Optimization Of Cooperative Learning Model Number Heads Together To Improve Understanding Of Mathematical Sentence Concepts In Grade IV Elementary School Students

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Abstract: This study uses the Classroom Action Research (CAR) method, which is designed to improve the learning outcomes of fourth-grade students by optimizing cooperative learning using the Number Heads Together (NHT) model in mathematics. The study was conducted in two cycles, where each cycle involved the stages of CAR according to Kemmis and McTaggart, namely planning, implementation, observation, and reflection. This study aims to improve the learning outcomes of fourth-grade students in mathematical sentences and calculations through optimizing Cooperative Learning, especially the Number Heads Together model. Data were collected through observation, documentation, interviews, and tests. The results showed that the application of the Number Heads Together model succeeded in significantly improving student learning outcomes from 58.33% in cycle I and achieving a classical learning completion percentage of 83.33% in cycle II. These results confirm that cooperative learning using the Number Heads Together model has great potential in improving the learning outcomes of fourth-grade students in mathematics. This study is expected to produce innovative contributions in improving the quality of mathematics learning, creating an interactive, collaborative, and effective learning environment.

Keywords: *Cooperative Learning*, *Number Heads Together*, Mathematics Learning, *Classroom Action Research*

PRELIMINARY

Education plays a fundamental role in determining the future of individuals and the progress of a nation. The flow of globalization marked by intense competition makes improving the quality of human resources through education an increasingly urgent need. Basic education is considered one of the main foundations in human resource development, because at this stage students begin to gain a strong foundation for academic abilities and basic skills (Stofkova & Sukalova, 2020). This is in line with research by (Siregar et al., 2024) which emphasizes the importance of education in

forming intelligent human resources in the digital era towards Smart Society 5.0. This study shows that education must focus on developing digital skills and competencies that are relevant to the needs of modern society, so that it can improve the quality of life.

Mathematics learning has a very vital role in this regard. In addition to teaching numeracy skills, mathematics also trains critical, logical, and creative thinking skills. However, amid the complexity of mathematical material, there are challenges faced by teachers and students, especially in understanding the concept of mathematical sentences and calculations. This study highlights the conceptual understanding of grade IV students at one of the Elementary Schools in South Sumatra Province, namely SD Negeri 01 Pemulutan, which is less than optimal, especially in the material of mathematical sentences and calculations. The evaluation shows that conceptual understanding is still not optimal, and the average daily value has not met the Learning Objective Achievement Criteria (KKTP) as shown in the following table.:

Tabel 1. Pre-Cycle Student Evaluation Results

Description	Mark Pre Cycle
Average	58.33
The highest score	90
Complete KKM	7
Incompleted KKM	17
Percentage KKM	29.17%

Based on the results of the daily evaluation, it can be seen that students' conceptual understanding is still not optimal. This is reflected in the average daily pre-cycle score which only reached 58.33, with the highest score of 90. A total of 7 students managed to achieve the Minimum Completion Criteria (KKM), while 17 other students had not yet achieved it. The percentage of students who completed the KKM only reached 29.17%, which shows that the majority of students need a more effective learning model to support their understanding of the material. These results indicate that the learning model currently used is not fully in accordance with students' needs in understanding the concepts taught. In addition, based on the results of observations conducted by researchers at SD Negeri 01 Pemulutan, it was found that the application of learning models in the learning process was still very minimal. The majority of teachers tend to use conventional learning models, such as lecture methods and one-way assignments. This approach does not provide sufficient opportunities for students to actively participate

in learning, thus creating a monotonous learning atmosphere. As a result, students often experience decreased concentration in learning and feel bored. This shows that the learning strategies applied are not varied enough and have not been fully adapted to the developmental needs of students, especially those at the concrete operational stage. At this stage, children need learning that involves direct experience, social interaction, and activities that stimulate thinking skills and cooperation. Therefore, innovation is needed in learning strategies that can overcome these challenges in order to fully support the achievement of learning objectives.

This study proposes the optimization of the Cooperative Learning model, especially the Number Heads Together (NHT) model, as an effort to improve student learning outcomes. Optimizing learning through selecting an appropriate learning model is considered the key to improving student learning outcomes. Cooperative Learning is a learning model that emphasizes collaboration and interaction between students, while the Number Heads Together model as one type of Cooperative Learning model accommodates opportunities for students to work together in completing mathematics assignments, with the aim of increasing student interaction and understanding of the subject matter.

According to Warsono & Hariyanto (2020), cooperative learning is a learning model in which a small group of students work together interactively to achieve predetermined learning goals, and help each other in the learning process. Riyanto (2019) added that cooperative learning is a learning model designed to teach academic skills, social skills, and interpersonal skills. The cooperative learning model emphasizes collaboration between students, so that they do not only achieve success individually or compete with each other. On the contrary, they can provide assistance to their study friends who have abilities that are still below the minimum standard. Therefore, this cooperative learning can develop a social spirit in students during the learning process.

Moreover, the NHT (Number Heads Together) model is a model where students have a very dominant role in the learning process, and encourages cooperation in groups. The characteristic of this model is the numbering, so that each student tries to understand all the material taught and is responsible for the number owned by each group member (Lidyawati & Zainuddin, 2024). Therefore, indirectly, this learning model encourages and trains students to share information, listen carefully, and convey information with careful

consideration. thus helping to increase student productivity and involvement in the learning process. Several previous studies have indicated that the application of the Cooperative Learning learning model, especially the Number Heads Together (NHT) model, can improve student learning outcomes in various mathematics learning contexts. Research by F.M. Rohmanurmeta (2020) shows that the use of the Number Heads Together model attracts students' interest in the learning process compared to conventional models. Classes that implement the Number Heads Together model show an increase in average scores and more effective teaching and learning interactions compared to classes that learn through conventional models. Through this model, students are active and focused in learning and increase their level of confidence in answering questions. Students' interest in learning also increases, which is reflected in their active participation in the teaching and learning process and their ease in understanding the subject matter.

This research is supported by research by R. M. Suwito (2020) with research results showing that the use of the Number Heads Together learning model is effective in improving the learning achievement of grade III students of SD YPS Singkole in Mathematics learning on the Perimeter of Flat Shapes. Through the steps implemented in each cycle, there was an overall increase in both the level of student activity and the learning outcomes obtained. Therefore, the main objective of this study is to improve the conceptual understanding of grade IV A students of SD 01 Pemulutan on the material of mathematical sentences and calculations through the optimization of Cooperative Learning, especially the NHT model. This study is expected to produce innovative contributions in improving the quality of mathematics learning and learning outcomes of grade IV students of SD Negeri 01 Pemulutan, especially on the material of mathematical sentences and calculations, thus creating a more interactive, collaborative, and effective learning environment for students in understanding mathematics learning.

METHOD

This study adapts the Classroom Action Research (CAR) method and is designed to improve the learning outcomes of fourth grade students through optimizing cooperative learning using the Number Heads Together (NHT) model in mathematics learning. The study was conducted for two cycles, namely on October 24, 2024 and October 31, 2024,

where each cycle consists of the stages of the Classroom Action Research cycle by Kemmis and Mc Taggart which begins with planning, then continues with implementation, observation, and reflection.

The subjects in this study were grade IV A students at SD Negeri 01 Pemulutan, with a total of 24 students divided into categories of low, medium, and high learning abilities. Data were collected through interviews, observations and documentation during the implementation of learning. The research instruments used included formative tests to measure and evaluate student learning outcomes, observation sheets to record student activities during learning, and interviews to obtain additional information from teachers and students.

The research procedure involved identifying problems in mathematics learning, planning learning activities based on the Number Heads Together model, developing teaching modules and learning media, and compiling assessment instruments. Furthermore, the action was carried out according to plan with a time allocation of 2x35 minutes at each meeting. Observations were carried out actively by researchers to record student development and interactions during the learning process. Student learning outcome data was analyzed quantitatively by calculating students' final learning scores, class average scores, and percentage of classical learning completion. Meanwhile, qualitative data was analyzed by observing student learning activities using an observation rubric that included student enthusiasm, questioning skills, collaboration skills, and the ability to follow up on the knowledge gained. The results of quantitative and qualitative data analysis were used to evaluate the success of the action and plan improvement steps for the next cycle.

The following is a description of the criteria for success of the actions in this research:

(1) Student activities towards the implementation of cooperative learning with the Number Head Together model and Flashcard Counting media to improve student learning outcomes on mathematical sentence and calculation materials are at least categorized as good.

(2) The learning outcomes of class IV B students at SDN 01 Pemulutan are at least categorized as good to show an increase in student learning outcomes on mathematical sentence and calculation materials.

Tabel 2. Action Success Criteria

Level of Success	Qualification	Success Rate
90 % - 100 %	Sangat Baik	Berhasil
80 % - 89 %	Baik	Berhasil
60 % - 79 %	Cukup	Tidak Berhasil
41 % - 59 %	Kurang	Tidak Berhasil
0 % - 40 %	Sangat Kurang	Tidak Berhasil

(Source: Researcher's Process)

If the implementation of cycle I has met the criteria for minimal Action success in the good category, then the research is complete. However, if cycle 1 has not met the criteria for minimal success in the good category, then the research needs to be continued in the next cycle. The percentage of classical learning completion can be calculated if the number of students who have achieved KKTP is known. The results are then compared with the criteria for student learning completion which are divided into two categories, namely: complete and incomplete. The criteria are described as follows:

Tabel 3. Learning Completion Criteria

Completion Criteria	Qualification
≥ 70	Completed
< 70	Not Completed

(Source: KKTP SDN 01 Pemulutan)

The determination of the results of the level of success in completing classical learning can be read in the following table:

Tabel 4. Student Learning Success Rate

No	Percentage	Category
1	> 80 %	Very high
2	60 – 79 %	High
3	40 – 59 %	Medium
4	20 – 39 %	Low
5	< 20 %	Very Low

(Source: Researcher's Process)

If 75% of all students who follow the learning process achieve a minimum success rate of the high category, then the next learning can be continued to cycle II. This research is expected to produce contributions in improving the understanding and learning outcomes of grade IV students through optimizing the NHT cooperative learning model. The research method used can be a guide for teachers in designing and developing effective learning that is oriented towards improving student learning outcomes.

RESULTS

Based on the implementation of the action during 2 cycles consisting of 2 meetings, the data obtained showed a significant increase in the level of student learning activity. This increase can be attributed to the implementation of cooperative learning type Number Heads Together. Data from observations showed consistent changes in student participation during the learning process. The results of observations on the optimization of cooperative learning model Number Heads Together are described in the following table:

Tabel 5. **Comparison of Observation Results of Student Learning Activity in Cooperative Learning Number Heads Together Type Cycle I and II**

Cycle I	Cycle II
68.75%	85.4%
Enough	Very good

Tabel 4 shows a significant increase in the percentage of student learning activity when implementing cooperative learning model Number Heads Together from cycle I to cycle II. Initially, the percentage of student learning activity in cycle I was recorded at 68.75% in sufficient qualification, but increased significantly to 85.4% in very good qualification in cycle II. This shows an increase of 16.65% in student learning activity from cycle I to cycle II. Student learning outcomes are obtained based on formative test scores at the end of each cycle I and II in cooperative learning model Number Heads Together to improve learning outcomes of class IV A students of SDN 01 Pemulutan. The formative test consists of 5 evaluation questions that have their own assessment indicators and qualifications, namely: (1) students interpret story problems containing addition and subtraction in the form of mathematical sentences; (2) students determine unknown values in a mathematical sentence related to addition or subtraction operations. A comparison of student learning outcomes can be seen in the following table:

Tabel 6. Student Evaluation Results Pre-Cycle, Cycle I and Cycle II

Information	Mark		
	Pre Cycle	Cycle I	Cycle II
Average	58.33	68.12	80.42
The highest score	90	90	100
Completed KKM	7	14	20
Not Completed KKM	17	10	4
Percentage of KKM	29.17%	58.33%	83.33%

Based on the table above, the results of student learning in the form of an average in cycle I were 68.12 in the sufficient category and still had not reached the expected target. The score for each question item was determined based on the correctness or incorrectness of the calculation and the final answer of the student. Some students in class IV A were able to examine a story problem and interpret it, but some still often made mistakes in doing their calculations so that their final answers were wrong. Some students were also sometimes still confused about the use of arithmetic marks, so they needed further guidance and direction from the teacher.

Most students also often asked about how to complete the existing arithmetic operations, only a few students could do it correctly and independently. In addition, errors in the use of brackets in mathematical sentences were also often experienced by students. KKTP or Learning Objective Completion Criteria for Mathematics subjects is 70, so students must get at least a score of 70 to achieve the completion criteria in this assessment. Based on the test conducted at the end of cycle I, there were only 14 students who got a score of ≥ 70 or were declared complete with a percentage of 58.33% of the total students. Meanwhile, students whose scores have not reached 70 or are declared incomplete are 10 students with a percentage of 31.66%. Students who have not completed are mostly caused by errors in the arithmetic operations carried out or the final answers of students. Overall, cycle I still has shortcomings and needs to be fixed in order to achieve the desired results. Therefore, it is necessary to repeat the cycle and take action to improve and enhance the learning outcomes.

DISCUSSION

The average student learning outcomes when repeating cycle or cycle II is 80.42 with good qualifications and has achieved the expected learning target. Students in class IV A have on average been able to demonstrate satisfactory abilities in analyzing story problems and doing arithmetic operations accurately, indicating that there has been a significant increase from the previous cycle. The ability of students in class IV A in working on questions interpreting story problems in the form of mathematical sentences has also developed well and there are no difficulties in doing calculations as in the previous cycle. In addition, students have also mastered the use of brackets correctly in the context of mathematical sentences.

Based on the test results at the end of cycle II, students who scored ≥ 70 were 20 students or 83.33% of the total. Meanwhile, students whose scores had not reached 70 or were declared incomplete were only 4 students with a percentage of 16.67%. Thus, repeating cycle or cycle III does not need to be held because the results of cycle II are optimal and have achieved the set target. The improvement in the process and student learning outcomes can be seen in the diagram below:

Picture1. Diagram of Improvement of Learning Outcomes of Grade IV Students

Based on Figure 1, it can be seen that there is a significant increase in the learning outcomes of class IV A students of SDN 01 Pemulutan when studying the material on mathematical sentences and calculations. These results indicate that the application of the Number Heads Together Cooperative Learning model has succeeded in optimally improving the learning outcomes of class IV A students of SDN 01 Pemulutan, especially in the material on mathematical sentences and calculations.

In cycle I, although there was an increase from before, student learning outcomes still did not achieve the set target. This is indicated by the percentage of student learning outcomes of 68.12%, which is still categorized as sufficient. However, through the final evaluation in cycle II, there was a striking increase, with student learning outcomes reaching 83.33%. This shows that the Number Heads Together cooperative learning model is able to provide a substantial positive influence on improving student learning outcomes.

The logical interpretation of this finding is in line with the opinion of Faiz, et al. (2022), who emphasized the importance of evaluation in assessing the progress of

educational outcomes. The success of an educational program can be assessed from the extent to which the results are in accordance with national education goals, both in the form of achievements and attitudes produced. With the increase in student learning outcomes in cycle II, it can be interpreted that the learning model used has succeeded in optimizing the learning process and improving students' cognition of the subject matter.

In addition, the success of this learning is also in line with the theory of learning motivation, as proposed by Elvira, et al. (2022), which states that learning motivation has a positive impact on student learning outcomes. In this context, active student participation in cooperative learning using the Number Heads Together model shows high motivation to achieve learning goals. However, there are several challenges faced during the implementation of learning. For example, in cycle I, there were still obstacles related to the lack of student discipline in implementing the cooperative learning model. However, with corrective measures and strict enforcement of rules, as proposed by Siahaan, et al. (2022), this situation was successfully overcome in cycle II.

As a follow-up step, it is necessary to conduct periodic monitoring and evaluation of the implementation of this learning model. Teachers need to continue to develop skills in managing classes and facilitating learning activities so that they remain conducive and effective. In addition, further research can be conducted to explore the influence of other additional factors that may affect student learning outcomes, such as learning motivation and support for the learning environment at home. Learning is a process. This statement is in line with Cronbach's opinion in (Nugroho, 2023), namely "The process of learning manifests through observable alterations in behavior consequent to experiential encounters". The learning process can be said to be going well if students experience an increase in the knowledge they gain and successfully complete the learning series. In addition, they are also able to feel the positive impact of these learning efforts on themselves.

The results show that cooperative learning with the Number Heads Together model has proven effective in optimally improving the learning outcomes of fourth grade students. The challenges faced during implementation can be overcome through appropriate corrective steps, so that learning can run more effectively and optimally. The results of this study can be the basis for developing more innovative learning strategies in the future.

CONCLUSION

Based on the data description and discussion results, it can be concluded that cooperative learning model Number Heads Together can effectively improve the learning outcomes of class IV A students in the material of mathematical sentences and calculations. This is evidenced by a significant increase in values from cycle I to cycle II, where cycle II shows results with a good category and achieves the expected learning targets. This confirms that the combination of optimizing interactive learning models and utilizing appropriate learning media can make a major contribution to improving the quality of learning and students' academic achievement.

The results obtained in this study consistently support the conclusion that the use of the Number Heads Together model is effective in improving students' understanding and skills in the material of mathematical sentences and calculations optimally. These results are consistent with the findings of previous studies, which indicate that cooperative learning model Number Heads Together with innovative learning media can improve student learning outcomes. However, it is important to note that there are still challenges that need to be overcome in the implementation of this learning. In this case, further attention is needed to student discipline in implementing learning models and effective group management so that the classroom atmosphere remains conducive. In addition, further development of learning media and enrichment of evaluation methods can also be important steps to improve and enhance the quality of learning in the future.

Based on the results of this study, several suggestions can be proposed for educators, students, and further researchers. For educators, it is advisable to consider the application of learning models and utilize innovative learning media in designing learning plans. Meanwhile, for students, it is important to be actively involved in the learning process and practice numeracy skills regularly at home. Finally, for further researchers, this study can be a starting point for further exploration in the development of innovative learning models and learning media in the context of mathematics learning. Thus, it can be concluded that cooperative learning model Number Head Together has significant potential in improving the learning outcomes of grade IV students. Through continuous efforts to improve the quality of learning, it is hoped that a conducive learning environment can be created and have a significant positive impact on students' academic achievement.

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