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EFFECTIVENESS OF THE STAD COOPERATIVE LEARNING MODEL IN ENHANCING LITERACY AND NUMERACY SKILLS AMONG FIFTH-GRADE STUDENTS

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Abstract

This study addresses the critical issue of low literacy and numeracy skills among elementary school students, as highlighted by national and international assessments. To bridge this gap, the research aims to evaluate the effectiveness of the Student Teams Achievement Division (STAD) cooperative learning model in improving literacy and numeracy skills. The study employed a Classroom Action Research (CAR) design, conducted in two cycles with 20 fifth-grade students from SD Negeri 7 Palembang as participants. Instruments included lesson plans, observation sheets, literacy-numeracy tests, and field notes. Data were collected through observations and tests and analyzed using descriptive quantitative and qualitative methods. The findings indicate significant improvement in literacy and numeracy skills, with 90% of students categorized as "Good" or "Very Good" in Cycle II, compared to 70% in Cycle I. Student engagement also increased from 55% in Cycle I to 75% in Cycle II. The study demonstrates the potential of the STAD model to create collaborative learning environments that foster critical thinking, problem-solving, and active participation. This research contributes to the theoretical framework of cooperative learning and offers practical implications for enhancing foundational competencies in alignment with the Kurikulum Merdeka and Sustainable Development Goals (SDGs).

Keywords: cooperative learning; literacy; numeracy; STAD model; student engagement

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Introduction

Literacy and numeracy skills have become critical issues in global education. The Programme for International Student Assessment (PISA) report highlights that many students worldwide, including those in Indonesia, perform below the international average in these foundational competencies (OECD, 2019). Nationally, the Minimum Competency Assessment (AKM), implemented by Indonesia's Ministry of Education, Culture, Research, and Technology in 2021, also underscores the low literacy and numeracy skills of elementary school students. These findings reflect significant challenges within the education system in improving basic competencies effectively (Kemdikbud, 2021).

To address these challenges, this study examines innovative teaching strategies, particularly the Student Teams Achievement Division (STAD) cooperative learning model, which has shown potential to improve learning outcomes. STAD emphasizes small-group collaboration, fostering both social interaction and academic achievement. As Slavin (2015) argues, cooperative learning models like STAD are effective in motivating students, enhancing their critical thinking skills, and reinforcing conceptual understanding through peer interaction. This aligns with findings from Caridah et al. (2024), who highlight that integrating innovative teaching methods improves not only academic outcomes but also critical thinking and problem-solving skills—key components of global educational goals outlined in the Sustainable Development Goals (SDGs).

Aligned with the findings of Caridah et al. (2024), integrating literacy and numeracy through innovative teaching strategies is not only relevant to achieving national education objectives but also consistent with the Sustainable Development Goals (SDGs), particularly SDG 4. This study emphasizes that strategies such as cooperative learning can enhance literacy and numeracy skills, which include analyzing data, logical reasoning, and solving complex problems—skills that are essential in 21st-century education. This approach has also proven effective in addressing gaps in literacy and numeracy skills across diverse educational contexts globally, as outlined by Larsen et al. (2019) and Misunas et al. (2024), who emphasize the importance of collaborative approaches in improving holistic educational quality.

However, significant gaps remain in understanding how STAD can be utilized to improve literacy and numeracy specifically, as most existing research focuses solely on academic outcomes without exploring its impact on these foundational skills (Caridah et al., 2024). Research shows that effective literacy and numeracy teaching strategies must align with SDG 4, which aims for inclusive and quality education for all (ISET, 2024). Innovative approaches, such as the integration of STAD with literacy-numeracy indicators, can address this gap. Additionally, using reflective cycles in this study enables the refinement of strategies to address specific challenges faced by students.

Moreover, this study offers theoretical contributions by exploring the relationship between literacy, numeracy, and group work within the context of mathematics instruction. As Zaelani et al. (2023) suggest, collaboration within heterogeneous groups facilitated by the STAD model allows students to share knowledge and support one another, thereby accelerating the understanding of fundamental concepts. This study aims to address the challenges identified by Kemdikbud (2021), namely how to create a learning approach that not only focuses on

improving test scores but also builds critical thinking skills that can be applied in real-life situations. By integrating literacy and numeracy indicators into the STAD model, this study provides a strategic solution for enhancing learning effectiveness while supporting the sustainable development of students' foundational skills.

This approach aligns with Vygotsky's social learning theory, which emphasizes the role of social interaction in learning. Within the STAD framework, group-based interaction supports students in developing critical literacy and numeracy skills by engaging them in active discussions, problem-solving, and cooperative learning tasks. As Caridah et al. (2024) state, integrating collaborative and interdisciplinary teaching strategies is essential for achieving advanced competencies, such as critical thinking and reasoning, in addition to foundational skills. These findings highlight the importance of holistic and innovative strategies for addressing literacy and numeracy challenges within diverse educational contexts.

This research aims to improve the literacy and numeracy skills of fifth-grade students through the implementation of the STAD cooperative learning model. By integrating literacy and numeracy into mathematics learning, the study seeks to bridge theoretical insights and practical applications. The findings will provide significant contributions to the field of education by offering a model that aligns with Indonesia's Merdeka Curriculum and supports students in achieving 21st-century learning goals.

Methods

This study employed a Classroom Action Research design. Generally, Classroom Action Research is defined as a type of research that focuses on implementing concrete steps to improve the quality of learning or solve problems faced by the research subjects. It involves observing the effectiveness or impact of these actions, followed by adjustments to refine and optimize outcomes (Fadhilaturrahmi, 2019). Classroom Action Research is particularly suited for addressing challenges that arise during the teaching and learning process, with the primary goal of improving and enhancing the classroom experience (Marta, 2019).

The research was conducted at SD Negeri 7 Palembang, focusing on fifth-grade students. The study involved 20 participants, comprising 12 female and 8 male students, selected purposively to meet the research objectives. The research was carried out in two cycles, with each cycle consisting of four stages: planning, implementation, observation, and reflection, as suggested by Mulyasa (2020). Each cycle included three meetings, with each meeting lasting 2 x 35 minutes. The research continued until a significant improvement in students' literacy and numeracy skills was observed.

Stages of Classroom Action Research

1. Planning Stage

The planning stage began with identifying students' literacy and numeracy skill levels through initial observations. These observations revealed that many students had difficulties comprehending reading texts and applying numeracy concepts. Based on these findings, the teacher developed an action plan, including preparing lesson plans (RPP), selecting teaching materials, and creating observation sheets and evaluation tests. The selected teaching materials

included contextual texts, simple story problems, and tasks that integrated literacy and numeracy skills. Additionally, group activities and individual assignments were designed to align with the cooperative learning model, emphasizing collaboration and peer support.

2. Implementation Stage

During the implementation stage, the Student Teams Achievement Division (STAD) cooperative learning model was applied. Students were divided into heterogeneous teams of 4–5 members and worked collaboratively to complete group tasks while preparing for individual quizzes. The teacher introduced literacy-based texts containing numeracy elements, such as problem-solving stories and contextual articles. Activities included group discussions, turn-taking reading, and summarizing, which aimed to enhance literacy skills while fostering teamwork. Students also completed numeracy exercises, such as basic arithmetic operations and interpreting data from charts. For students requiring additional assistance, the teacher provided tailored guidance and encouragement to ensure their active participation.

3. Observation Stage

During this stage, the teacher observed student engagement, participation, and behavior throughout the learning process. The observation focused on four key areas: visual, verbal, written, and listening activities. Observation sheets were used to document students' responses, levels of participation, and their ability to engage with both literacy and numeracy tasks. Additionally, test data were collected at the end of each cycle to evaluate the students' skill improvements. Field notes were also maintained to capture qualitative insights into the learning process.

4. Reflection Stage

In the reflection stage, the teacher analyzed the results of the implementation phase, focusing on both observation and test data. The effectiveness of the STAD model in improving literacy and numeracy skills was assessed. If significant improvement was observed, the action was deemed successful. However, if the results were unsatisfactory, adjustments were made for the next cycle. These adjustments could include modifying the teaching methods, selecting more appropriate materials, or providing more intensive guidance for students. This iterative process ensured continuous improvement in teaching strategies and student outcomes.

Data Collection Techniques

The data in this study were collected using several techniques, including tests, observations, and field notes. Literacy and numeracy tests were conducted before and after each cycle to measure students' improvements. Literacy tests assessed students' comprehension of texts, while numeracy tests focused on math problems embedded within the texts. Observations recorded students' engagement and behavior during the learning process, documenting their ability to collaborate and actively participate in group activities. Field notes provided additional qualitative data to complement the quantitative findings.

Data Analysis Techniques

The data analysis was conducted using both quantitative and qualitative methods. Quantitative data, derived from literacy and numeracy test results, were analyzed descriptively by

calculating average scores, success percentages, and improvements in students' scores from Cycle I to Cycle II. The percentage of student mastery was calculated using the following formula:

$$\text{Percentage of Mastery} = \left(\frac{\text{Number of Students Who Mastered the Material}}{\text{Total Number of Students}}\right) \times 100\%$$

Students were categorized based on their scores, with the categories ranging from "Very Good" to "Needs Guidance." The research was considered successful if all students achieved at least the "Good" category (scores of 75–84) or above.

Table 1. Student Mastery Level Categories Based on Score Range

Score Range	*Category*	*Mastery Status*
85–100	Very Good	Completed
75–84	Good	Completed
65–74	Satisfactory	Not Completed
< 64	Needs Guidance	Not Completed

Qualitative data, obtained from observations and field notes, were analyzed using content analysis techniques. Patterns in student behavior, their responses to the teaching approach, and challenges encountered during the process were identified. These qualitative insights were used to adjust and refine teaching strategies for the subsequent cycle, ensuring a more effective implementation of the STAD model.

Results

This classroom action research was conducted in two cycles to improve the literacy and numeracy skills of fifth-grade students at SD Negeri 7 Palembang by implementing the STAD cooperative learning model. Each cycle consisted of two meetings, with each meeting lasting two lesson hours (2 x 35 minutes). The research process included the stages of planning, implementation, observation, and reflection. The results of each cycle are summarized as follows.

Cycle 1

In Cycle I, actions were taken to identify the students' initial literacy and numeracy abilities. The teacher designed learning activities based on the STAD model, including study groups, teaching materials on the perimeter of geometric shapes, and evaluation tools such as observation sheets and formative tests.

a) Planning
   Before the research was conducted, the researcher prepared instructional materials based on the STAD Cooperative Learning model. The topic covered in Cycle I was the *Perimeter of Geometric Shapes*. The researcher prepared a teaching module, Student Worksheets (LKPD), and evaluation tools for this cycle.
b) Implementation of Actions
   Cycle I consisted of three meetings. During this phase, students learned using the STAD Cooperative Learning model, as planned in the lesson plans. The topic for this cycle focused

on the *Perimeter of Geometric Shapes*.

- Phase 1: The learning session began with an initial activity where the teacher explained the learning objectives to be achieved during the lesson and motivated students by providing real-life examples related to the perimeter of geometric shapes.
- Phase 2: The teacher delivered information to the students by demonstrating the material and using an educational video prepared by the researcher.
- Phase 3: Students were organized into study groups. The teacher explained how to form study groups and assisted each group in transitioning efficiently. Each group consisted of five students.
- Phase 4: While students worked in their groups, the teacher walked around to guide and assist the groups as they completed their tasks.

This structured approach ensured active student participation, with each phase designed to build their understanding of the topic through collaboration and guided learning activities.

Figure 1. Students watching a learning video (left) & Teacher guiding groups in working and learning (right)

Next, in Phase 5 of the STAD learning model, the stage is Evaluation, where the teacher evaluates the learning outcomes of the material that has been taught, or each group presents their work results. The final phase of the STAD model is Group Rewards. The teacher finds ways to appreciate both the effort and the learning outcomes of individuals and groups. In Cycle I, the teacher provided rewards by ranking the groups and giving recognition in the form of "Great Kid" star illustrations.

Figure 2. Group Presentation (left) & Group Rewards (right)

c) Observation

In this stage, observations were conducted during the implementation of Cycle I to assess whether the learning activities using the STAD Cooperative Learning model were in accordance with the planned lesson objectives. Additionally, the students' engagement in

the learning process and their literacy and numeracy skills in this cycle were also examined. Observations were carried out throughout the implementation process to collect data on students' activities during the learning process. These observations were conducted by the researcher with the assistance of the teacher.

The observed student activities included: (1) Visual activities; (2) Oral activities; (3) Writing activities; and (4) Listening activities. The results of the observations on student activities and their literacy and numeracy skills can be seen in the following table:

Table 1. Student Engagement in Cycle 1

Engagement Category	*Frequency*	*%*
Very active	2	10
Active	9	45
Less Active	6	30
Not active	3	15
Total	20	100

Student engagement based on the data does not meet the success criteria, which requires 70% of students to fall into the "Active" category. Student engagement is also illustrated in the bar chart below.

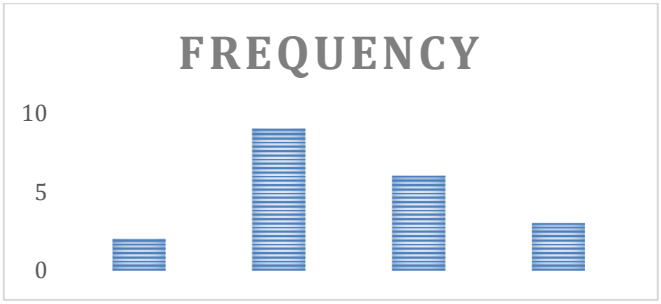

Figure 3. Bar Chart of Student Engagement in Cycle I

Students' literacy and numeracy skills are assessed based on their ability to complete test questions using literacy and numeracy indicators as defined by Han Weilin et al. (2017), which include: (1) Using various numbers and symbols related to operations on numerical forms to solve problems in real-life contexts; (2) Analyzing information (graphs, tables, charts, diagrams, etc.); and (3) Interpreting the results of the analysis to predict and make decisions. The evaluation results of students' literacy and numeracy skills in Cycle 1 can be seen in the table below:

Table 2. Students' Literacy-Numeracy Skills in Cycle I

Literacy-Numeracy Skills	f	%
Excellent	3	15
Good	11	55
Poor	6	30

The table above shows that 70% of students were able to complete literacy-numeracy-based questions. Students' literacy and numeracy skills are illustrated in the following bar chart:

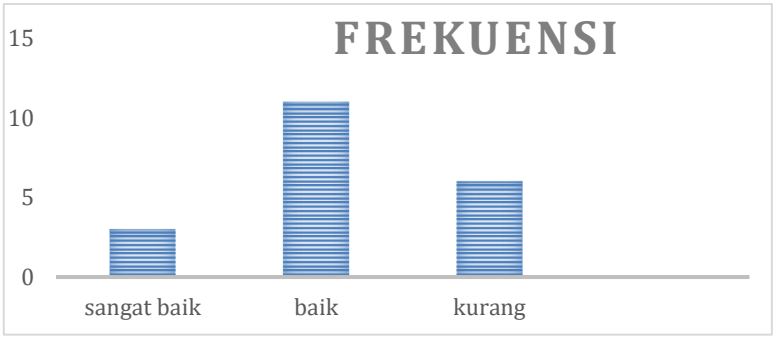

Figure 4. Bar Chart of Students' Mathematical Literacy-Numeracy Skills

d) Reflection

Based on reflections from the researcher and teacher regarding the learning improvement activities in Cycle I, several weaknesses were identified, including: (a) Group discussion activities appeared monotonous, as students were still not accustomed to collaborating in groups; (b) Students were less active in expressing their thoughts about the material being studied; (c) The use of teaching aids was not yet optimal; and (d) Students were still weak in calculations. Improvements planned for Cycle II included revisiting materials that students had not yet understood. As students struggled with calculations, the procedures for solving them needed to be explained in greater detail. Additionally, motivational strategies were implemented to boost students' enthusiasm for learning.

Cycle II

Based on the reflections from Cycle I, Cycle II focused on enhancing group activity and understanding of the perimeter of polygons. The teaching materials and methods were improved to maximize the effectiveness of the learning process.

a) Planning

Addressing the weaknesses identified in Cycle I, the researcher continued improving the learning process by preparing lesson plans (RPP), student worksheets (LKPD), observation sheets, and evaluation tools to measure students' literacy and numeracy skills. The material for Cycle II covered the *Perimeter of Polygons*.

b) *Implementation*

Cycle II was conducted over three meetings. The learning procedure remained similar to that of Cycle I. Phase 1: The learning process began with the teacher stating the learning objectives, specifically that students should be able to determine the perimeter of polygons. The planned actions were implemented according to the pre-designed scenarios and prepared materials. The teacher conducted classroom instruction using the STAD cooperative learning model, which included six phases of activity. These refinements aimed to address the shortcomings of Cycle I and further enhance students' engagement, collaboration, and understanding of the material.

Figure 5. Students working in groups during Cycle 2

c) Observation

Observations were conducted throughout the implementation of the actions. The results of student activity observations in Cycle II showed an increase in student engagement. Literacy and numeracy skills also improved. An increase was noted in visual activities, particularly the number of students reading learning resources and paying attention to their peers speaking. However, a decrease in engagement was observed in the indicator of paying attention to the teacher's explanation. Oral activity improvements were seen in the indicator of asking questions, while there was a decline in the willingness to discuss in groups, and no improvement was observed in the indicator of providing suggestions, objections, or opinions. Listening activities showed improvement across all indicators. Writing activities improved in the indicators of taking notes during the teacher's explanation and writing summaries during group discussions, but there was no improvement in the indicator of copying answers from the teacher.

Figure 6. Students actively discussing with peers and the teacher (left) & Students working on group games (right)

The results of student activity observations and literacy-numeracy skills in Cycle II are presented in the following tables:

Table 3. Student Engagement in Cycle II

Engagement Category	Frequency	%
Very Active	5	25
Active	10	50
Less Active	4	20
Not Active	1	5
Total	20	100

Student engagement based on the data met the success criteria, with 75% of students categorized as "Active." Student engagement is also illustrated in the bar chart below.

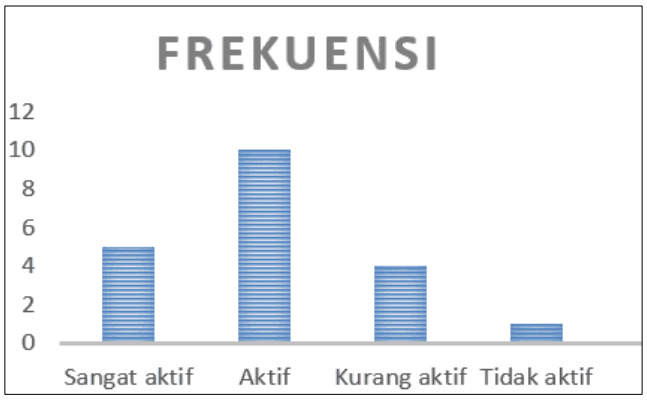

Figure 7. Bar Chart of Student Engagement in Cycle II

The results of the literacy-numeracy skill test for students are as follows:

Table 4. Literacy-Numeracy Skills of Students in Cycle II

Literacy-Numeracy Skills	Frequency	%
Very Good	8	40
Good	10	50
Poor	2	10

From Table 4, 90% of students achieved literacy-numeracy skills in the "Good" and "Very Good" categories.

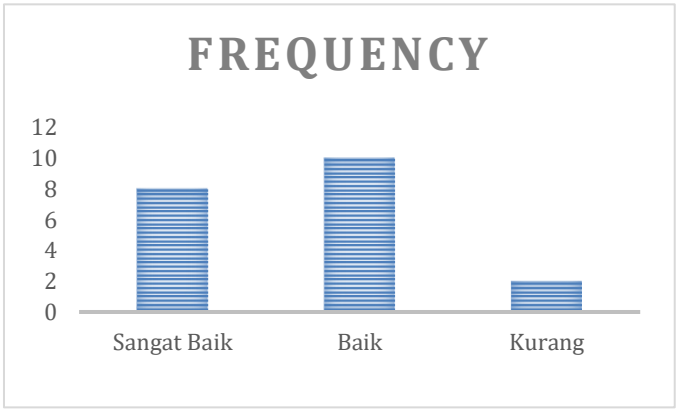

Figure 8. Literacy-Numeracy Skills in Cycle II

d) Reflection

Based on observations during the implementation of the previous research stages, the overall implementation of the stages in Cycle II ran smoothly. The results of the actions in Cycle II met the success criteria for both student engagement and literacy-numeracy skills. During the learning activities in Cycle II, students were actively engaged in group discussions and were able to participate in discussions with the teacher.

Discussion

This study aimed to address the main question: Can the STAD cooperative learning model improve the literacy and numeracy skills of fifth-grade students at SD Negeri 7 Palembang? The findings of the study indicate that implementing the STAD model significantly enhances student engagement, literacy skills, and numeracy skills. These findings confirm the hypothesis that a group-based approach through the STAD model is effective in fostering social interaction and collaborative learning, which supports the development of students' abilities to understand, analyze, and solve mathematics problems embedded in literacy and numeracy contexts. The significant improvements observed in Cycle II demonstrate the success of this strategy, with the proportion of students in the "Excellent" category increasing from 15% in Cycle I to 40% in Cycle II.

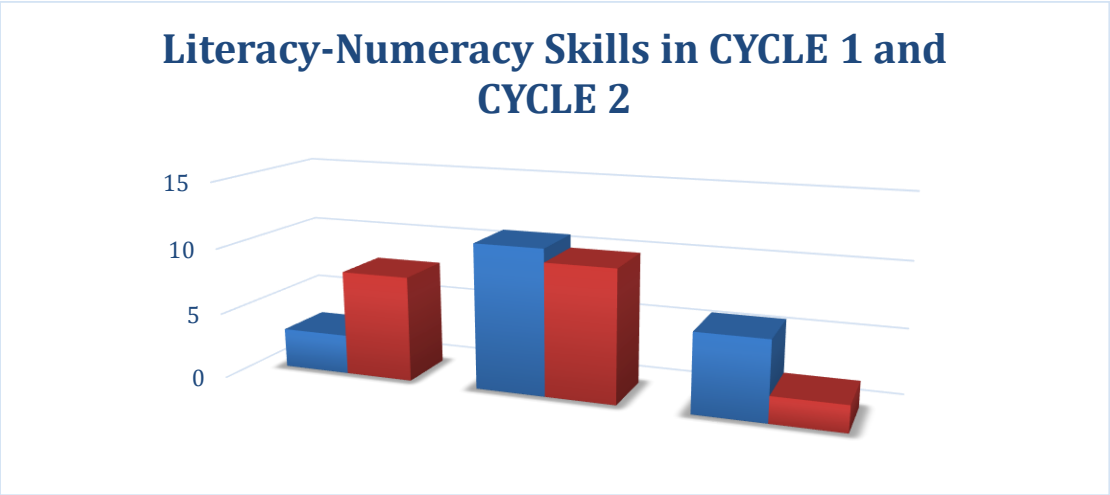

Figure 9. Literacy-Numeracy Skills in CYCLE 1 and CYCLE 2

The STAD model creates a collaborative learning environment that actively enhances student participation. The group discussion process within heterogeneous groups provides opportunities for high-achieving students to assist their peers, aligning with Vygotsky's constructivist learning theory, which emphasizes the importance of social interaction in learning. The increase in the number of active students from 55% in Cycle I to 75% in Cycle II illustrates that this method effectively fosters deeper student engagement. Additionally, students' literacy and numeracy abilities showed significant improvement. They became increasingly adept at integrating literacy with numeracy, such as understanding story-based problems, analyzing data from tables or graphs, and applying basic mathematical operations. The increase in average scores from 70.1 in Cycle I to 82.3 in Cycle II demonstrates that the STAD approach successfully develops critical thinking and problem-solving skills among students.

These findings align with Slavin's (2009) research, which reported that cooperative learning improves academic outcomes through group work. The study also supports Zaelani et al. (2023), who found that the STAD model enhances students' understanding of mathematical concepts and social interaction. However, this study offers novelty by focusing on the integration of literacy and numeracy within mathematics instruction, which is particularly relevant to the needs of Indonesia's Kurikulum Merdeka (Independent Curriculum). In contrast, this study differs from Nabila's (2023) findings, which suggested that individual problem-

solving is more effective in fostering student independence. In this context, the combination of group-based and individual activities in Cycle II proved to yield more optimal results.

The implications of this research are broad. In the context of mathematics education, implementing the STAD model provides concrete guidance for teachers to improve learning outcomes that not only focus on calculation skills but also on literacy and numeracy comprehension relevant to real-life situations. Furthermore, this research supports the vision of the Kurikulum Merdeka, which emphasizes project-based and collaborative learning. By creating a collaborative learning environment, the STAD model facilitates the development of 21st-century skills such as critical thinking, collaboration, and communication.

The novelty of this study lies in its integration of the STAD cooperative learning model with literacy and numeracy approaches at the elementary school level. This combination provides a new contribution to existing literature, as few studies have specifically explored how these two approaches can be integrated to improve students' foundational skills. Future research can explore the long-term impact of the STAD model on literacy and numeracy retention, particularly in the transition to higher levels of education. Additionally, integrating digital technology into the STAD model, such as interactive applications or simulations, can further enhance its effectiveness. Future studies might also examine the application of this model in other subjects, such as science or language, to assess its flexibility and impact in various learning contexts.

In conclusion, the STAD cooperative learning model has been proven effective in improving the literacy and numeracy skills of fifth-grade students at SD Negeri 7 Palembang. These findings not only support existing theories and research but also offer an innovative approach that can be widely adopted to support the success of the Kurikulum Merdeka. The success of this study demonstrates that structured and collaborative learning approaches like STAD can enhance students' academic outcomes while fostering active participation and a deeper understanding of the concepts being taught.

Conclusion

This study addressed the question of whether the Student Teams Achievement Division (STAD) cooperative learning model can effectively improve the literacy and numeracy skills of fifth-grade students at SD Negeri 7 Palembang. The findings demonstrate that the STAD model significantly enhances students' engagement, literacy, and numeracy skills through its emphasis on collaboration and structured group-based learning. The model successfully created an interactive and supportive learning environment where students could engage in problem-solving activities and develop critical thinking skills. The literacy-numeracy integration within the STAD framework allowed students to understand and analyze real-life problems, interpret data, and apply mathematical concepts effectively.

The results show substantial improvement in student outcomes from Cycle I to Cycle II. In Cycle I, only 15% of students were in the "Very Good" category, while in Cycle II, this increased to 40%. Additionally, overall student engagement rose from 55% active participation in Cycle I to 75% in Cycle II. These findings underscore the STAD model's ability to enhance students' foundational skills while fostering motivation and collaboration, aligning with Vygotsky's constructivist theory. The study also contributes theoretically by highlighting the

integration of literacy and numeracy into cooperative learning strategies, an area that has received limited attention in previous research.

The implications of this study extend to the broader field of education. By adopting the STAD model, teachers can go beyond rote learning and focus on fostering real-world skills such as critical thinking, teamwork, and problem-solving. This aligns with the objectives of Indonesia's Kurikulum Merdeka and the global Sustainable Development Goals (SDGs), which emphasize inclusive and quality education. Furthermore, this research provides practical insights for educators seeking innovative strategies to improve literacy and numeracy outcomes, particularly in elementary school settings. Despite its promising results, this study has limitations. The research was conducted in a single school with a small sample size of 20 students, which may limit the generalizability of the findings. Additionally, the study focused on mathematics; future research could explore the application of the STAD model in other subjects to assess its flexibility and broader impact. The integration of digital tools and technology into the STAD model also remains an area for further exploration, as such advancements could enhance student engagement and learning outcomes.

In conclusion, the STAD cooperative learning model effectively improves literacy and numeracy skills while fostering active participation and deeper understanding among students. The findings offer an innovative approach that can be widely adopted to enhance foundational skills and support the success of contemporary educational frameworks like Kurikulum Merdeka. Further research is encouraged to refine and expand the application of this model to address diverse educational challenges in various contexts.

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Conflicts of Interest

The authors affirm that there are no conflicts of interest related to the publication of this manuscript. Furthermore, ethical issues such as plagiarism, misconduct, data fabrication or falsification, duplicate publication or submission, and redundancies have been addressed and resolved by the authors.

Author Contributions

Cecil Hiltrimartin & Yusuf Hartono: Developed the concept, formulated the idea, wrote the initial draft, created the visualization, collected data, conducted formal analysis, and designed the methodology; **Somakim & Budi Mulyono:** Contributed to concept development, writing, and reviewing, and was responsible for validation and supervision; **Destiana Wati, Pedi Agus Susanto & Marta Aulia** : Involved in writing, reviewing, and data collection.

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