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Application of STAD (student team-achievement divisions) Model to Increase Problem-Solving Activities for Quadratic Equation Material Class IX SMP Negeri 13 Malang

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ABSTRACT

The low quality of problem-solving activities can be marked by a lack of understanding of students' understanding of problems. For this reason, the author conducted research by implementing STAD-type cooperative learning, which is expected to make it easier for students, especially to understand the material and information conveyed, to improve their ability to solve problems through student activities. The purpose of this study is to improve student learning outcomes and problem-solving activities using the STAD model. The researcher uses Classroom Action Research (PTK) which aims to examine problems in the classroom and can improve student problem-solving activities and learning outcomes. The research was carried out in the odd semester of the 2018-2019 school year and took place at SMP Negeri 13 Malang. Data collection was carried out by instrument test and non-test (questionnaire). The results showed that students who completed learning increased by 33% in cycle 1 and 10% in cycle 2. Students' problem-solving activities, initially the average number of 0.32 became more active with an average number of 0.6. Problem-solving strategies for students of quadratic equation material can use the STAD model with various games such as PUZZLE and RUTAN SAKU.

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1. Introduction

The world of education today is very different from the previous world of education. Moreover, Class VII science is the beginning of entering junior high school. Life offers two different things, namely joy or sorrow. Grief is generally caused by the problems faced. Problems must be faced wisely and must be solved in a good way. Learning is an activity that aims to help students face the real world. Therefore, mathematics learning cannot be separated from problem-solving activities.

Learning should be associated with effort and train students to think in solving problems. Ideally, math learning should offer problems to solve as an exercise for students in building and developing students' cognitive abilities. Problem solving is one of the five goals of mathematics learning.

Math problems. Problems are not only faced by adults, school-age children also face problems in their learning environment. In this context, the problems in question are in the form of questions and assignments that can be understood but are challenging to solve by students. In addition, the question is certainly not easy to solve with routine procedures that students already know. Therefore, the time factor for solving the problem should not be seen as crucial.

Talking about mathematical problems, Lencher (in Wardhani et al., 2010:7) described them as mathematical problems whose solution strategies are not immediately visible, so that their solution requires knowledge, skills and understanding that have been learned beforehand. Furthermore, Poyla (in Hudojo, 2005: 164) proposed two kinds of mathematical problems, namely:

1) Problem to find where we try to construct all kinds of objects or information that can be used to solve the problem.
2) The problem of proving where we will show one of the truths of the statement, namely whether the statement is true or false. This type of problem prioritizes the hypothesis or conclusion of a theorem whose truth must be proven. Education is a way to develop your potential.

Education is a way to develop the potential of students by facilitating student learning activities. Education also plays an important role in human knowledge in this era of globalization. Efforts to improve the quality of education are one of the main focuses in the development of Indonesian education today. Therefore, it is necessary to have a learning model that is in accordance with the learning characteristics of students. One of the learning models that can be used as an alternative is the Student Teams Achievement Divisions (STAD) type cooperative learning model. In this STAD-type cooperative learning, teachers are the central point as facilitators, mediators, motivators, and evaluators as an improvement in the quality of education based on the teaching-learning process and outcomes.

Currently, in educational activities in Indonesia since the 2013-2018 school year, the 2013 curriculum or often referred to as K13 has been implemented as a substitute for KTSP. In the implementation of the curriculum, there are still many things that must be improved. Based on the information obtained by the researcher at the time of making initial observations, students felt bored with the way the teacher taught. This needs to be understood because educators are still experiencing difficulties in developing the existing learning process. In the Learning Process Plan

(RPP) there are several stages of learning known as 5M. The 5M is observing, questioning, exploring, associating, and the last is communicating, which is a new thing for teachers.

In the 2013 Curriculum, it is stated that this learning is creative learning. This means learning that prioritizes communication between teachers and students. Teaching and learning activities are conditioned in such a way that there is intensive communication between teachers and students as well as the learning environment. In order for the communication process to run well, the guidance that must be fulfilled is: the involvement of teachers' creativity and student activities in a fun teaching and learning process. In addition, learning methods in the classroom should be diverse because with diverse learning methods, fun classroom conditions will be created in line with the conditions of students when participating in teaching and learning activities. Therefore, in the implementation of K13, teachers are required to be more innovative in carrying out learning.

Through the STAD (Student Team Achievement Divisions) type cooperative learning model, it is one of the solutions to improve student activities and the ability to solve problems. Through the STAD learning model, students will be inspired and encouraged to solve mathematical problems through student activities, because the STAD-type cooperative learning model can motivate and make it easier for students to learn set material. Because the STAD learning model has an advantage in the team. Students will be grouped into 4 students, where one of the members of the group who already understands can explain to the other members until all members in the group understand and understand the material to be worked on. Therefore, all students will understand the material.

The STAD-type cooperative learning model was developed by Robert Slavin and his colleagues from John Hopkins University. According to Slavin (in Rusman 2010:213), the STAD (Student Team Achievement Divisions) model is the most widely researched variation of cooperative learning. This model is also very adaptable, it has been widely used in mathematics, science, social studies, English, engineering, Indonesian and many other subjects, and at the elementary school to tertiary level.

So from the above understanding, it can be concluded that Student Team Achievement Divisions (STAD) is one of the simplest types of cooperative learning. Students are placed in a study team of six members which is a mixture according to their performance level, gender and ethnicity. The teacher presents the lesson and then the students work in teams to ensure that all team members have mastered the lesson. Finally, all students were subjected to a quiz about the material with notes, during the quiz they were not allowed to help each other.

Based on the description above, it is necessary to implement a learning model that is able to improve student learning outcomes in the process of teaching and learning activities in the classroom. For this reason, the author conducted research by applying STAD-type cooperative learning, which is expected to make it easier for students, especially to understand the material and information conveyed in order to improve their ability to solve problems through the activities of grade IX students of SMP Negeri 13 Malang, The reason why the researcher chose SMP Negeri 13 Malang is because the place is easy to reach and open. In addition, SMP Negeri 13 Malang has implemented the 2013 curriculum. Based on the above background, the research entitled "Application of the STAD (Student Team-

Achievement Divisions) model to increase student activities and solve problems of quadratic equation material in grade IX SMP Negeri 13 Malang" was carried out for the 2018-2019 school year.

2. Method

This type of research is Classroom Action Research (PTK), because it aims to examine problems in the classroom and improve activities and problem-solving skills.

a. Data Collection Techniques

There are four data that will be obtained in this study, namely: the completeness of learning outcomes, student activities in the learning process, and students' ability to solve problems. With this data, the techniques used for data collection are non-test and test Non-test techniques are used to find out students' problem-solving activities. The instrument used used a questionnaire on students' ability to solve problems.The test technique is to determine the completeness of student learning outcomes in accordance with the student's ability to understand the test that has been given when learning will begin and after learning on the material ends. The instruments used are pre-test sheets, post-test sheets, and LKPD

b. Data Analysis Techniques

1) Questionnaire data analysis can be done by determining the percentage of student answers for each statement item in the questionnaire which is then analyzed descriptively or by transforming the data into an attitude scale which is then quantitatively analyzed. To determine the percentage of student answers for each statement item in the questionnaire, the following formula is used:

$$P=f/n\times 100\ \%$$

Information:
P= percentage of answers
f= frequency of answers
n= many respondents
The percentages obtained on each statement item are then interpreted based on the following criteria

Criteria	Interpretation
$P = 0\%$	No One
$0\% < P < 25\%$	A Small Part
$25\% \leq P < 50\%$	Almost Half of Them
$P = 50\%$	Half
$50\% < P < 75\%$	Most
$75\% \leq P < 100\%$	Almost all of Them
$P = 100\%$	Entirely

2) Learning outcome data using Test instruments with material mastery level

$$\text{Level of Mastery} = \frac{score}{maxsimal\ scare} \times 100\%$$

$$\bar{x} = \frac{\sum x \cdot i}{n}$$

$$s = \sqrt{\frac{(\sum x \cdot i^2 - (\sum x \cdot i)^2)}{(n-1)-n}}$$

Description: $\bar{x}$ = average n = amount of data
x·i= data to i s = standard deviation

3. Results and Discussion

Data description is an effort to display data carried out by researchers so that data can be presented properly and easily. The data presented in the action results are data before the action and data after the action:

1. Stages of action

   The stages in action are used to increase problem-solving activities for students in grades IX-B SMP Negeri 13 Malang mathematics subject on quadratic equation material. The increase in problem-solving activities of students in grades IX-B can be presented in several stages, namely:

   a. Early stage

      The initial stage of the study is data collection before the research. The data collection carried out by the researcher was to observe the problem-solving activities of students' mathematics subjects before the model learning (STAD) of the Student Teams Achievement Division.

   b. Planning stage

      The planning stage includes the preparation of learning tools and the manufacture of research instruments. The learning tools that will be used for research are the Learning Implementation Plan (RPP) and Student Worksheets (LKPD), while the production of research instruments is Puzzle, Pre Test, Post Test, RUTAN SAKU, questionnaire sheets. The learning tools and instrument making have been validated by lecturers and teachers. The validation of devices and instruments functions to determine the feasibility of the devices and instruments that will be used as learning guidelines. The validation indicates that the device and instrument can be used without revision.

   c. Implementation stage

      After the learning tools and the creation of instruments will be carried out the implementation of the research, the implementation of this research includes: the implementation of the RPP and LKPD learning tools which in the process will also be carried out the implementation of puzzle research instruments, pre test, post test, RUTAN SAKU, questionnaire sheets. The implementation of this research lasted for one month.

2. Initial Observation
3. Initial observation aims to make it easier for researchers to detect students' activities and problem-solving skills. In conducting observations, the researcher found several students who had above and below average problem-solving skills. This extra ability is due to students who are always active in answering, asking questions and working on math problems, while students who are below average tend to be less active. Therefore, the researcher tried to further observe the value of mathematics learning outcomes before learning the STAD model. The student learning outcome data was obtained from the Daily Assessment I.

Learning outcome data is used to find out which students in class IX-B are complete and incomplete in PH I odd semester and can also show the average score and standard deviation of all students in class IX-B in PH 1 odd semester which is carried out by 30 students in class IX-B. Among them, there are 24 students who have completed their studies because they got a PH score of more than 75 with a percentage of 80% while 6 students in class IX-B have not completed because the PH score is less than 75. The average overall odd semester PH score of students in class IX-B was 76.8 with a standard deviation of 9.24.

With the results of PH 1 odd semester, the researcher decided to conduct a study on quadratic equation material using the STAD model. Learning in this material, the researcher applies the group discussion method with the aim of finding out the differences before the implementation of learning using the lecture method and after the implementation of the group discussion method. The group discussion uses the rule that in one group consisting of 6 students who will discuss the LKPD to improve the ability to solve mathematical problems related to square equation material in daily life.

Post-Action Data

Post-action data is data obtained from test results and questionnaire results provided by researchers after applying the STAD model. The data was carried out in two cycles. The two cycles can be presented in the following discussion:

1. Cycle 1

   The implementation stage of cycle 1 is planned in four meetings and each meeting requires about 2 hours of lessons, 1 hour of lessons, 2 hours of lessons, 2 hours of lessons. Each hour of lessons lasts 40 minutes. Pre test 1 was held at the first meeting, while post test 1 was carried out at the fourth meeting. The first meeting of students conducted a pre-test of quadratic equation material in the factoring sub-chapter, the second meeting of students carried out learning outside the classroom by heterogeneous groups through the learning method of one group making problems and the other group answering questions. In the third meeting, students learned the factoring material of the form $x^2+bx+c=0$ and $ax^2+bx+c=0$ and played Puzzle. In the fourth meeting, students conducted a post test of the quadratic sub-chapter of factoring.

   Cycle 1 data is quantitative data obtained from pre test 1 and post test 1. Pre test 1 is used to find out the learning outcomes of students before learning activities begin. Pre test 1 is the data after the first cycle is about to start. Pre test 1 is used to find out the beginning of the teaching results before the STAD model is implemented. Data on student learning outcomes after being given a pre-test in cycle 1. From the table, it can be seen that 15 students or a total of 50% were declared complete and 15 students or a total of 50% were declared incomplete with an average score obtained from 30 students of class IX-B of 65.3. Therefore, it is necessary to carry out a post test. Post test 1 is the data after the first cycle ends. Post test 1 is used to determine the learning outcomes after the STAD model is implemented.

   Data on student learning outcomes after being given a post test in cycle 1. From the table, it can be seen that 25 students or a total of 83% were declared complete and 5 students or a total of 17% were declared incomplete with an

average score obtained from 30 students of class IX-B of 84.1. Therefore, it is necessary to implement cycle 2. After cycle 1 ends, the teacher gives a questionnaire to students in grades IX-B. Questionnaires are usually used to provide additional/supporting information regarding aspects of problem-solving activities that may not be obtained from the results of measurement through test instruments.

Students pay close attention to the teacher's explanation of the mathematical topic of quadratic equations (factoring) by 30%. This shows that almost half of the students pay close attention to the teacher's explanation of the mathematical topic of quadratic equations (factoring). Based on the results of the calculation, the average percentage of student answers as a whole was 25%. This shows that the average percentage of students' problem-solving activities is 25%, meaning that almost half of the students already have activities that can solve math problems. Nonetheless, students' problem-solving activities need to be improved.

2. Cycle 2

The implementation stage of cycle 2 is carried out in six meetings and each meeting requires about 1 hour of lessons, 2 hours of lessons, 1 hour of lessons, 2 hours of lessons, 2 hours of lessons, 1 hour of lessons. Each hour of lessons lasts 40 minutes. Pre test 2 was held at the first meeting, while the implementation of post test 2 was carried out at the sixth meeting.

The first meeting of students conducted a pre-test of the square equation material sub-chapter of perfect squares, ABC formula, discrimination, and square equations of everyday problems, the second meeting of students carried out learning in the classroom with the material completing the perfect square. The third meeting, students were in groups using LKPD media. In the fourth meeting, students learned ABC/quadratic formula material. The fifth meeting of students played RUTAN SAKU and discrimination material from quadratic equations. The sixth meeting of students did a POST test of square equation material sub-chapter perfect squares, ABC formula, discrimination, and square equations of everyday problems.

Cycle 2 data is quantitative data obtained from pre test 2 and post test 2. Pre test 2 is used to find out the learning outcomes of students before learning activities begin with sub-chapters of perfect squares, ABC formulas, discrimination, and squared equations of everyday problems. Pre test 2 is the data after the first cycle is about to start. Pre test 2 is used to compare le Data on student learning outcomes after being given a pre-test in cycle 2. From the table, it can be seen that 19 students or a total of 63% were declared complete and 11 students or a total of 37% were declared incomplete with an average score obtained from 30 students of class IX-B of 71.9. Therefore, it is necessary to carry out a post test.

Post test 2 is the data after the second cycle ends. Post test 2 is used to find out the results of the comparison between the learning outcomes of pre test 2 and post test 2.arning outcomes with post test 2. Data on student learning outcomes after being given a post test in cycle 2. From the table, it can be seen that 22 students or a total of 73% were declared complete and 8 students or a total of 27% were declared incomplete with an average score obtained from 30 students of class IX-B of 75.7. Therefore, the cycle stops in cycle 2. After cycle 2

ends, the teacher gives a questionnaire to students in grades IX-B

Questionnaires are usually used to provide additional / supporting information regarding aspects of problem-solving activities that may not be obtained from the results of measurements through istrument tests. Students pay close attention to the teacher's explanation of the mathematical topic of quadratic equations (completing perfect squares, abc formulas, discrimination, and everyday problems) by 29%. This shows that almost half of the students pay close attention to the teacher's explanation of the math topic of square equations (completing perfect squares, abc formulas, discrimination, and everyday problems).

Based on the results of the calculation, the average percentage of student answers as a whole was 25%. This shows that the average percentage of students' problem-solving activities is 25%, meaning that almost half of the students already have activities that can solve math problems. Nonetheless, students' problem-solving activities need to be improved.

Test Results

Based on the results of the mathematics test, students in grades IX-B SMP Negeri 13 Malang who have completed their studies have improved. The percentage of cycle 1 obtained by students of grade IX-B of SMP Negeri 13 Malang on the results of students who completed pre test 1 was 50% and the results of post test 1 students who completed their studies were 83% while the percentage in cycle 2 obtained from students in class IX-B who completed their studies in the results of pre test 2 was 63% and the results of the post test of students who completed their studies were 73%. Judging from the increase in student learning outcomes in cycle 1 to cycle 2, a table of complete student learning outcomes was given.

Student problem-solving activities

Student problem-solving activities during the application of the STAD model obtained the percentage of relevant problem-solving activities in cycle1, namely students pay close attention to the teacher's explanation of the mathematical topic of quadratic equations (factoring) with a percentage of 30%; When the teacher is explaining the mathematics subject matter, students discuss non-mathematics topics with their peers with a percentage of 30%; Students understand the math problem being discussed with a percentage of 29%; Students were confused about applying the mathematical concepts that had been explained by the teacher in the mathematical problems faced with a percentage of 27%; Students dare to ask questions when it is difficult to understand mathematical explanations from teachers with a percentage of 24%; Students avoid answering math questions asked by teachers/friends with a percentage of 30%; Students are silent when they do not understand the mathematics material explained by the teacher with a percentage of 24%; During group work, students are willing to submit proposals explanation of mathematical problems in LKPD with a percentage of 25 %; Students avoided completing math group assignments that were part of the student with a percentage of 32%; Students were enthusiastic about discussing mathematics group assignments with a percentage of 19%; Students are anxious when they are assigned to express their opinions about solving math problems in front of the class with a

percentage of 22%; Students are confident that they can express their own opinions during mathematics discussions with a percentage of 20%; Students limit the opportunity for friends to express their opinions during a mathematics group discussion with a percentage of 41%; During the math group work, we divided the task to express each opinion with a percentage of 27%.

Students offer members of the mathematics group to express their opinions with a percentage of 27%, Students are willing to present the results of the mathematics group work in front of the school teacher council with a percentage of 23%; Students avoid the task of presenting the results of the mathematics group work in front of the class with a percentage of 30%; Students argued that they were given the task of presenting the results of the mathematics group's work in an inter-school competition with a percentage of 26%; Students Present problems in a clearer form with a percentage of 13%; Students stated the problem in an operational form (solvable) with a percentage of 22%; Students compiled alternative hypotheses and work procedures that were estimated to be good to be used in solving the problem with a percentage of 22%; Students test hypotheses and do work to obtain results (data collection, data processing, etc.), the results may be more than one with a percentage of 20%; Students recheck (check) whether the results obtained are correct, or may choose the best solution alternative with a percentage of 25%; Students dabbled in how to solve problems with a percentage of 22%; Students ignore the impossible in solving problems with a percentage of 16%.

Meanwhile, student problem-solving activities during the implementation of the STAD model learning obtained the percentage of relevant student problem-solving activities in cycle 2 students paid serious attention to the teacher's explanation of the mathematical topic of quadratic equations (completing perfect squares, abc formulas, discrimination, and everyday problems) with a percentage of 29 %; When the teacher is explaining the mathematics subject matter, students discuss non-mathematics topics with their peers with a percentage of 29%; Students understood the mathematical problem being discussed with a percentage of 34%; Students are confused about applying mathematical concepts that have been explained by the teacher in the mathematical problems faced with a percentage of 32%; Students dare to ask questions when it is difficult to understand mathematical explanations from teachers with a percentage of 23%; Student avoid answering math questions asked by teachers/friends with a percentage of 27%; Students are silent when they do not understand the mathematics material explained by the teacher with a percentage of 21%; When working in groups, students are willing to propose explanations of mathematical problems in the LKPD with a percentage of 23%; Students avoided completing math group assignments that were part of the student with a percentage of 36%; Students were enthusiastic about discussing mathematics group assignments with a percentage of 22%; Students are anxious when they are assigned to express their opinions about solving math problems in front of the class with a percentage of 22%; Students are confident that they can express their own opinions during mathematics discussions with a percentage of 24%; Students limited the opportunity for friends to express their opinions during group discussions in mathematics with a percentage of 34%; During the mathematics group work, we divided the task to convey each opinion with a percentage of 25%; Students offer members of the mathematics group to express their opinions at a percentage of 30%, Students are willing to present the results of

the work of the mathematics group in front of the school teacher council with a percentage of 19%; Students avoided the task of presenting the results of the mathematics group work in front of the class with a percentage of 28%; Students argued that they were given the task of presenting the results of the mathematics group's work in an inter-school competition with a percentage of 23%; Students presented the problem in a clearer form with a percentage of 25%; Students stated the problem in an operational form (solvable) with a percentage of 27%; Students compiled alternative hypotheses and work procedures that were estimated to be good to be used in solving the problem with a percentage of 22%;

Students test hypotheses and do work to obtain results (data collection, data processing, etc.), the results may be more than one with a percentage of 21%; Students recheck (check) whether the results obtained are correct, or may choose the best solution alternative with a percentage of 23 %; Students dabbled in how to solve problems with a percentage of 23 %; Students ignore the impossible in solving problems with a percentage of 14%.

Student problem-solving activities during the learning process during ten meetings with two cycles can be seen to have increased.The increase in problem-solving activities of students who were previously passive with an average of 0.32 became more active with an average of 0.6 and the same with an average of 0.08.

4. Conclusions

According to the formulation of the problem that has been applied in the introduction, the answer to the formulation of the problem is described as follows:

a. The number of students who completed learning increased from pre test 1 to post test 1 increased by 33% and pre test 2 to post test 2 increased by 10%
b. Student problem-solving activities in the mathematics learning process in class IX-B SMP Negeri 13 Malang after using the STAD (Student Team-Achievement Divisions) model can be said to be active, this is shown by the increase in student problem-solving activities that were previously passive with an average number of 0.32 to be more active with an average number of 0.6 and the same with an average number of 0.08.
c. Students' problem-solving strategies in mathematics subjects, especially quadratic equation materials, can use the STAD model with various games such as PUZZLE and RUTAN SAKU.

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