which hold the group responsible

in accordance to the purpose of the lecture [19].

In this research, the cooperative learning model that is applied is the Student Team Achievement Division (STAD) method in Applied Electronic Circuit courses. STAD was chosen in this research because this method prioritizes activity and interaction of students, which results in students giving each other motivation and help to better understand the course materials, so that all the students achieve maximum efforts to achieve in accordance to their capabilities [19].

Student Team Achievement Division (STAD) Model is a kind of group study strategy. This cooperative learning type was developed by Robert Slavin and his peers at John Hopkins University [9]. This method is the simplest cooperative learning method which makes it suitable for new students that will learn in a cooperative manner. Students would be placed in a group study that consist of four to six people heterogeneously based on work ethics, gender, and ethnicity. Lecturers would give course materials and the students would work as a team to ensure that all members would understand the course materials. To know the capabilities for each student, there would be a quiz given to all students with a condition noting that they would not be able to help each other.

The main characteristic of STAD cooperative learning is the existence of motivation between students in a group to each give encouragement, teamwork, and helping each other to understand or improve skills that is being lectured to face the individual-based quiz. This method of learning also pressures the learner to acknowledge other students so that they are more motivated to study for the individual-based quiz to achieve a high score [19].

There are 5 main components in STAD based learning of which they are: class presentation, teamwork, quiz, individual remedial test, and team acknowledgement [19]. Class presentation in STAD is different from regular lectures because these presentations have to clearly focus on the STAD units. With this method, students realize that they have to pay attention to the class presentation, because then it would help them learn about the quiz properly, and their quiz scores affect the scores of the group. Afterwards each group which consists of 4-5 students that each represent the heterogeneity in work ethics, gender, and ethnicity. The main function of the team is to prepare each member to successfully face the quiz. Teamwork is the most important aspect in STAD. These groups serve to support academic performances of friends of the same age to have an impactful meaning towards the lecture, whilst having a team that cares and respect each other, these things have a meaningful impact on the results and learning outcomes [19].

While doing the quiz students are not allowed to help each other. This is done to guarantee that each student is responsible for learning the materials of the course. Every student can donate their maximum point to the team in these scoring system, however not a single student can do it without showing the improvement over past performances. Every student is given a base score, which is given from the average performances of their previous quiz. Then, the student would get points for their group based on how much their quiz scores increase over their base score. A group would receive acknowledgement if their average scores would be improved by a certain amount/criteria. The group score would be counted based on the percentage increase their test scores received compared to their previous scores [19].

In university level, the application of STAD method is proven to improve the improve the learning achievements of students. Students attending The Department of English Education from *Universitas Islam Negeri Ar-Raniry* achieved better grammar after using Student Teams-Achievement Division compared to them that didn't use STAD methods [9]. The STAD method does not only improve the learning achievements of students but also increases the pass percentage of students that attended Physics course in Telkom University [19]. Furthermore, the application of STAD method in computer programming courses could push students to work together in a team, the more they understood, maintained, and felt more confident in themselves and their partners [10]. Other studies that have been done includes studies by Mutianingsih [11], applying STAD learning method to increase improve the learning achievements of UNIPA Surabaya economic students for the year of 2016, with an average test result improving from 67,5 in cycle I to 76,13 in cycle II. Based on the results of these studies, the researcher would like to research to know if the application of STAD learning methods in Applied Electronic Circuit courses would also improve the learning achievements of the students.

METHOD

This research is done in collaboration with plenty of lecturers which are responsible for Applied Electronic Circuit courses. The design of choice that is used in this research follows the research design that has been done by Kemmis and Mc Taggart, where their research design is an expansion of Kurt Lewin's model [12]. The base concept for this research is composed of 4 components, which are: a) planning; b) acting; c) observing; and d) reflecting. The relationship between these four components can be seen as a cycle that is depicted as the following Figure 1.
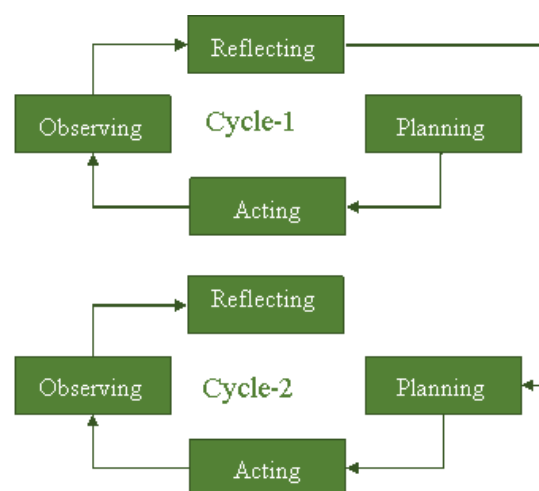
Gambar 1. Model Kemmis – Taggart untuk metode STAD

These 4 steps create a cycle or a lap. This means, after the fourth step, it would then be back to the first step to enter the next cycle if needed. The planning stage would consist of making learning devices, preparation of research facilities and infrastructure and determining performance indicators. The action stage consists of everything needed in the Semester Learning Plan (SLP). The observing stage is held alongside the action stage. Observer does observation towards the implementation of the action and result of the action. Stages of reflection are carried out through discussions with peers and as well as the analysis of the results of observations each cycle. Classroom action research would be conducted in two cycles.

The time of the study was conducted in September 2018 until December 2018 at Telkom University. The subjects of the research were the students who participated in the Applied Electronics Circuit EL-39-G1 class of 32 students. Data collection method used in this study is the method of observation, with the aim to observe every student and lecturer activity in the application of STAD during the

learning process. Furthermore, the test method to determine student learning outcomes using the STAD cooperative learning model, where the type of test questions used in the form of essays. In addition, documentation in the form of photographs in this study was also carried out to describe the atmosphere during the learning process.

The indicator of success in this study is if the grade average obtained from the test results in learning with the STAD model ≥ 75.00 and there are 75% of the number of students passed with a minimum grade of C.

RESULTS

In this section the results and discussion of the research is explained, namely the application of the STAD learning model to improve student learning outcomes in the Applied Electronics Circuits course. This research was conducted in two cycles and the stages of each cycle were applied. The following passage is a brief description in each cycle.

In cycles 1 and 2, the planning stage consists of making learning tools including learning plans that have been prepared based on the application of the STAD learning model. Then, prepare facilities and infrastructure that includes observation sheets that are used to observe the activities of lecturers and student activities during the learning process. Next prepare the material presented and the question sheet as a posttest question.

The action stage involves all actions contained in the Semester Learning Plan (SLP) by applying each stage in the STAD learning model. In this action, the lecturer divides learning activities into 3 activities, namely initial activities, core activities, and closing activities.

In the initial activity, the lecturer starts the lecture by saying greetings, ensuring students have tapped their student cards to record attendance. The lecturer then gives an apperception so that students could recall the material explained in the previous meeting as well as provide motivation so that students are enthusiastic in following the learning process from beginning to end. Then the lecturer conveys the learning objectives and learning outcomes for the material provided. As well as conveying that the material taught in these courses is very useful for application in the electrical engineering field in accordance with the study program they are currently living. After that the lecturer tells that the learning process uses the STAD model and provides an explanation of the scenario.

In the core activity, the lecturer starts by asking students to sit in groups according to the group that has been distributed by the lecturer. The members of these groups are based on the results of the pretest given at the previous meeting. The number of groups formed is 8 groups. The lecturer emphasized that this learning model is for mutual cooperation with group members. Students consist of 5-6 students in groups, and appoint one student as group leader. The distribution of these groups is heterogeneous, both in terms of knowledge, ethnicity and gender. Lecturers deliver learning material in accordance with the learning plan that has been prepared. Lecturers also give verbal questions to students about the material presented and provide opportunities for students if there are things that they want to ask or don't understand. If everything is clear and understood, the lecturer gives the task in groups. The lecturer emphasized that the given assignment must be discussed as a group. While students work on assignments in groups, the lecturer also monitors and observes students in each group. If there are things that are not understood by students, the lecturer

guides and directs them so that students can continue the discussion of working on group assignments. In this case the observer also observes students involved actively discussing and taking notes in accordance with the observed aspects.

Still with the core activity, after the task discussed is complete the lecturer gives time for each group to present the results of the discussion. The lecturer also assesses the results of each group. After the group activities are finished, the lecturer gives a post test that is done individually and emphasizes that they are not allowed to do or discuss it together.

In the closing activity, lecturers and students all conclude the material taught on that day. At the same time emphasizing important things that must be understood by students. Then, the lecturer gives an award in the form of a gift to the group that has the best predicate, both in group collaboration and in accordance with the work done. In closing, the lecturer closes the lecture by saying greetings and thanking students for being able to contribute and pay attention in participating in the learning process that day.

The observation stage is carried out simultaneously with the action stage. At this stage the observer observes the implementation of the action and the results of the action. At the observation stage the lecturer must carefully observe the process that has already been carried out. The lecturer is a subject that explains and manages the class, therefore another person would act to help the lecturer as an observer. In this case there are other lecturers, namely observer lecturers as member lecturers who become observers. The lecturer monitors students in the group discussion process. From the stages that have been carried out, namely the planning, action and observation stages of reflection as the final stage in cycle 1.

In the reflection stage which includes discussions with the team of lecturers in the Applied Electronics Circuits course and analyzes the observations of each cycle, the results of which can be used as input for improvement in the next cycle. In addition, the lecturer sees the deficiencies that occur and make improvements.

Assignment result data which consist of the average pretest scores conducted individually in the form of quizzes and the average scores of the posttest consisting of the average scores of individual and group assignments, can be seen in Table 1. Before the test was used in the post-test assignment, the questions were first tested on students who had passed the Applied Electronics Circuit course the previous year. The test was conducted on four students who received various final grade indices. This aims to verify the questions that will be used, whether these questions can be used to find out / measure the level of understanding of students.

Table 1. Average Scores for Individual-Based Task in Cycle 1

Group	Pretest		Posttest	
	Average	S. Deviation	Average	S. Deviation
1	33.33	23.09	53.33	28.87
2	30	17.32	36.67	28.87
3	26.67	5.77	53.33	28.87
4	30	10	23	15.38
5	50	20	46.67	32.15
6	25	7.07	15	7.07
7	25	7.07	70	0
8	25	7.07	40	42.43
Total	30.63	14.59	42.25	26.82

In Table 2, it can be seen that the overall mean score of the group at the time of the post-test increased (around 40%) compared to the average achievement at the time of the pretest. The distribution of values (standard deviation) in the post-test results increased by around 84%. From the assessment data it was found that the increase in achievement was only obtained by one member who incidentally was

the group leader. This is also supported by the high average post-test scores on group assignments. So it can be concluded that the learning method applied has succeeded in increasing average class achievement but the process of knowledge transfer within the group has not been running properly. This will be further investigated by using observational data to compile corrective steps in the implementation of the next cycle.

Tabel 2. Scores of Each Group in Cycle 1

Group	Scores
1	60
2	40
3	76,67
4	33.3
5	50
6	50
7	70
8	80
Average	**60**

Other observations made during class action research are data on students' responses to the research implementation and the performance of group members. Data is collected through a questionnaire filled in after the class action is complete. This data will be used as a reference to determine the corrective steps to be used in cycle 2 in terms of conducting research, as shown in the following table.

Table 3. Observation Results from implementation of STAD cooperative learning in Cycle 1

	Subject of Observation	Cycle 1
STAD Process	Steps of STAD cooperative learning is achieved sufficiently	88,5%
Student's Activities	Active discussion and teamwork with members of the group.	87,55%
Group Assignments	Completion of all assignments that are assigned to the groups.	87,3%

The results of the implementation and the data obtained in the first cycle can be concluded that all stages of the research planned in the first cycle were successfully implemented. The increasing achievement of the average post-test scores shows that the

STAD method can be used to improve student understanding, especially in the Applied Electronics Circuits course. The increasing standard deviation in each group shows that the increase in group achievements is only due to the contribution of a small number of group members or the process of transfer of understanding with group discussions has not been proceeding properly.

The average score in cycle 1 is 30.63. This score still does not meet the minimum passing grade set, which is 75. Furthermore, the passing percentage is still also 9.37%, which has not yet reached the specified indicator, there are also 75% who have only reached the minimum passing grade. These two things are an established indicator of success. However, the achievement of the specified indicators has not yet been fulfilled, so continued classroom action research in cycle 2.

From the results of analyzed data obtained in cycle 1 and the obstacles that arise in the implementation of cycle 1, several improvements would be made to be carried out in cycle 2 as follows: Evaluate the assignment questions and add variations to the practice questions. This is based on the results of the assignments which are reinforced by the findings in cycle 1 where most of the workmanship lies in the development questions. Redistributing groups where smarter students are gathered to test the method applied can increase student understanding and encourage other groups not to depend on smart students (group leaders). Give group assignments at a more intensive rate to improve material understanding, communication skills and cooperation of each group member. Evaluate and develop data collection methods (not assignments) in order to obtain data that can describe the actual conditions.

In cycle 2, assignments are still divided into two, namely individual and group assignments.

Pretest scores are taken from the individual student quiz scores before cycle 2 proceeds. Furthermore, the scores of the pretest will be compared with the results of individual assignments at the posttest. Here are the average individual assignments for each group.

Table 4. Average Scores for Individual-Based Task in Cycle 2

Groups	Pretest		Posttest	
	Average	S. Deviation	Average	S. Deviation
1	53,33	36,82	98,33	2,36
2	43,33	17	98,33	2,36
3	66,67	28,67	60	14,14
4	100	0	82,5	12,5
5	20	10	100	0
6	70	30	50	0
7	35	15	92,5	13
8	98,75	2,16	98,75	2,16
9	13,33	4,71	91,67	11,78
10	20	0	80	0
Total	54,26	35,40	87,22	18,17

The data in Table 4 shows that there was a significant increase in the posttest results when compared with the pretest results. In addition, the decrease in standard deviations in the posttest results indicates that the posttest results are more evenly distributed. This indicates that there was a discussion process in the group.

The resulting scores of the group assignment as post-test in cycle 2 have been summarized in Table 5. This assignment aims to find out the correlation between group understanding and each individual's understanding after the discussion process so that the data can be used to see the effectiveness and quality of group discussion. The following is a recap of the results of each group's work.

Table 5. Scores of Each Group in Cycle 2

Group	Scores
1	100
2	100
3	100
4	100
5	60
6	40
7	20
8	100
Average	77,5

From table 5 it can be seen that the results obtained are quite satisfying although the average obtained on the results of group assignments is lower than the results of individual assignments. This is because the group assignment is made more difficult than the individual assignment problem. It aims to bring up discussion in groups when working on it. Results showed that 70% of the groups managed to do the problems very well. This shows that there is a good discussion in each group.

Broadly speaking, data collection on the implementation of classroom action research and group members 'performance in the second cycle research uses the same mechanism as the data collection in cycle 1. The difference is in the time when filling out the group members' performance questionnaires. In cycle 2, appraisal data for the importance of each members' performance are recalled and re-emphasized on the analysis of the results of the assessment. So, their answers are expected to be based on the actual conditions.

Table 6. Observation Results from implementation of STAD cooperative learning in 2nd Cycle

	Subject of Observation	2nd Cycle
STAD Process	Steps of STAD cooperative learning is achieved sufficiently	88,5%
Student's Activities	Active discussion and teamwork with members of the group.	94,05%
Group Assignments	Completion of all assignments that are assigned to the groups.	94,8%

Improved learning outcomes that occur from cycle 1 to cycle 2, can be seen in Figure 2 below.
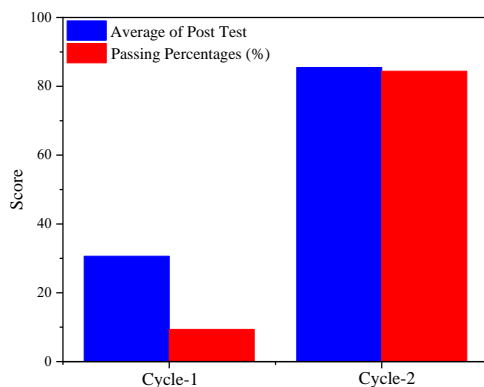
Figure 2. Score and Passing Percentages
Improvements

DISCUSSION

It can be seen from the outcome of data analysis on cycle 2 that a few improvements had succeeded in increasing the average of assignment results significantly and also promoted the process of group discussion so as the understanding level of students becomes equally distributed. The matter can be seen in the decreasing value of standard deviation on cycle 2 compared to the standard deviation value on cycle 1.

Significant improvement occurs in the post test average value and passing percentage from cycle 2 to 1. The learning outcome improvement with a value of 64.16% has been achieved in the Applied Electronic Circuits course implemented with the STAD method. As well as confirmed improvement of passing percentage with a value of 75.01%. %.

The improvement occurs because the shortcoming in the execution of cycle 1 has been fixed in cycle 2 therefore students have had awareness and compassion towards the members of the group, therefore helping other members in trouble furthermore building self-confidence in each member to take part in doing group assignments.

Based on the research outcome explained before, the research design in class measure on the STAD cooperative learning model has been going well. This can be seen in the improvement of individual test average value in the execution of cycle 1 and 2. The individual test value used as a benchmark for learning outcomes in Applied Electronic Circuits courses. The understanding rate in the learning process can be shown in their own learning outcome [13]. In which Susanto [14], stated that the learning outcome can be given in the form of value or score acquired from fulfilling tests in certain materials.

Students' improvement in the learning outcome comes about because of the learning method applied differently than usual by the lecturer. The lecturer has been applying conventional learning which was a classic way of learning where the attention is on the teacher and students are only receiving lectures from the teacher. When the cooperative learning method type STAD is applied [19], students have more parts in becoming active in group discussion in terms of the learning materials. The group assignment grade can also include group discussion by working on problems by discussing. On cycle 1 and 2, the average value in group assignment is also high [19].

The improvement in learning outcome from cycle 1 to 2 was because of the nicely done process of discussion in doing the assignment in most groups. The statement fits with the research outcome [15] which states that group learning activity in students is one of the characteristics of applying model STAD in helping students understand materials given by the lecturer.

Furthermore, the improvements that happened after exercises were given continuously with various forms, therefore increasing the learning outcome of students. By giving exercises continuously and variously

will challenge the students to finish answering exercises and not undergo boredom, therefore the learning outcome becomes meaningful to students [16].

The outcome values of individual tests and group assignment were still low on cycle 1. This was assumedly caused by the lack of understanding/basic skill of Applied Electronic Circuits course in becoming the main reason for the low level of compassion of members helping others in need and self-confidence in each member to participate in group assignments.

Moreover, different patterns of group members' performance evaluation outcome can be found immediately by observers and other members. This occurs because most groups cooperate in giving a good score without considering the actual performance. Therefore, in cycle 2, the problem was emphasized that the evaluation in observation will not be accounted for in the final result.

As an educator, lecturers are always demanded to be able to create a conducive learning atmosphere and also motivate students in learning positively to reach learning achievement optimally. As for the lecturers, teaching effectively and efficiently needs an appropriate strategy therefore what's done can be of help to students in increasing their motivation to study and learning outcome [17, 18]. According to Bandiyah, et. al [19], learning is a process in the implementation of its change that can be found in themselves that is doing it. The change in the learning process can be shown in several forms, such as changes in knowledge, understanding, behavior, and ability in receiving of each individual. Every type of learning has its own unique traits therefore making it possible to have different learning results. In this paper, the applied method of STAD can improve the learning

achievement of Telkom University students in Applied Electronic Circuits course.

CONCLUSION

Based on the result of the research, therefore it can be concluded that the practice of cooperative learning model type STAD in Applied Electronic Circuits course on cycle 1 have not reached the appointed passing rate because of the lack of basic skill nor knowledge in students to understand materials in the course. The average learning outcome in cycle 1 is 30.63 with a passing percentage of 9,37%. Whereas in cycle 2 can be seen a significant improvement because the students can learn and discuss in groups well. The average learning outcome in cycle 2 is 85.47 with a passing percentage of 84,38%. Therefore, the improvement of students passing is 75,01%. Cooperative learning model type STAD can be a reference by a lecturer to improve students' learning outcome in other courses.

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