

**THE APPLICATION OF JIGSAW TYPE OF COOPERATIVE LEARNING MODEL
IN MATHEMATICS SUBJECT TO INCREASE STUDENTS' LEARNING
OUTCOMES**

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Article Info	Abstract
<p>History: Submitted March 3th, 2021</p> <p>Revised August 9th, 2021</p> <p>Accepted September 10th, 2021</p>	<p>The background of this research is from the results of initial observations which show that the children only listen, take notes, memorize, and students are not active to be able to find their own concepts, so it resulting in low learning outcomes. With that background, the researchers took the initiative to make improvements using the Jigsaw-Type Cooperative method. The result of this classroom action research, obtain that: 1) Students' learning outcomes in mathematics subjects before using jigsaw cooperative learning in the teaching materials of addition and subtraction of fractions are still very low. This is proved by the average score of students' learning outcomes that is only 51.75 (below the Minimum Completeness Criteria). Because the learning activities are monotonous which means that learning does not vary when delivering the subject material. Students' enthusiasm, interest, and activity decreased due to difficulties in working and solving the worksheets. 2) With applying jigsaw-type cooperative learning, students' activities in individual learning, group learning, learning enthusiasm, attention, collaboration, communication, and discipline, overall have shown well as expected. 3) After implementing jigsaw-type cooperative learning in mathematics learning, students' learning outcomes showed improvement. This is proven from the acquisition results of the first cycle average score is 60.75 and the average score in the second cycle reaches 75, above the Minimum Completeness Criteria (KKM) of 55.</p> <p>Keywords: Jigsaw; Mathematics; Learning Outcomes</p>

A. Introduction

The field of mathematics studies needs to be taught to all students from elementary school as a provision of students with the ability to think logically, critically, analytically, creatively, systematically, and the ability to work together (collaboration). This ability is needed by students so they can have the ability to obtain, utilize, and manage information as a means of survival in conditions that are always changing and competitive.

The purpose of mathematics learning is to train students and foster critical, systematic, creative, logical, and consistent thinking, and provide a persistent or confident attitude when solving problems. Related to the purpose of mathematics learning, logical thinking in understanding mathematics learning is a part that should exist in the learning process. This activity is very pronounced if the learning process involves students actively in the process of constructing knowledge. That liveliness is not only in working assignments or answering questions from the teacher to individual or groups, but should include how students ask questions to fellow students or teachers. Giving questions and responses is an implementation of logical thinking. According to Waluya (2015) mathematics

skills are developed when playing the game, even when the game is not related to math.

The term of learning has a relationship with the definition of learning and teaching. The teaching and learning activities are the activities that are conducted together. Learning activities can occur even without the teacher or without teaching and learning activities. While the teaching activities include all actions that teachers take in class. As the opinion of Hasmianti, et al (2017) states that learning is an individual activity to acquire knowledge, behavior, and skills by managing the learning materials.. In these activities, individuals apply cognitive, affective, and psychomotor knowledge. Rosyidah U (2016) explained that a teacher's duty is not easy, he must be able to guide and direct his students so they can learn and obtain the expected learning outcomes. In line with the opinion of Norhayati in (W.B. Sulfemi dkk, 2018), the teacher's duty in learning is to make students learn through the creation of interesting and meaningful learning strategies and environments. The learning process is said to be successful when the students can absorb and master the material well.

Duffy and Roehler, 1998 (in Whandie, 2007) said that what the teachers did so the

teaching and learning process runs smoothly, is moral, and makes students feel comfortable is part of the teaching activities, also specifically trying to implement the curriculum in the classroom. Meanwhile, learning is an effort that intentionally involves and uses the professional knowledge possessed by teachers to achieve the curriculum goals.

So, learning is an activity that is intentionally conducted as a modification of various conditions given to achieve curriculum goals. The explanation is in the guidebook for implementing the elementary, junior high, and high curriculum (in Whandie, 2007) “The term of learning as a process of changing attitudes and behavior basically takes place in an artificial (experimental) environment and very little depends on the natural situations (reality)”.

Fahrudin (2021), without being taught, students will never know how to help themselves. In the learning process, the student should be roled as subject and object, thus mathematic learning process is not centered on the teacher.

Based on that, the learning environment can be formed to support learning so the learning process can be optimal. The process of forming the learning environment is called the learning process.

Learning can occur without learning, but the impact of learning outcomes is more often advantageous and usually easy to observe. Teaching can be defined as a condition that creates a situation so it can motivate students to learn. This situation does not have to be a transformation of knowledge from teachers to students but can be in other ways such as learning by using the learning media. As stated by Astuti (2015), learning will be more effective if the individuals are aware and know the learning process, and can monitor their own strategies, goals, results, and consequences of the learning process.

The process of mathematics learning as much as possible is delivered in a pleasant atmosphere so the students can be motivated to learn mathematics. Therefore, a teacher should be able to design the learning when providing learning, so the students receive and understand well by applying appropriate learning media. According to Pingge (2017) that teacher competency is the ability or capability of teachers to manage learning, as the knowledge, skills, and basic values that are reflected in the habits of thinking and acting. Of the many mathematics learning materials in the elementary school, one of which is addition and subtraction of fractions. In that material, children are required to think critically, logically,

creatively, and innovatively so they can draw conclusions from a problem. In line with the opinion of Gunawan, et al, (2018) which explains that motivation in learning is also very much needed by every student. Without motivation in learning, it is impossible for the knowledge taught by every teacher to be accepted by students.

Based on the experience of the researcher as well as the 5th grade teacher at SDN Banjar 3, from 20 students, 11 students or 55% scored \leq the average minimum completeness criteria (MCC) of 55. It can be seen from the results of the tests conducted before carrying out the research. From those data, it can be seen that students feel difficulty in solving problems. Students do not yet have confidence in their abilities, so the students make mistakes when solving problems. The addition and subtraction fractions questions are given, such as common fractions, mixed fractions, and decimal fractions. Students often feel confused about how to solve the problems, so in the end, students act carelessly in filling out the questions or assignments given. As a result, some of the students in the 5th grade of SDN Banjar 3 have low achievement in mathematics. If left unchecked, these problems will have a major impact on students, while we know that mathematics is

very important in the education world. So it can be seen that the student's ability in solving the problems related to addition and subtraction of fractions is very low. According to Fona Fitry Burais, et al (2015) in fact, there are still many students in Indonesia who have difficulty in mathematics learning. One of the reasons is the low mathematical communication skills of students.

From the description above, it mandates that in learning, students are an object so the learning process should always be based on students' needs. The problem faced by teachers is how to apply the concept of learning. Students need to be motivated to be able to develop thinking skills because the learning activities in the classroom are aimed at the students' ability to process information, so the students are required to remember and store information without any hope to understand the information they remember and being able to relate it to everyday life. This learning has an impact that they are able theoretically but weak in applying it.

According to Mawardi in FFK Sari (2018), the learning model is a conceptual framework for designing and implementing learning, organizing learning experiences to achieve goals, and as a guide in the learning process because it contains a systematic

learning syntax. Based on that, researchers need to implement a method that can assist students in solving the addition and subtraction of fractions with jigsaw cooperative learning. Rien Anitra (2021), this jigsaw learning model is one of cooperative learning that involves students actively in learning and trains students to work together in a group. This opinion was corroborated by Kahar (2020) that from various researches that have been conducted about cooperative learning, shows that the approach with this model is much better than other approaches. Jigsaw cooperative learning gives students the opportunity to process information and express the opinions they get and are able to improve communication skills, all group members have the responsibility for their group successes and can convey the results of their work to other groups. Martina (2013) explained that effective learning methods can produce a good understanding of students' mathematical concepts. This can be obtained through jigsaw-type of cooperative learning. This opinion is in line with the opinion of Norhayati Endah Permatasari (2017), who affirms that in order for children's cognitive development to run well, one form of learning is needed, namely the cooperative learning model.

This jigsaw learning model is also known as the cooperative learning of the expert. This is because each group member is given a different problem. Although the problems are different, the core problems faced by each group are the same. Furthermore, the discussion results are brought to the home group then conveyed to the members of the group.

Cooperative learning is a form of learning where the students learn and work collaboratively in groups consisting of four to five people with heterogeneous group members. In essence, jigsaw-type cooperative learning is the same as group work. With the learning that is almost the same as group work, teachers do not experience difficulties in cooperative learning because they assume that they are used to doing the same cooperative learning as group learning. Although in fact that not all group learning can be said to be cooperative learning as explained by Abdulhak (2001 : 19-20), "cooperative learning is conducted through sharing among the learning participants themselves".

This learning is able to form a wider interaction, namely social interaction and communication between teachers and students, students with students, and students with teachers. Cooperative learning is a

learning strategy that raises the interaction of students in groups to interact with each other. In a cooperative learning system, students learn to work together with their group

members. In this learning, students are given two responsibilities, learning for themselves and can help their fellow group members to understand the material.

B. Research Methodology

The research was conducted in the 5th grade of SDN Banjar 3 in Banjar District, Pandeglang Regency. This is done because the place of research is close to the researcher's resident, so it eases the researcher to conduct research. The subjects of this research were the 5th grade students of SDN Banjar, with a total of 20 students, consisting of 11 boys' students and 9 girls' students. The material that will be discussed is the operation of calculating fractions with the indicators of fractions addition with different denominators. Because the teaching material is in the even semester, so it doesn't interfere mathematics learning program.

As stated that the problems in this research arise from daily learning practices felt directly by teachers and students in the classroom, that the problem of operation learning of fractions addition and subtraction. Therefore, an effort is needed to improve and increase the quality of learning practices by applying the jigsaw-type cooperative learning. So to overcome the

problems faced is through the Classroom Action Research (CAR).

'Classroom Action Research (CAR) is research conducted by teachers in the classroom or at the school where they teach, with an emphasis on improving or increasing the practices and processes in learning' (Susilo, Herawati dkk,2009:16).

Besides the above definition, other opinions expressed experts' several views regarding the definition of Classroom Action Research (CAR). Suharsimi (2007), states that classroom action research is an activity of learning activities in the form of an action, which is intentionally raised and occurs in a class simultaneously. The action is given by the teacher or with the teacher's direction done by students. Suhardjono (2007) defines classroom action research as action research conducted in the classroom with the aim of improving/increasing the quality of learning practice. Rustam and Mundilarto (2004), 'defines classroom action research as research conducted by teachers in their own classrooms by designing, implementing, and

reflecting actions collaboratively and participatory with the aim to improve their performance as teachers, so the students' learning outcomes can be increased.

From some of these experts' definitions, it can be concluded that classroom action research is a form of reflective research by doing certain actions that help improve and increase learning in class well, so students obtained good learning outcomes. Therefore, classroom action research is also one of the reparative research, which means that research is conducted as an effort to improve the learning process so the students can achieve maximum learning outcomes. As to reviewing the success level in this research by applying the assessment system as proposed by IW Subagya (2016), learning outcomes Assessment is an activity of standardizing students' learning outcomes which are carried out through two main activities, namely assessment and evaluation activities. According to Deni Hardiana (2015), based on its function, assessment is often divided into two groups, namely formative and summative assessments.

The data collection instruments in this research were in the form of test and non-test tools as a means to obtain data in data collection activities, data processing, data

analysis, and data presentation. The instruments prepared in this research were tests, observations, and interview guidelines.

Student Worksheets are used when the learning process occurs. These student worksheets are given to each group or individual as a reference to whether they can complete the tasks assigned to them. In the research implementation, worksheets are compiled and prepared by researchers to be discussed or completed together in their study groups.

The test tools in the form of questions that must be answered by each student independently to measure whether the material presented has been mastered by them or not. The test questions have been formulated according to the indicators contained in the lesson plan.

Observation is a way to evaluate by observing the symptoms or characteristics of an event, situation, and certain objects directly, the data obtained are recorded in the observation sheets. Observation aims to obtain information or an overview of the activities of teachers and students during the learning process. The development of learning activities that become the attention in observations such as learning motivation, communication, collaboration, student's attention, individual learning activities,

student's responsibility, discipline, group learning activities, and teacher performance.

The data obtained in each cycle in this research were then be analyzed. This data analysis activity is intended to parse the data in each cycle and see whether there is an increase in students' learning outcomes on the addition and subtraction of fractions after conducting the jigsaw-type learning. The way to analyze students' learning outcomes is by assessing and comparing the test scores

of each student in each cycle. Analyzing data in the form of students' learning outcomes tests from each cycle aims to determine the success of the conducted research. Agree with Nasution's opinion (2018), which states that learning outcomes are the achievement of the students' learning process. In these learning results, can be seen the scores obtained by students during the learning process.

C. Result and Discussion

After analyzing the student's ability, which is conducted after each learning cycle in the first cycle and the second cycle, then

the test results obtained by students in each cycle are listed in Table 1 below:

Table 1. The List of Evaluation Scores

No.	Students' Attendance Number	Pre-Test	Cycle I	Cycle II
1	01	40	55	70
2	02	55	65	100
3	03	40	50	70
4	04	30	40	90
5	05	50	50	70
6	06	50	70	85
7	07	50	55	85
8	08	60	70	70

9	09	60	80	80
10	10	50	60	70
11	11	40	50	70
12	12	50	70	90
13	13	55	60	80
14	14	60	80	85
15	15	60	70	85
16	16	35	50	70
17	17	60	70	75
18	18	50	70	100
19	19	55	65	70
20	20	55	60	70
	Total	1010	1215	1500

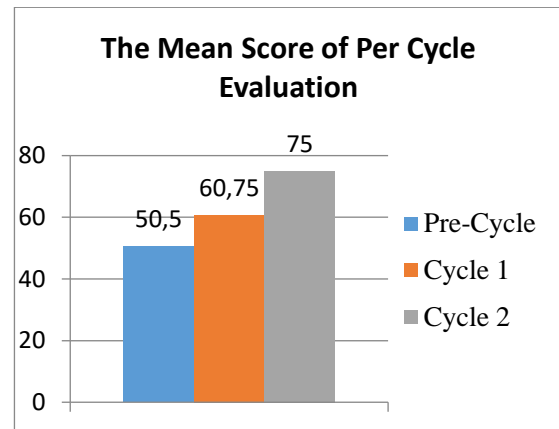
	Average	50,5	60,75	75
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Based on the data in table 1 above, the pre-cycle obtained an average score of 50.5, from 20 students who scored \leq the average were 9 students or 45%, and those who scored \geq the average were 5 students or 25%. There are 6 students scored above the minimum completeness criteria (MCC) or 30%. Thus, it can be concluded that students' ability in solving addition and subtraction problems is still very low.

From the data of table 1 above, in the first cycle can be concluded that there were 8 students (40%) who had passed, while the remaining 12 students (60%) had not passed. The average score of the first cycle is 60.75.

In the second cycle, the average score of the class reached 75 with a percentage of 100%. Based on the predetermined Minimum Completeness Criteria (CCM) of 55, then, 5th grade students are declared to have passed the learning. So, the application of jigsaw-type of cooperative learning can improve the learning outcomes in 5th grade mathematics of SDN Banjar 3. This is evidenced in the graph of the students' learning developments results with the

application of jigsaw-type cooperative learning in each cycle as follows:



Picture 1. The Average Score of The Class

The observation data on students' activities were analyzed after the learning was carried out and had been collected in

each cycle, then the results were obtained as shown in Table 2 below:

Table 2. The Observation of Students' Activity in Cycle I and II

No	Observations	Indicators	Score	
			Cycle I	Cycle II
1	Groups: - Member - Tasks distribution	a. Dividing the number of members	2	3
		b. Forming the small groups	2	3
		c. Determining different parts of the material	2	3
		d. Determine the assigned parts of the material	1	2
2	Discussion: Common Fraction - Fractions with the same denominator - Factions with different denominator	a. Performing the addition operation of common fractions with the same denominator	2	3
		b. Performing the addition operation of common fractions with the different denominator	1	2
		c. Performing the subtraction operation of common fractions with the same denominator	2	3
		d. Performing the subtraction operation of common fractions with the different denominator	1	2
3	Presentation: - Common fractions addition - Common fractions subtraction	a. Presenting the addition of the common fractions with the same denominator	2	3
		b. Presenting the addition of the common fractions with the different denominator	1	2
		c. Presenting the subtraction of the common fractions with the same denominator	2	3
		d. Presenting the subtraction of the common fractions with the different denominator	1	2
4	Conclusion	Concluding the fractional operations	2	3

The observations results of students' activities from the first cycle to the second cycle when applying jigsaw-type learning showed an improvement, where the students were more active in individual and group learning, students' learning enthusiasm was

higher, communication and collaboration were established from various directions.

This interview was conducted on all 5th grade students according to the interview guidelines. The interview results in each cycle are listed in the Table 3 below:

Tabel 3. Students' Interview in the Cycle I and II

No.	Questions	Cycle I	Cycle II
		Jawaban	Jawaban
1.	Do you like group learning using the jigsaw type?	Yes	Yes
2.	Can you solve the questions on the worksheets?	Yes	Yes

3.	What are the advantages of studying mathematics in groups?	Able to ask the group	Able to exchange ideas
4.	Do you have trouble studying in groups?	No	Yes
5.	Is there a difference of opinion with your teammates?	Yes	Yes
6.	Do you appreciate other people's opinions?	Yes	Yes
7.	Is there any message you want to express?	Yes, keep studying math	Yes, keep learning like this

Based on the results of the interviews conducted during the research in two cycles, in general, students liked the jigsaw type of cooperative learning in mathematics subject because this learning process tried to relate

the learning with students' everyday real-life. Besides that, the collaboration element contained in the jigsaw type of learning model makes students' activities and learning outcomes increased.

D. Conclusion

Based on the results of classroom action research of the jigsaw-type cooperative learning application to improve the students' learning outcomes in mathematics subjects on the teaching materials of addition and subtraction of fractions that have been carried out in 5th grade of SDN Banjar 3, the results can be concluded as follows:

Students' learning outcomes in mathematics subjects before using jigsaw-type cooperative learning in the teaching materials of addition and subtraction of fractions are still very low. This is evident from the results of the average student score of 51.75 is below the Minimum Completeness Criteria (MCC) of 55, because the learning activities are monotonous, in the sense that there is no variation in delivering

the subject matter. Students' enthusiasm, interest, and activity decreased due to difficulties in working and solving the worksheets.

With the application of jigsaw-type cooperative learning, students' activities in individual learning, group learning, learning enthusiasm, attention, collaboration, communication, and discipline, as overall have shown well as expected.

After implementing jigsaw-type cooperative learning in mathematics subjects, the students' learning outcomes showed an improvement. This is proven from the acquisition results of the first cycle average score is 60.75 and the average score in the second cycle reaches 75, above the Minimum Completeness Criteria (KKM) of

55. Thus, the 5th-grade students are declared to have passed in learning.

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