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Application of the Jigsaw Learning Model to Improve Student Learning Outcomes in Mathematics

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ABSTRACT

The quality of student learning outcomes in science subjects (exact), especially mathematics, is still relatively low and has always been a problem in Indonesia, namely in education. This is supported by the findings of the 2015 PISA (Program for International Student Assessment) study, which found that Indonesian students ranked 62 out of 70 countries, especially in mathematics skills. So, this study aims to improve student learning outcomes in learning mathematics, focusing on quadratic equation material. The research method used is classroom action research (CAR), applying the jigsaw-type cooperative learning model. The subject was class nine grade students of Al-Kautsar Plus Junior High School, Malang City, totaling 20 students consisting of 12 female and eight male students. Data collection using observation and test techniques. Qualitative analysis was carried out of the observation data, which contained information on student interaction. The research design consisted of planning, action, observation, and reflection. Quantitatively, the test data were analyzed, including pre and post-test scores measuring the math learning outcomes of students. The results of this study began from the beginning (pre-cycle) to cycle I, which is an increase from 50% to 65%. Then, in cycle II, there was an increase from 65% to 90% because it had met the success indicator with the number of students who scored ≥ 75 more than 80%, so it stopped in cycle II. Thus, implementing the Jigsaw-type cooperative model can improve students' learning outcomes in mathematics. In conclusion, the findings of this study show that a jigsaw-type cooperative learning model effectively improves mathematics education and teaching in secondary schools. The jigsaw model, which encourages student engagement, collaboration, and critical thinking, is a promising approach to improving mathematics education and preparing students for success in the 21st century, so it has the potential to be widely adopted in other schools by educators.

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A. INTRODUCTION

Mathematics studies abstract objects based on logic, reasoning, and deductive proof. As a science, mathematics aims to train humans to think deductively, following the statement by Silver (1990) that one of the characteristics of mathematics is deductive thinking. Deductive thinking is a general idea applied or directed to a specific thing. So, mathematics learning aims to shape students' thinking patterns by observing, guessing, doing, trying, answering why questions, and

discussing. From this statement, if students are brought into critical and creative learning, it will improve the quality of student learning outcomes.

However, in reality, the quality of student learning outcomes in science subjects, especially mathematics, is still relatively low and has always been a problem in Indonesia, namely in education. This statement is supported by the results of the PISA (Program for International Student Assessment) study in 2015, which found that Indonesian students ranked 62 out of 70 countries, especially in mathematics skills (OECD, 2016). Another problem is that mathematics in schools seems to be oriented only to textbooks, so this is one of the factors that cause low student learning outcomes in mathematics (Lindorff et al., 2019; Sievert et al., 2019). Hence, in this scenario, the teacher's significance substantially enhances the quality of students' learning achievements.

The vital role of a teacher is to be able to carry out and realize learning by the objectives of learning outcomes. One of the things that can help teachers make it happen is to use a learning model suitable for the conditions of students in the classroom. According to research conducted by Jian (2019), a learning model is a design or pattern that guides learning planning, which helps increase student motivation and learning outcomes. In other words, teachers must be able to implement learning models to deliver material to students so that the quality of student learning outcomes increases.

However, based on observations made by researchers at one of the junior high schools in Malang City, several student problems were found, including (1) student learning outcomes in mathematics are still relatively low, (2) lack of student interest in participating in mathematics learning, (3) low student responsibility for math assignments given by the teacher, and (4) lack of teacher and student interaction during classroom learning. Some of these problems are pretty severe learning problems, and action must be taken so that they do not continue to impact student learning outcomes. One of the things that can be done is to choose a suitable learning model.

The selection of an inappropriate learning model in the classroom can cause students to have difficulty understanding the material, resulting in student errors in solving problems (Agustyaningrum et al., 2020; Winarso & Toheri, 2021). It also has an impact on the low quality of student learning outcomes. For this reason, the Jigsaw-type cooperative learning model is considered appropriate and necessary to overcome some of the problems mentioned. The Jigsaw-type cooperative model divides students into several groups and then systematically breaks the group back down to discuss with members of other groups a specific section of material and groups then return to the original group and present the results of their discussion (Ramlawati et al., 2018; Fitriana et al., 2023).

The jigsaw-type cooperative model is a collaborative learning approach where groups typically consist of 4 to 5 individuals. Each group comprehends the material assigned to them and then shares their understanding with other groups (Saputra et al., 2019; Telaumbanua, 2022). Karacop (2017) further emphasizes that this method fosters active participation and collaboration among students under the teacher's guidance, resulting in optimal comprehension of the subject matter. Moreover, a meta-analysis was conducted by Stanczak et al. (2022).

Several studies on the success of implementing the jigsaw model have been conducted, including Sari & Haji (2021) showing that the Jigsaw type cooperative learning model succeeded in improving learning conceptual understanding in algebra subjects. The research conducted by Timayi et al. (2015) showed an increase in student learning outcomes in geometry subjects with a significant effect. Not only that, the use of the jigsaw learning model can also foster other mathematical abilities, including improving formal and concrete reasoning that has been done by

Mari & Gumel (2015). Overall, the Jigsaw-type cooperative learning model offers a practical and effective approach to promoting student engagement, collaboration, and learning in mathematics and other subjects. With its simplicity, flexibility, and proven efficacy, it is well-suited for adoption by other schools seeking to enhance their instructional practices and student outcomes.

B. METHODS

The research method used was Classroom Action Research (CAR). The research subject was class nine grade students of Al-Kautsar Plus Junior High School, Malang City, totaling 20 students consisting of 12 female and 8 male students. The research design used is the design by Altrichter et al. (2002). The following researchers developed a flowchart in Figure 1.

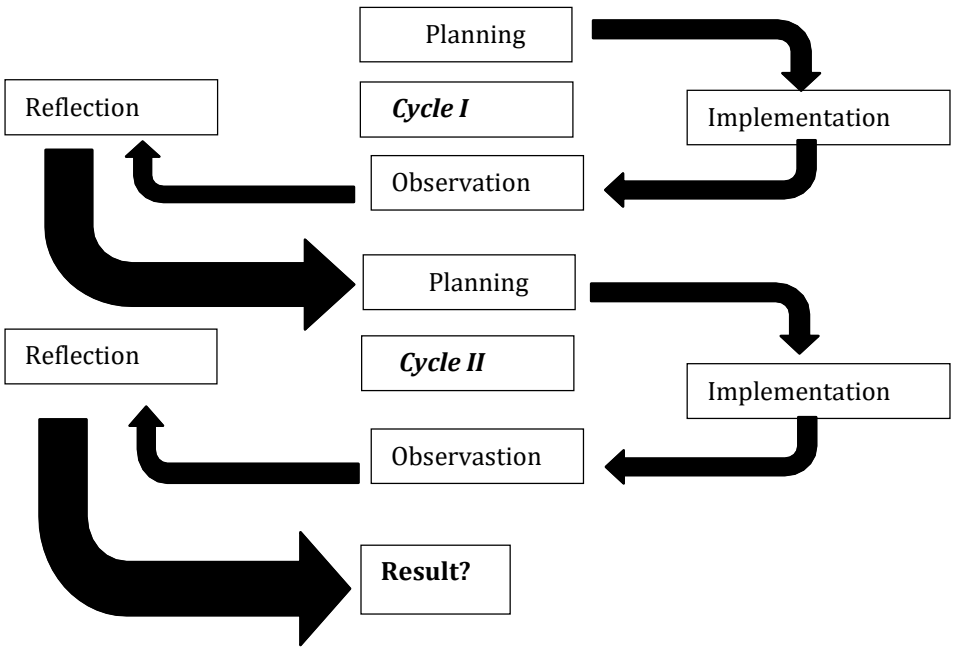

Figure 1. Schematic of Classroom Action Research (Altrichter et al., 2002)

From Figure 1, researchers can elaborate on the explanation as follows:

1. Cycle I

a. Planning Stage

Planning is an activity plan to improve and change attitudes and behavior as desired. At this stage, researchers identified problems at the research location, compiled tests and non-test instruments, learning media needed, and formed 4 groups with 1 group of 5 students and 1 person as group leader.

b. Action Phase

This stage includes preliminary activities, core activities, and closing.

1) Teachers carry out learning by the lesson plan that has been made
2) Students can follow the learning according to the teacher's direction
3) Researchers observe the learning process
4) In the closing activity, the teacher reinforces the form of giving conclusions and evaluating learning.

c. Observation Stage
The observation stage is an observation of the results of learning activities. This stage is carried out during the learning process. In addition, students were given a test instrument at the end of learning in this cycle I. The purpose of giving test instruments is to determine the results obtained by students with the jigsaw-type cooperative model and to assist researchers in taking the next step.

d. Reflection Stage
Reflection is understanding the events and impacts that occur. At this stage, researchers observe, review, and consider the results of the learning that has been implemented. Reflection activities help determine the next steps that researchers must take.

2. Cycle II

Cycle II was a follow-up to cycle I. The material taught to students was advanced material from cycle I. In cycle II, planning activities were carried out by identifying problems found in cycle I and improving devices and tools, materials, and test instruments. In this cycle II, a new group was formed, and the group leader was chosen from students who got high scores. Each group consisted of 5 students. Data collection using observation and test techniques. Qualitative analysis was carried out of the observation data, which contained information on student interaction. The qualitative analysis was designed to demonstrate that the Jigsway teaching model is effective when students actively collaborate during mathematics studies to improve their educational outcomes. Quantitatively, the test data were analyzed, including pre and post-test scores measuring the math learning outcomes of students. Quantitative analysis is used to objectively measure the effectiveness of the Jigsaw model in improving student learning outcomes, particularly in mathematics. A collection of math questions on quadratic equations is contained in this test instrument. It is said that if a student scores 75 or 80 % of the number of students enrolled in research conducted, this indicator of success will be successful.

C. RESULT AND DISCUSSION

Researchers found that the percentage of students who scored ≥ 75 was 50% of the total number of students. Therefore, this study applied the jigsaw-type cooperative learning model to improve student learning outcomes on quadratic equation material. Table 1 shows the students' test results in cycle 1.

Table 1. Cyle I Results

No	Value	Many Students	Percentage
1	0 - 24	2	10%
2	25 - 49	3	15%
3	50 - 74	3	15%
4	75 - 100	13	65%
Total		20	100%

Table 1 shows that students who scored ≥ 75 were 65%, namely 13 students from the initial 50%, which can be said to be an increase of 15% in student learning outcomes on quadratic equation material. The researcher provides More details in the bar chart in Figure 2.

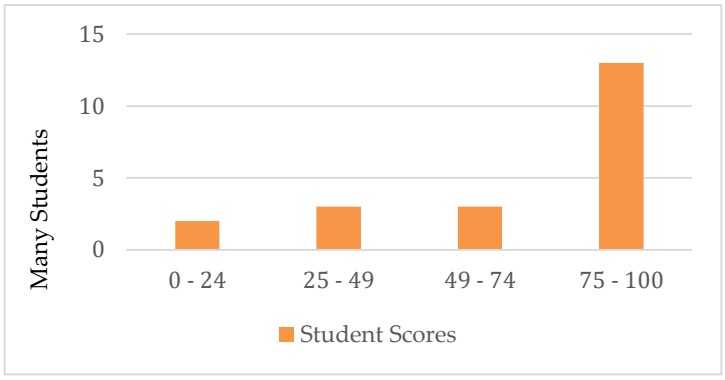

Figure 2. Bar Chart of Cycle I Test Results

From the test results obtained by students in cycle 1, it can be concluded that there was an increase in student learning outcomes. However, the increase that occurred still did not meet the classical completeness that the researchers had written in the research method. Then, the step taken by the researcher was to continue in cycle II. The results of cycle II can be seen in Table 2. which did not meet the classical completeness set by the researcher.

Table 2. Cycle II Results

No	Value	Many Students	Percentage
1	0 - 24	0	0%
2	25 - 49	1	5%
3	50 - 74	1	5%
4	75 - 100	18	90%
Total		20	100%

Table 2 shows that students who scored ≥ 75 were 90%, namely 18 students. From what was initially in cycle I, only 65% increased by 25% to 90%. For more details, the researcher shows it in a bar chart in Figure 3.

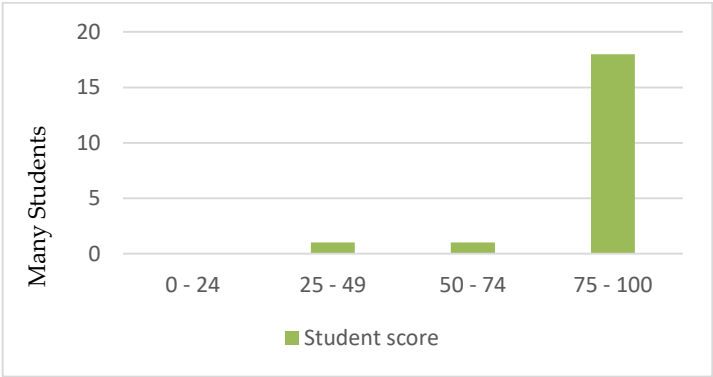

Figure 3. Bar Chart of Cycle II Test Results

From the explanation that the researcher has described in the results and discussion, it can be concluded that the student learning outcomes have met the completeness set by the researcher, namely, the value of students who get ≥ 75 is ≥ 80% of the number of students in the class. So this proves that applying the Jigsaw learning model can improve the mathematics learning outcomes of class nine grade Al-Kautsar Plus Junior High School students on the quadratic equation material.

The following researchers compare the percentage of pre-cycle, cycle I, and cycle II results in a bar chart in Figure 4.

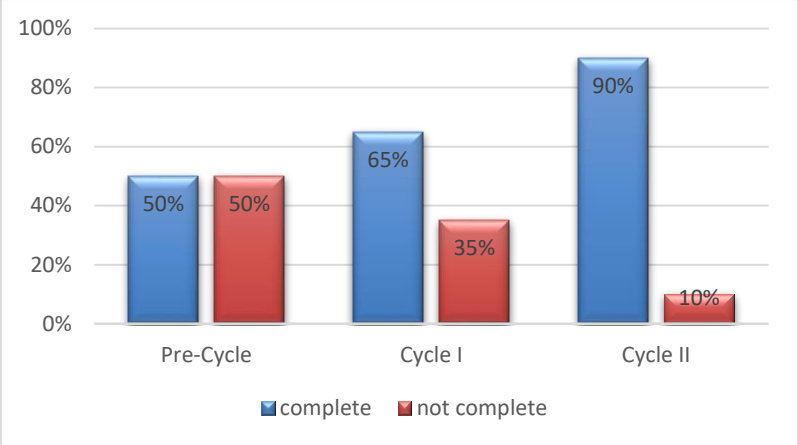

Figure 4. Diagram of Percentage Comparison of Pre-Cycle, Cycle I, and Cycle II Results

Based on the results of the research obtained from the application of the jigsaw-type cooperative learning model in the learning process, it can be seen that the student's learning outcomes increased; it can be seen that in cycle II, almost all students scored above 75. The results of this study are in line with several previous studies which show that students' learning outcomes in mathematics increased after using the jigsaw-type cooperative learning model from several mathematics materials (Usman et al., 2022; Tabiolo & Rogayan, 2019; Zakaria et al., 2013).

D. CONCLUSION AND SUGGESTIONS

The conclusion explains that implementing the jigsaw-type cooperative learning model in class nine A students at the Plus Al-Kautsar Malang Junior High School can improve learning outcomes on quadratic equation material. This is evident from the pre-cycle, cycle I, and cycle II results. The change in the percentage of initial reflection to cycle I is from 50% to 65%. Then, in cycle II, it increased from 65% to 90% and met the success indicator with the number of students who got a score greater than or equal to 75 more than 80%. In conclusion, the findings of this study show that a jigsaw-type cooperative learning model effectively improves mathematics education and teaching in secondary schools. The jigsaw model, which encourages student engagement, collaboration, and critical thinking, is a promising approach to improving mathematics education and preparing students for success in the 21st century, so it has the potential to be widely adopted in other schools by educators. Therefore, the researcher recommends that other researchers apply the jigsaw-type learning model in other schools with different mathematics materials, for example, on the material of complex building spaces.

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