



The Effectiveness of MEA Cooperative Learning Model by Scientific Approach to Improve Students' Mathematics Learning Outcomes

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Abstract

The objectives of this study include: 1) to determine the mathematics learning outcomes of students in class X.IPS SMAN 2 Mawasangka Tengah before the MEA cooperative learning model with a scientific approach is applied; 2) to find out the average increase in students' mathematics learning outcomes after applying the MEA cooperative learning model with a scientific approach; 3) to find out the MEA cooperative learning model with a scientific approach is effectively applied in improving students' mathematics learning outcomes. This type of research is Pre-Experimental with One-Group Pretest-Posttest Design. The population in this study were all students of class X.IPS SMAN 2 Mawasangka Middle School Year 2020/2021 with a total of 27 students, while the sample in this study was the entire population selected using the totally sampling technique. Data on students' mathematics learning outcomes were obtained from the results of the Pretest and Posttest in the form of essays, indicating that there was an average increase in students' mathematics learning outcomes before being applied (60.95%) and (75.17%) after the MEA learning model was applied. Furthermore, the results of testing based on hypothesis testing were carried out with one sample t-test statistic (one sample t-test) obtained $t_{hitung}(5,6735) > t_{tabel}(2,05553)$, then H_0 it was rejected and H_1 accepted. So it was concluded that the MEA cooperative learning model was effective in improving students' mathematics learning outcomes.

Keywords: Effectiveness, MEA, Scientific, Learning Outcomes

A. Introduction

The quality of education depends on human resources as the spearhead of successful learning, if students are successful there are educators who take part. Likewise, the success of teachers to become experts in their fields is related to skills in improving self-efficacy, the ability to manage learning, and being up to date with advances in science and technology to achieve learning goals. Education is stated (Hidajat et al., 2018) as one of the complex learning process activities, this can be seen by the many factors involved and mutually influencing change.

Mathematics is a subject that is related to everyday life and also supports other sciences (Kusmanto & Marliyana, 2019). Based on the reality in the field, many students have difficulty in mathematics. This fact needs attention considering that mathematics is one of the basic sciences that can train students to study logical, critical, and systematic problems. In addition, Mathematics is one of the subjects that play an important role in the world of education. This can be seen from the many problems in everyday life that can be solved with mathematical concepts. Studying mathematics is the same as learning about how to think (Siregar et al., 2017).

The low quality of education can be seen from some students who get high scores but are less able to apply knowledge. The low learning outcomes of mathematics are caused by the difficulty of students understanding mathematics and less motivated to learn mathematics due to poor study habits (Farman et al., 2021). Many factors cause low mathematics learning outcomes, including the lack of student activity in learning and the lack of teacher skills in providing learning materials. The teacher's inaccuracy in designing and implementing learning (Nabillah & Abadi, 2019) and less use of more innovative learning models (Farman & Chairuddin, 2020). In addition to conventional learning according to (Juanda et al., 2014) the conventional learning model is a classical learning model that is often applied in schools, where learning goes one way and the teacher is the center.

Based on the results of an interview with one of the mathematics teachers, it was stated that the mathematics learning outcomes of students at SMAN 2 Mawasangka Tengah, especially in class X Social Sciences with an average daily test score of 65.25 were still below the Minimum Completeness Criteria (KKM) that had been determined by the school (KKM 70). This is because most students still have difficulty in learning mathematics. Students during the learning process tend to be passive, resulting in the material delivered in class not being absorbed properly and having an impact on their learning outcomes that have not yet reached completeness. This is also because students are accustomed to conventional learning in previous schools, coupled with the schools that are still under construction for several years and are also located in rural areas, so that there are still many schools in the Central Buton area that use the old curriculum.

Learning outcomes are real results of learning subjects from the learning process. From the teacher's point of view, not teaching ends with a learning evaluation process, from the student side, learning outcomes are the end of the peak of the learning process (Maharani et al., 2019). In addition, learning outcomes cover the cognitive, affective and psychomotor domains. Learning outcomes have an important role in the learning process because it provides information to teachers about the progress of students in an effort to achieve their learning goals through the process of further learning activities. Factors influencing mathematics learning outcomes consist of internal factors and external factors. To overcome these problems, teachers must be wise in determining appropriate learning models and can create conducive situations and conditions so that the learning process takes place in accordance with the expected goals and students can be more active (Nabillah & Abadi, 2019).

Various efforts have been made by the school and the government in improving the quality of learning and education. The school has tried to create a school atmosphere as well as possible to support the success of the teaching and learning process. Likewise, teachers have made various efforts such as: providing motivation, class management, forming groups with small group discussions, providing practice questions and so on (Hariyanti, 2018). In learning activities there is a series of interaction processes between teachers and students based on interrelated relationships in an educational situation or situation in order to achieve the expected common goals (Sudarman & Linuhung, 2021).

One of the lessons that can improve students' mathematics learning outcomes is student-centered learning. Indonesia has implemented the 2013 curriculum since the 2013/2014 school

year. The 2013 curriculum recommends that every lesson uses a scientific approach, including for learning mathematics. Since 2017 SMAN 2 Mawasangka Tengah has evenly applied the 2013 curriculum. Although there are still many obstacles, such as in lesson planning. All subjects in school definitely require careful planning. Mathematics is one of the subjects that requires careful planning in the implementation of learning activities, the planning can be described through lesson plans. Most mathematics teachers have memorized the subject matter that will be delivered, so this has an impact on the main task of the teacher to plan learning. The limited development of lesson plans that use certain approaches or models is an obstacle in a learning process in schools. Therefore, the lesson plans that have been made by the teacher need to be developed, especially in the part of learning activities that further encourage student activity.

The application of scientific learning in supporting the learning process can be combined with other learning models, one of which is the MEA type cooperative learning model because cooperative learning and scientific learning are both student-centered. The cooperative learning model proposed (Enidar, 2020) is one of the learning models that provides opportunities for students to be more active with their groups. In addition, MEA is a strategy that separates known problems (Problem State) and goals to be achieved (Goal State) which is then continued by doing various ways to reduce the differences that exist between problems and goals. To achieve the Goal State, it takes several stages, including: 1) identifying the difference between the current state (Current State) and the goal (Goal State); 2) develop subgoals to reduce these differences; and 3) choosing the right operator and applying it correctly, so that the subgoals that have been compiled can be achieved (Sahrudin, 2016).

The MEA learning model consists of three words, namely: Means means the way, Ends means the goal, Anaysis means to analyze or investigate systematically (Hernaeny et al., 2019). The learning model is a conceptual framework that describes learning procedures systematically in managing student learning experiences so that certain desired learning objectives can be achieved (Juanda et al., 2014). In this learning model, it is not only assessed based on the results, but based on the teaching process, besides that students are required to know what the goals to be achieved or what problems are to be solved and solve a problem into two or more sub-goals and then work on successively at the end of the lesson. each of these sub-goals (Maharani et al., 2019).

Learning according to the 2013 Curriculum emphasizes student-centeredness. In this context, the teacher acts as a resource or facilitator, directing learning activities, providing feedback, explanations, and so on. At the observing stage, the teacher helps students find, register or take an inventory of anything they want to know, so they can do or create something. At the questioning stage, the teacher helps students formulate questions based on a list of things they want to know in order to do or create something and facilitate students so that the questions formulated are in line with indicators of competency achievement. At the stage of trying or collecting information, the teacher helps students plan and obtain information data to answer questions that have been formulated and provide or inform data sources. At the reasoning or associating stage, the teacher helps students process or analyze data or information and draw conclusions and confirm the knowledge that has been constructed by students. At the communicating stage, the teacher acts as a manager, feedback provider, reinforcement provider, explanation or broader information provider. While at the stage of creating, the teacher gives examples or ideas, provides choices, gives encouragement, gives rewards, as members who are directly involved. In the implementation of the learning process, the steps in the scientific approach do not have to be complete in one meeting. Certain steps in the scientific approach can be repeated. Steps to create must be adapted to the demands of basic competencies. Learning activities in the creating stage should be carried out through the stages of guided, semi-guided, and independent activities (Mahmudi, 2015).

B. Methodology

This research was conducted at SMAN 2 Mawasangka Tengah, Mawasangka Tengah District, Central Buton Regency, Southeast Sulawesi Province. Time of Research Implementation on 27 October – 27 November odd semester of the 2020/2021 academic year. The population in this study were all students of class X.IPS SMAN 2 Mawasangka Tengah, totaling 27 students. The sample in this study was selected using a totally sampling technique, namely a sampling technique where the number of samples is the same as the population.

Table 1. Research Design

<i>Pretest</i>	<i>Treatment</i>	<i>Posttest</i>
O_1	X	O_2

The data collection techniques used are: 1) the test technique to determine an increase in students' mathematics learning outcomes after learning. N-Gain in the experimental class. The pretest and posttest scores were used to test the effectiveness of the MEA learning model with a scientific approach to student learning outcomes; 2) observations to obtain information related to student activities during the learning process and teacher activities in managing the class; 3) documentation to obtain data in the form of a list of names, the number of students and image documentation in the form of photos of teacher and student activities during the learning process.

The instruments used in this study were test questions and observation sheets. The test questions were carried out to obtain the value of students' mathematics learning outcomes. The test is carried out at the end of the class using the MEA learning model with a scientific approach. Before the test is used, the validity and reliability of the instrument is first tested. The test reliability coefficient value of the Pretest instrument = 0.542 which can be interpreted in the medium reliability category and the test reliability coefficient of the Posttest instrument = 0.523 which can be interpreted in the medium reliability category. This means that this test is sufficient to measure students' mathematics learning outcomes.

Inferential analysis is used to test the research hypothesis. First, through another test stage, namely the normality test to test the hypothesis. The data used in the normality test and t-test are in the form of Normalized Gain (N-gain) scores. Gain is the difference between the posttest and pretest scores, the gain shows an increase in student learning outcomes after the teacher teaches in the same group.

The normality test is used to determine whether the N-Gain data for class mathematical learning outcomes is normally distributed or not. To test whether the data is normally distributed or not, the normality test statistic using the Lilliefors formula is used. Based on the tests that have been carried out, the maximum D results are obtained $D_{hitung} = 0,09339$, while from the table above $\alpha = 0,05(n = 27)$, it is obtained $D_{tabel} = 0,173$. It means $D_{hitung} = 0,09339 < D_{tabel} = 0,173$. Thus H_0 it is accepted and H_1 rejected, so it can be concluded that the Normalized gain data on students' mathematics learning outcomes is normally distributed.

Based on the prerequisite tests carried out, the results of the Normalized gain data on students' mathematics learning outcomes are normally distributed. Then the hypothesis testing using one sample t-test (one sample t-test) on the Normalized gain score is obtained $t_{hitung} = (\alpha = 0,05; dk = n - 1 = 27 - 1 = 26) = 2,05553$. Because $t_{hitung}(5,6735) > t_{tabel}(2,05553)$, it is rejected H_0 and H_1 accepted. So it was concluded that the MEA cooperative learning model was effective in improving students' mathematics learning outcomes.

C. Findings and Discussion

The results of the analysis include descriptive analysis and inferential analysis. Descriptive analysis consists of: data analysis of students' mathematics learning outcomes, teacher activity observation sheets, and student activity observation sheets.

Table 2. Descriptive Data on Students' Mathematics Learning Outcomes

Statistics	MEA Learning Model		
	<i>Pretest</i>	<i>Posttest</i>	<i>N-Gain</i>
N	27	27	27
Average	60.950	75.177	0.358
Standard deviation	13.380	11.397	0.328
Maximum	78.261	95.745	0.867
Minimum	30.435	59.574	-0.189
Variance	179.032	129.888	0.107

Based on table 2 the average student learning outcomes before and after being given learning are 60,950 and 75,177, while the average N-Gain value of student learning outcomes in mathematics is 0.358 so it can be concluded that the MEA learning model is effective in improving mathematics learning outcomes student. The average value of N-Gain is included in the category of moderate improvement which is close to low. This is due to the limitations and weaknesses that exist in this study, including Covid-19.

Table 3. Results of Teacher Activity Observation Sheet

Meeting	Score acquisition	Maximum Score	Final score
I	14	19	73,68%
II	16	19	84,21%
III	17	19	89,47%
Average		82,45%	
Category		Very active	

Based on the results of the analysis of the teacher's observation sheet in table 3, it can be seen that every teacher meeting has followed the learning steps in accordance with the MEA learning model with a Scientific approach in class X.IPS. The observer's observations on the teacher's ability to process learning in class for 3 (three) consecutive meetings with the MEA cooperative learning model on trigonometry material, the implementation of learning management at the first meeting was good with the level of implementation of the learning process from all aspects of 73, 68%. However, at the first meeting, the researcher still adjusted the students' conditions to the learning that had just been implemented in the classroom. In this case the researcher did not convey apperception by reminding the previous material and did not provide motivation to students at the beginning of learning.

Tabel 4. Student Activity Observation Sheet Results

Meeting	Score acquisition	Maximum Score	Final score
I	55	76	72,37%
II	63	76	82,89%
III	69	76	90,78%
Average		82,01%	
Category		Very active	

Based on the results of the analysis in table 4, it can be seen that the average student activity in the learning process with the MEA learning model with a scientific approach for class X.IPS is 82.01% on a scale of 5. This scale indicates that student activities are classified as good or in other words students are very active in the learning process

Inferential analysis is intended to test different hypotheses regarding students' mathematics learning outcomes using the MEA cooperative learning model. Before conducting inferential analysis to test the hypotheses that have been previously proposed, the requirements analysis test is carried out first.

Based on the prerequisite tests carried out, the results of the Normalized gain data on students' mathematics learning outcomes are normally distributed. Then the hypothesis testing using one sample t-test (one sample t-test) on the Normalized gain score is obtained. Because, it is rejected and accepted. So that the MEA cooperative learning model a scientific approach is effective in improving students' mathematics learning outcomes.

One of the causes of difficulty in improving learning outcomes is that students are still accustomed to conventional learning models in previous schools and also teachers have not implemented appropriate learning models to improve students' mathematics learning outcomes. As happened at SMAN 2 Mawasangka Tengah. Based on these problems, teachers need to apply appropriate learning models in improving students' mathematics learning outcomes, one of which is the MEA cooperative learning model with a scientific approach, which seeks a student to better understand and understand in depth about the subject matter being studied. This is because students get an explanation. From peers who are specially prepared by the teacher and mobilize sight and speak the material discussed in groups in learning mathematics.

Prior to the treatment in the form of learning using the MEA Cooperative Learning Model with a Scientific Approach, students were first given a pretest with the aim of knowing the students' initial mathematics learning outcomes. After the pretest, students were then given treatment in the form of MEA cooperative learning with a scientific approach to improve students' mathematics learning outcomes and then continued with the final test (posttest). The number of questions used for the pretest is 6 numbers and the posttest is 5 questions.

The pretest and posttest scores were processed into normalized gain values. The pretest and posttest questions used in the study were first tested with the aim of knowing their validity and reliability. After testing the items, based on the results of the analysis of the existing 6 pretest questions, 4 questions were declared valid and the test reliability was in the moderate category with a value of $r_{11} = 0.542$ and two of the 6 pretest test items were declared invalid. While the questions used for the posttest, one question was declared invalid and the other 4 numbers were declared valid and the reliability of the test was in the moderate category with a value of $r_{11} = 0.523$. From the results of the validity and reliability analysis, which were then used as pretest and posttest to determine student learning outcomes after being taught mathematics using the MEA cooperative learning model with a scientific approach.

The conditions at SMAN 2 Mawasangka Tengah implemented an online learning process for several months, but many students complained because of the limited cost to buy quotas to connect to the internet network, and the lack of understanding of the material provided by the teacher, the Principal of SMAN 2 Mawasangka Tengah decided to apply the teaching and learning process face to face. However, this actually causes stuttering in the process of adjusting teaching and learning activities. That's why it's impossible for an ideal learning to be achieved during a pandemic like now, other than that the conditions and time are inefficient.

The increase in students' mathematics learning outcomes after being taught using the MEA cooperative learning model with a scientific approach is shown by the Normalized Gain average value of 0.358 which means that overall students experience an increase in mathematics learning outcomes in the medium category or in other words, the MEA cooperative learning model with scientific approach is effective in improving students' mathematics learning outcomes.

Based on the results of the analysis, it was found that the mathematics learning outcomes of X.IPS class students before being taught using the MEA cooperative learning model with a scientific approach consisted of 27 students with a mean value of 60.950, a variance of 119.032 and a standard deviation of 13.380, while after being taught the MEA learning model with the scientific approach, the mean value is 75.177, the variance is 129.888 and the standard deviation is 11.397. In the MEA learning model with a scientific approach, there is a significant difference in the average applied to the trigonometry learning material for X.IPS class students at SMAN 2 Mawasangka Tengah. Inferentially the mean of the two has a significant difference.

E. Conclusion

Based on the results of the research and discussion, the conclusions are as follows: 1) The mathematics learning outcomes of X.IPS class students of SMAN 2 Mawasangka Tengah before using the MEA cooperative learning model on trigonometry material, the class average value is 60.950. In other words, the average value of students' mathematics learning outcomes is included in the low category. After learning using the MEA cooperative learning model, the class average value is 75,177. In other words, the average value of students' mathematics learning outcomes is included in the medium category. 2) The average percentage of the implementation of the MEA cooperative learning model by teachers from the first meeting to the last meeting increased from 73.68%, 84.21% and 89.47%. While the average percentage of student activity in the implementation of the MEA cooperative learning model from the first meeting to the last meeting also increased from 72.37%, 82.89% and 90.78%. 3) The MEA cooperative learning model is effective in improving students' mathematics learning outcomes in trigonometry material, class X.IPS SMAN 2 Mawasangka Tengah for the 2020/2021 academic year.

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