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Improving Mathematics Learning Outcomes of Fifth Grade Elementary School Students through the STAD Cooperative Model on Fractions

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ABSTRACT

This study aims to determine whether the Student Teams Achievement Division (STAD) cooperative learning model improves fifth-grade students' mathematics learning outcomes in adding fractions with different denominators. This study used a classroom action research (CAR) design conducted in two cycles, involving 19 students of SDN 03 Pulai Anak Air, Bukittinggi. Data were collected through learning achievement tests and structured observations of student activities. The results showed a measurable increase in student learning outcomes. The percentage of students achieving mastery increased from 60.87% in Cycle I to 78.26% in Cycle II, while the average score increased from 71.39 to 77.13. In addition, student learning activities showed an increase from 51.33% to 58.5% in both cycles. These findings indicate that the implementation of the STAD model positively contributes to both cognitive achievement and student engagement in mathematics learning.

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INTRODUCTION

Mathematics instruction in elementary schools should position students as active participants in the learning process. Active engagement through exploration, discussion, and collaboration is crucial for developing students' conceptual understanding. However, in practice, this ideal situation has not been fully achieved in many classrooms. (Yustisia Library Team, 2008). The learning process is still dominated by the teacher, with instruction delivered through one-way communication. According to (Mujiati, 2023) a teacher must be able to motivate students to learn, master classroom skills, and be creative, creating an engaging learning environment that engages students and fosters active interaction between students and teachers.

This approach limits students' opportunities to actively construct knowledge and results in low engagement during the learning process. As a result, students tend to be passive and rely heavily on teacher explanations rather than developing their own understanding. Based on field observations conducted in class V of SDN 03 Pulai Anak Air, Bukittinggi City, the results Study mathematics low students This is closely related to the dominance of lecture-based teaching and

minimally structured discussions. Learning activities are less interactive, and the use of learning media is still limited. Furthermore, student participation is low, as indicated by the small number of students actively asking questions or solving problems in front of the class, often by the same individuals (Rohman, 2025). In group activities, collaboration between students is suboptimal; students who do not understand the material tend to remain silent due to a lack of confidence or fear of negative responses from peers. This condition indicates that students are not actively involved. in the learning process (Nalole, 2004).

This issue highlights the need for a learning model that actively engages students, encourages collaboration, and improves learning activities and outcomes. One alternative approach is the implementation of a cooperative learning model that emphasizes student interaction and shared responsibility for learning (Lie, 2020). The implementation of learning that can increase student interaction and improve their understanding is very necessary, such as the cooperative learning model. According to Trianto (2007:41), "Cooperative learning encourages students to discover and understand difficult concepts, and students can discuss these problems with their friends." (Trianto, 2007) .

The advantages of cooperative learning according to Wina (2007:249-250) are as follows: 1) through cooperative learning students are not too dependent on teachers; 2) can develop students' ability to express ideas, ideas verbally and compare them with the ideas of other students; 3) can help students to respect other students; 4) is a strategy that can improve academic achievement and social skills; 5) can develop students' ability to test their own ideas and understanding, receive feedback; 6) can improve students' ability to use information and abstract learning skills to become real; 7) interaction during cooperative learning can increase motivation and provide stimulation for thinking (Sanjaya, 2008) .

Then Johnson and Johnson (in Masniladevi, 2003:8) stated that cooperative learning is very necessary, because with cooperative learning: 1) students can learn more; 2) students like the school environment more; 3) students like each other more; 4) students have higher self-esteem; 5) students learn social skills more actively (Masniladevi, 2003). From the explanation above, it is clear that cooperative learning can improve student achievement and understanding, and can improve leadership qualities, positive attitudes towards subject matter, and a sense of mutual respect and togetherness. One type of cooperative learning is Student Teams Achievement Division (STAD). Slavin (in Nur Asma, 2006:51) explains that in STAD cooperative learning, students are placed in study groups consisting of four or five students who are a mixture of various academic abilities, so that in each group there are students with high, medium, and low achievements or variations in gender, race and ethnic groups, or other social groups (Asma, 2006). The teacher delivers a lesson, and then students work in their teams to ensure that all team members have mastered the material. Then, all students are given a test on the material, during which they are not allowed to help each other.

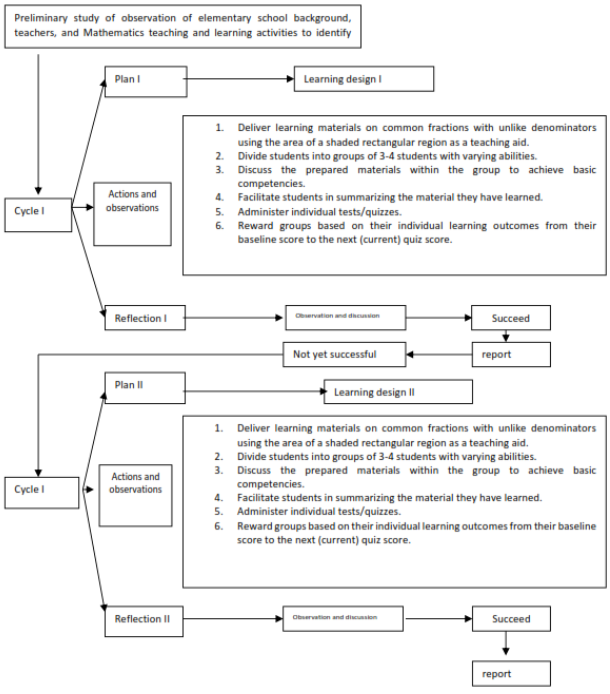
The STAD cooperative learning model was chosen because its assessment system differs from traditional group learning. Group grades are derived from individual progress and are shared equally. Individual success determines group progress, and vice versa. The best group receives

recognition (praise/prizes). Thus, all group members are expected to be more active and motivated in learning, which is expected to improve student understanding of the lesson and ultimately improve learning outcomes (Masyhudah & Widyasari, 2024).

METHOD

This study is a classroom action research (CAR) with a qualitative approach. This approach was chosen because the researcher will present data obtained naturally, starting from data before, during, and after the action. The action was carried out as an effort to improve mathematics learning outcomes using the STAD cooperative model for fifth-grade students at SDN 03 Pulai Anak Air. As stated by Bogdan and Biglen (in Martianty, 2004:32), the characteristics of a qualitative approach are: "1) natural setting, direct data sources, and the researcher acts as the main instrument; 2) descriptive; 3) data prioritizes the process rather than just the product; 4) data is analyzed inductively; and 5) the meaning of the qualitative approach is very important."

The steps taken are repetitive (cyclical) to achieve learning that can improve students' mathematics learning outcomes. This classroom action research uses the cycle model developed by Kemmis and Taggart. This cycle model has four components: planning, action, observation, and reflection. The action research process is a recyclable or cyclical process that is assessed by developing a plan, implementing the action according to the plan, observing the action, and reflecting on the planning, action activities, and the success of the results obtained. In accordance with general research principles, participation and collaboration between researchers and practitioners in the school system are essential. This research cycle can be seen in the following diagram:



Figur 1: Classroom Action Research Flow

The stages carried out in this research include 1) the planning stage; 2) the implementation stage; 3) the observation stage; and 4) the reflection stage. In the planning stage, the researcher and teacher create an action plan. This activity begins with formulating an action plan in the form of a learning implementation plan. In the implementation stage, the intended action is to carry out learning activities to help students improve their understanding of mathematical concepts using the STAD type of cooperative learning model. The learning activities are carried out by the researcher. The activities will end after the students who are the research subjects achieve the predetermined success criteria. The implementation stage of this research is divided into two cycles, namely: cycle I on adding fractions with different denominators using area, cycle II on adding fractions with different denominators using a number line (tape). The implementation of each action is carried out in accordance with the spiral cycle proposed by Kemis and Taggart (in Rochiati, 2005:66-67) which consists of four components, namely: 1) planning; 2) implementation; 3) observation and 4) reflection. The cycle in an action will repeat until the criteria set in each action are achieved. (Zainurie, 2007).

Meanwhile, the observation phase was conducted during the action activities. Observations were conducted by a fifth-grade mathematics teacher. The activities observed were the teacher and students' activities during the learning activities. Observations were conducted according to the observation sheet provided. The reflection phase was a series of activities carried out by the class teacher during the reflection phase. The researcher and the class teacher analyzed and reflected on the results of the actions in each cycle to determine whether the actions taken needed to be repeated. To complete the action criteria determined in the reflection, an assessment of the learning process was also conducted. The learning process was considered good if it achieved a score of 80%. If the action criteria had been achieved but the learning process had not reached 80%, the researcher proceeded to cycle II, but weaknesses found in cycle I were corrected in cycle II. If repetition was necessary, the researcher re-planned (revised) for the next cycle. And so on until students achieved a score of 80% or more.

The research data relates to matters related to planning and learning outcomes, including information on learning implementation, teacher and student behavior, and interactions between teaching and learning using the STAD cooperative learning model, as well as student learning abilities/outcomes (in the form of tests, observations, and questionnaires). The data sources for this study were 19 fifth-grade students at SDN 03 Pulai Anak Air who participated in STAD cooperative learning: 14 boys and 5 girls.

The main instrument in this study is the researcher himself, who acts as the planner and implementer of learning in the classroom. The researcher, as the main instrument, is responsible for collecting, assessing, concluding, and deciding the data used, including observation sheets of teacher and student activities in STAD cooperative learning to improve student learning outcomes, observation sheets of student cooperative skills, and questionnaires of student responses to teaching and learning activities. The data obtained in this study were analyzed using a qualitative data analysis model. The qualitative data analysis model is a data analysis that begins by reviewing from the time of data collection until all data is collected (Miles and Huberman (in Ritawati,

2006:78). The data is then reduced based on the problems that are carried out repeatedly at each stage of data collection in each action.

The analysis stages are as follows: reviewing the data collected through observation, recording, and selection. The data is then reduced through categorization and classification. All collected data is grouped and selected according to their respective focuses, then presented by compiling the reduced information into an integrated summary. Finally, conclusions are drawn from the research findings. Data analysis was performed on the reduced data, including planning, implementation, and evaluation data. Data analysis was conducted separately. This aimed to identify deficiencies and address them appropriately.

FINDINGS AND DISCUSSION

FINDINGS

This research is a classroom action research with a qualitative approach in mathematics subjects using the STAD type cooperative model for fifth-grade students of SD 03 Pulai Anak Air. The implementation of the action is divided into 2 cycles, each cycle consisting of 2 meetings. In the implementation of the learning action, the researcher acts as an observer while the educator acts as a practitioner educator. The learning stages of each action are adjusted to the learning stages of mathematics subjects using the STAD type cooperative model. Details of the research results in each cycle are as follows:

Improving Student Learning Activities in Cycle I and Cycle II

Observations were obtained using a student activity observation sheet. This sheet was used to track the process and development of activities occurring during the lesson. Observers' observations of student activity were visible throughout the lesson. This can be seen from the average percentage of student activity in Table 1 below:

Table 1. Comparison of Student Learning Activities in Cycle I and Cycle II

Indicator	Cycle I	Cycle II	Difference	Percentage Improvement
Average Value	68.5	82.3	+13.8	20.15%
Completion (%)	62%	88%	+26%	41.93%

The table above shows that all indicators consistently improved from cycle I to cycle II. The largest increase occurred in the learning completion aspect, which rose by 26%, indicating that most students had achieved the minimum completion criteria. Meanwhile, the average score also increased by 13.8 points, indicating an overall improvement in students' conceptual understanding. This confirms that the STAD cooperative learning model is capable of significantly improving learning outcomes.

Improving Student Learning Outcomes in Cycle I and Cycle II

Based on the results of the learning outcome tests in Cycles I and II, the percentage of students who completed the end-of-cycle tests and their average test scores can be seen in Table 2 below:

Table 2. Average and Percentage of Students' Science Learning Outcomes in Cycles I and II

Cycle	Graduate Students	Students Who Have Not Completed Their Studies	Average
I	60.87%	39.13%	71.39%
II	78.26%	21.74%	77.13%

From the data analysis above, it can be seen that 60.87% of students completed the final exam in cycle I, while 78.26% completed the final exam in cycle II. This indicates an increase in student learning outcomes in mathematics learning using the STAD cooperative model.

DISCUSSION

Observations made by observers of teacher and student activities in Cycles I and II showed good progress. Students were able to answer teacher questions and had acquired prerequisite knowledge about adding fractions with unlike denominators. Students were grouped into several groups based on academic ability and gender.

In addition, students' understanding of the assigned worksheets (LKS) was quite good. They experienced some difficulties due to their unfamiliarity with the worksheets and teaching aids. When completing assignments, students focused more on asking questions to their group members, and if they could not answer, they consulted the teacher. This situation is in line with the principles of cooperative learning, which requires students to ask questions or discuss problems with their group members before asking the researcher (Kusuma & Aisyah, 2012; Yuliasari, 2020). Students' collaboration skills were also good, but motivating peers to share their opinions/ideas still needs improvement. Students performed well on individual quizzes, and at the end of the lesson, with teacher guidance, they were able to summarize the lesson, particularly on the steps for adding fractions with unlike denominators. (Solihatin, 2005) .

Based on observations of student skills in STAD cooperative learning, it is known that students' cooperative skills develop when they collaborate with their group members. This can be seen from students' willingness to remain in their groups by actively engaging in group assignments and continuing tasks that are their responsibility, sharing tasks in completing tasks that are their group's responsibility, being willing to accept assignments and giving trust to friends in completing group assignments, and showing an attitude of respect and valuing friends' opinions and developing questioning skills. According to the results of observations, skills that often appear are in assignments, and active listening. While other cooperative skills such as asking friends or

teachers still appear less, this may be because students are not used to working in cooperative groups and this can be input for making improvements in the next STAD type of cooperative learning (Ertanti et al., 2025) .

Collaboration within groups regardless of gender and academic ability. Although students initially disagreed with the combination of male and female students into groups, student cooperation within the groups developed well. This was driven by each individual's responsibility in understanding the results of their group work. High-ability students helped low-ability students understand their group work (Aprilia, 2024). Low-ability students preferred to ask their group mates questions rather than the researcher, because they felt their friends' explanations were easier to understand than the researcher's. This is in line with Ibrahim's opinion in (Masniladevi, 2003: 119) that in cooperative learning, students will learn more from their peers than from the teacher (Masniladevi, 2003).

The improvement in students' mathematics learning outcomes after implementing the STAD model indicates that this approach is effective in helping them understand concepts more deeply. Cognitively, this can be explained through Piaget's developmental theory, which states that elementary school students are in the concrete operational stage (Rahmaniar dkk., 2022; Syafawani & Safari, 2024). The STAD model, which emphasizes group activities and the use of worksheets (LKS), is well suited to the characteristics of this stage, as it allows students to learn through direct experience and social interaction. (Nalole, 2004).

Furthermore, the group reward system in STAD also plays a role in increasing student learning motivation. This aligns with learning motivation theory, which states that external rewards can strengthen student engagement in the learning process. Therefore, the improvement in learning outcomes in this study was not solely due to the learning method, but also to a combination of social interaction, motivation, and learning strategies appropriate to the students' developmental stage.

CONCLUSION

From the data analysis and discussion that has been explained, it can be concluded as follows: First, the application of STAD type cooperative learning in Mathematics learning in class V SDN 03 Pulai Anak Air can increase student learning activities, namely in cycle I by 51.33% with a less category, while in cycle II the average student learning activity increased to 58.5% with a good category based on the criteria of each student's activities. Second, student learning outcomes in Mathematics learning in class V SDN 03 Pulai Anak Air also increased, namely in cycle I an average of 60.87% (less) and in cycle II by 78.26%.

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