

THE IMPLEMENTATION OF THE STUDENT TEAMS ACHIEVEMENT DIVISION MODEL IN MATHEMATICS LEARNING TO IMPROVE THE LEARNING PROCESS AND OUTCOMES OF FOURTH-GRADE STUDENTS

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Abstract

This study aimed to improve the learning process and outcomes of fourth-grade students in mathematics through the implementation of the Student Teams Achievement Division (STAD) cooperative learning model integrated with digital technology media, namely Wordwall, Quizizz, GeoGebra, and Canva for Education. The study was motivated by an initial observation showing that only 42.85%, or 6 of 14 fourth-grade students at a public elementary school, achieved the minimum learning completeness criterion of 70, while the classroom process was dominated by one-way, teacher-centered instruction. This study used a Classroom Action Research design following the Arikunto model, carried out in two cycles, each consisting of planning, acting, observing, and reflecting stages. The subjects were 14 fourth-grade students, consisting of seven male and seven female students. Data were collected through a teacher observation sheet with 26 indicators, a student observation sheet with 24 indicators, and an essay-based learning achievement test equipped with colored images of plane figures, then analyzed descriptively using percentage formulas. The results showed that teacher performance in implementing the STAD steps increased from 84%, categorized as good, in Cycle I to 94%, categorized as very good, in Cycle II. The student learning process score increased from 57%, categorized as poor, to 81.5%, categorized as good. Student learning outcomes improved from 42.85% completeness before the action to 64.28% in Cycle I and reached 85.71% in Cycle II, exceeding the targeted success indicator of 75%. These findings indicate that the STAD model, supported by digital media and concrete colored visual aids, effectively enhanced both the learning process and the mathematics achievement of elementary school students.

Keywords: Student Teams Achievement Division; mathematics learning outcomes; learning process; elementary school

Abstrak

Penelitian ini bertujuan untuk meningkatkan proses dan hasil belajar matematika siswa kelas IV melalui penerapan model pembelajaran kooperatif Student Teams Achievement Division (STAD) yang diintegrasikan dengan media teknologi digital, yaitu Wordwall, Quizizz, GeoGebra, dan Canva for Education. Penelitian ini dilatarbelakangi oleh hasil observasi awal yang menunjukkan bahwa hanya 42,85%, atau 6 dari 14 siswa kelas IV di sebuah sekolah dasar negeri, yang mencapai Kriteria Ketuntasan Tujuan Pembelajaran (KKTP) dengan nilai minimal 70, sementara proses pembelajaran masih didominasi oleh pembelajaran satu arah yang berpusat pada guru. Penelitian ini menggunakan desain Penelitian Tindakan Kelas mengikuti model Arikunto yang dilaksanakan dalam dua siklus, masing-masing terdiri atas tahap perencanaan, tindakan, pengamatan, dan refleksi. Subjek penelitian berjumlah 14 siswa kelas IV, terdiri atas tujuh siswa laki-laki dan tujuh siswa perempuan. Data dikumpulkan melalui lembar observasi guru dengan 26 indikator, lembar observasi siswa dengan 24 indikator, dan tes hasil belajar berbentuk uraian yang dilengkapi gambar bangun datar berwarna, kemudian dianalisis secara deskriptif menggunakan rumus persentase. Hasil penelitian menunjukkan bahwa kinerja guru dalam menerapkan langkah-langkah STAD meningkat dari 84% berkategori baik pada siklus I menjadi 94% berkategori sangat baik pada siklus II. Skor proses belajar siswa meningkat dari 57% berkategori kurang baik menjadi 81,5% berkategori baik. Hasil belajar siswa meningkat dari 42,85% ketuntasan sebelum tindakan menjadi 64,28% pada siklus I dan mencapai 85,71% pada siklus II, melampaui indikator keberhasilan yang ditetapkan sebesar 75%. Temuan ini menunjukkan bahwa model STAD yang didukung media digital dan alat peraga konkret berwarna efektif meningkatkan proses pembelajaran maupun capaian matematika siswa sekolah dasar.

Kata kunci: Student Teams Achievement Division; hasil belajar matematika; proses pembelajaran; sekolah dasar

INTRODUCTION

Mathematics plays an important role in developing students' logical, systematic, critical, and creative thinking. Mastering mathematical concepts from an early age contributes greatly to students' ability to solve everyday problems and supports the development of science and technology (Putri, Rohana, & Arief, 2024). Under the Merdeka Curriculum, mathematics learning in elementary school is directed at developing students' competence holistically, including conceptual understanding, procedural application, critical thinking, and contextual problem solving (Anggraini, 2024).

In practice, however, mathematics learning in elementary school still frequently faces the problem of teacher-centered instruction. Teachers dominate classroom activities through monotonous lecturing while students tend to be passive, are less engaged, and have difficulty understanding abstract concepts (Susanto, 2022). A similar condition was found during an initial observation conducted on 6 October 2025 in a fourth-grade classroom at a public elementary school in Tanah Sepenggal Subdistrict, Bungo Regency, Jambi Province. The observation revealed three main problems: (1) the learning process was one-directional and did not involve group discussion; (2) students' mathematics learning outcomes were low, with only 6 of 14 students (42.85%) achieving the Learning Objective Completion Criterion (KKTP) of a minimum score of 70; and (3) students showed low engagement, rarely asked questions, and quickly became bored during lessons.

These problems were rooted in several factors: communication in the classroom remained largely one-way, the teaching method used was conventional without a cooperative learning model, the use of technology-based learning media was not yet optimal, and structured group-based cooperative learning had not been implemented. This situation called for a learning innovation capable of shifting instruction from teacher-centered to student-centered.

One learning model considered appropriate for addressing this problem is the cooperative learning model Student Teams Achievement Division (STAD). STAD was developed by Robert E. Slavin of Johns Hopkins University in 1978, based on Vygotsky's social constructivism theory. The model places students into heterogeneous groups of four to five members so that they encourage, help, and motivate one another in mastering the learning material, through five main components: class presentation, teamwork, individual quizzes,

individual improvement scores, and team recognition (Slavin, 2021). Johnson and Johnson (2023) emphasized that positive interdependence among group members is the main foundation of successful cooperative learning, including STAD.

The effectiveness of STAD in improving mathematics learning outcomes has been demonstrated by a number of recent studies. Asih, Arifin, and Marshanawiah (2024) found that media-assisted STAD improved fourth-grade students' mathematics learning outcomes from 56% to 88%. Purnama Sari and Ahmala (2023) reported an increase from 38% to 90% using STAD assisted with fraction-block media, while Ulum (2023) reported an increase from 53% to 85% among fourth-grade students. At the international level, a meta-analysis by Capar and Tarim (2021) as well as a study by Fraysse, Chanquoy, and Tricot (2022) confirmed that cooperative learning of the STAD type significantly improves mathematics learning outcomes compared with conventional learning. Lestari and Surya (2023) reported a 23.5% improvement in elementary students' mathematics outcomes compared with a control class, while Hamid, Yuliati, and Diantoro (2022) as well as Majoka and Khan (2021) showed that STAD is effective in improving students' mathematical problem-solving skills. Locally, Avana, Wiyoko, and Wulandari (2022) and Maharani and Avana (2025) demonstrated that cooperative learning positively affects elementary students' mathematics learning outcomes in Bungo Regency.

Nevertheless, most previous studies have focused solely on learning outcomes without comprehensively measuring the learning process, and the application of STAD integrated with digital technology media in fourth-grade elementary classrooms remains rarely investigated (Nurdiana & Saefudin, 2024; Veloo, Md-Ali, & Chairany, 2022). The present study seeks to fill this gap by simultaneously examining the improvement of both the learning process and mathematics learning outcomes of fourth-grade students through the implementation of the STAD model integrated with Wordwall, Quizizz, GeoGebra, and Canva for Education, together with colored concrete images and teaching aids suited to the concrete-operational thinking stage of elementary students.

Based on the description above, this study aims to: (1) describe the process of implementing the STAD model in mathematics learning in a fourth-grade classroom; and (2) describe the improvement of students' mathematics learning outcomes after the

implementation of the STAD model, so that at least 75% of students achieve the KKTP with a score of ≥ 70 .

METHODS

This study used a Classroom Action Research (CAR) method following the Arikunto (2021) model, carried out in two cycles, each consisting of four stages: planning, acting, observing, and reflecting. The Arikunto model was chosen because its steps are systematic, cyclical, and reflective, allowing for continuous improvement in addressing the identified problems in mathematics learning, namely: (1) a learning process that had not run optimally, with limited interaction; (2) low learning outcomes, with only 42.85% completeness; and (3) students who were not sufficiently active in asking questions and expressing opinions.

The subjects of this study were 14 fourth-grade students of a public elementary school in Tanah Sepenggal Subdistrict, Bungo Regency, Jambi Province, consisting of 7 male and 7 female students. This class was selected based on the initial observation, which showed a significant problem in mathematics learning outcomes and student engagement. The study was conducted in the even semester of the 2025/2026 academic year, with Cycle I implemented on 11–12 May 2026 and Cycle II on 25–26 May 2026, each cycle consisting of two meetings.

The research variables consisted of an action variable, namely the implementation of the STAD model integrated with digital technology-based learning media (Wordwall, Quizizz, GeoGebra, and Canva for Education), and an outcome variable, namely students' learning process and mathematics learning outcomes on the topic of Plane Figures (Polygons and Triangles Classified by Side).

Data sources came from students, the teacher, and peer observers. Data were collected through observation, learning achievement tests, and documentation. The research instruments consisted of: (1) a teacher performance observation sheet with 26 indicators, completed by the homeroom teacher as observer; (2) a student activity observation sheet with 24 indicators, completed by two peer teachers as observers; and (3) an essay-based learning achievement test consisting of 5 items per cycle, equipped with colored images of plane figures. All instruments were validated through expert judgment by the research supervisor, a mathematics education expert, and the class mathematics teacher.

Each learning action was carried out through the seven steps of the STAD model, namely: (1) conveying learning objectives and motivating students; (2) presenting information using GeoGebra, animated videos, and Canva for Education; (3) organizing students into heterogeneous groups of four to five members; (4) guiding groups in completing the Student Worksheet (LKPD) equipped with colored images; (5) group presentations; (6) individual quizzes using Wordwall or Quizizz; and (7) awarding recognition to the best groups based on individual improvement scores, categorized as Super Team (≥ 90), Great Team (80–89), and Good Team (70–79).

Data on the learning process were analyzed using the following completeness-percentage formula:

$$\text{Percentage} = (\text{score obtained} \div \text{maximum score}) \times 100\%$$

The resulting percentage was then categorized as poor ($\leq 60\%$), fair (61–70%), good (71–80%), and very good (81–100%), following Arikunto's criteria (in Susanto, 2022). Learning outcome data were analyzed descriptively and quantitatively by calculating individual completeness, whereby a student was declared to have passed if the score obtained was ≥ 70 according to the KKTP, and classical completeness using the formula $KB = (NS/N) \times 100\%$, where NS is the number of students who passed and N is the total number of students.

The study was declared successful if: (1) the implementation of the STAD model by the teacher reached at least 75%; (2) students showed increased active participation at every step of STAD; and (3) at least 75% of students achieved the KKTP (≥ 70), with an average class score increase of at least 10 points from the initial condition.

RESULTS AND DISCUSSION

Research Results

This study was conducted at a public elementary school in Tanah Sepenggal Subdistrict, Bungo Regency, Jambi Province, in a fourth-grade mathematics class on the topic of Plane Figures (Polygons and Triangles Classified by Side). The research subjects numbered 14 students, consisting of 7 male and 7 female students. The study was carried out in two cycles, each with two meetings: Cycle I on 11–12 May 2026 and Cycle II on 25–26 May 2026. Each cycle was implemented through the seven steps of the STAD model and analyzed using the Arikunto model, comprising planning, acting, observing, and reflecting.

The observation of teacher performance in Cycle I meeting 1 obtained a score of 21 out of 26 aspects (80%, categorized as good), which increased to a score of 23 (88%, good) in meeting 2, giving a Cycle I average of 84%. In Cycle II, teacher performance increased to a score of 24 (92%, very good) in meeting 1 and a score of 25 (96%, very good) in meeting 2, giving a Cycle II average of 94%. A summary of the results is presented in Table 1 and Figure 1.

Table 1. Recapitulation of Teacher Performance Observation Results

Cycle/Meeting	Score	Percentage	Category
Cycle I – Meeting 1	21/26	80%	Good
Cycle I – Meeting 2	23/26	88%	Good
Cycle II – Meeting 1	24/26	92%	Very Good
Cycle II – Meeting 2	25/26	96%	Very Good

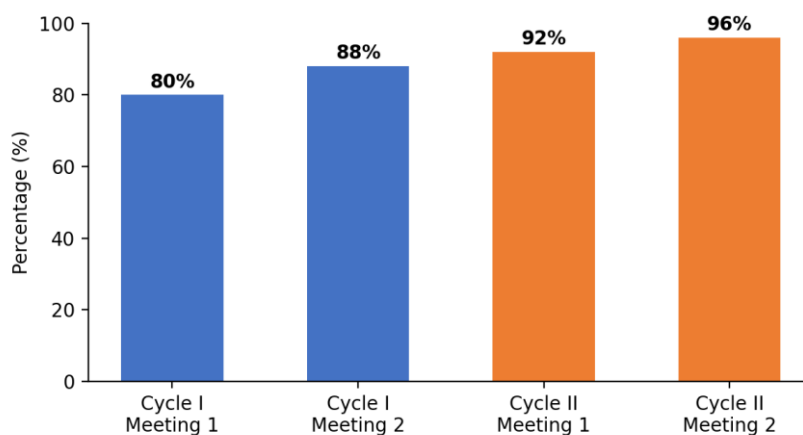


Figure 1. Teacher Performance in Implementing the STAD Model

The observation of students' learning process in Cycle I meeting 1 showed that 7 of 14 students (50%) were categorized as good or above, increasing to 9 students (64%) in meeting 2, giving a Cycle I average of 57% (categorized as poor). In Cycle II, the student learning process improved to 11 students (78%) in meeting 1 and 12 students (85%) in meeting 2, giving a Cycle II average of 81.5% (categorized as good). The recapitulation is presented in Table 2 and Figure 2.

Table 2. Recapitulation of Student Learning Process Observation Results

Cycle/Meeting	Students in Good Category	Total Students	Percentage	Category
Cycle I – Meeting 1	7	14	50%	Poor
Cycle I – Meeting 2	9	14	64%	Fair
Cycle II – Meeting 1	11	14	78%	Good

Cycle/Meeting	Students in Good Category	Total Students	Percentage	Category
Cycle II – Meeting 2	12	14	85%	Very Good

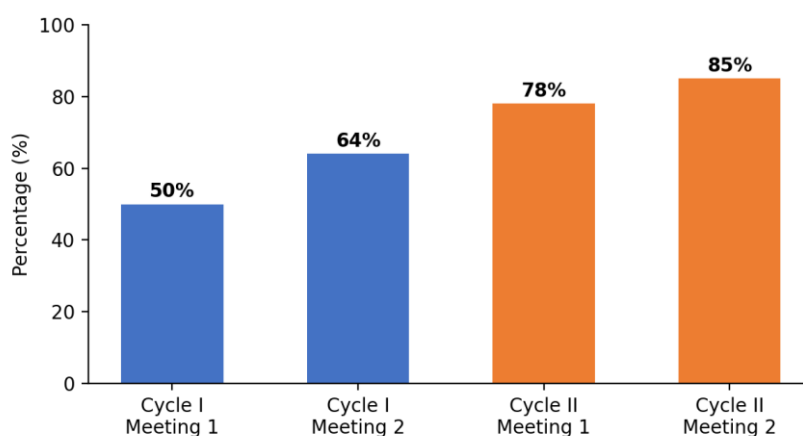


Figure 2. Student Learning Process

At the pre-cycle stage, only 6 of 14 students (42.85%) achieved the KKTP of ≥ 70 . After the Cycle I action, the mathematics achievement test showed a class average of 73, with the highest score of 92 and the lowest score of 50; 9 of 14 students (64.28%) were declared to have passed. In Cycle II, the class average increased to 77, with the highest score of 92 and the lowest score of 57; 12 of 14 students (85.71%) were declared to have passed, exceeding the targeted success indicator of 75%. The improvement in the completeness of students' mathematics learning outcomes is presented in Table 3 and Figure 3.

Table 3. Recapitulation of Mathematics Learning Outcome Completeness

Stage	Average Score	Number Passed	Completeness Percentage	Category
Pre-cycle	–	6/14	42.85%	Not Complete
Cycle I	73	9/14	64.28%	Fair
Cycle II	77	12/14	85.71%	Good

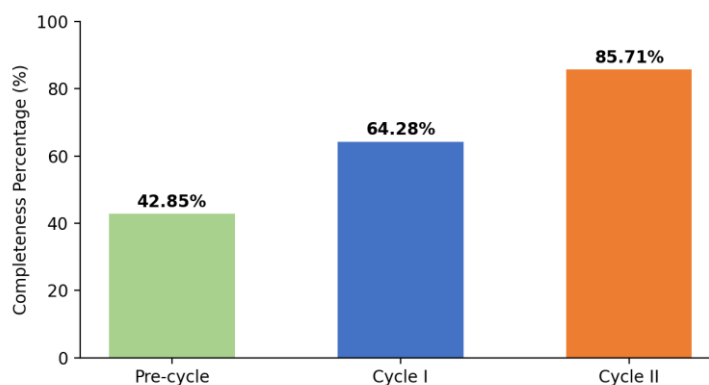


Figure 3. Completeness of Students' Mathematics Learning Outcomes

Discussion

The increase in teacher performance from 84% in Cycle I to 94% in Cycle II is consistent with Slavin's (2021) view that the effectiveness of STAD depends heavily on the consistent implementation of its five main components, namely class presentation, teamwork, individual quizzes, individual improvement scores, and team recognition. The teacher's ability to guide groups, make use of digital media such as GeoGebra, Wordwall, and Quizizz, and create an interactive learning atmosphere further supported this improvement. This finding is in line with Asih, Arifin, and Marshanawiah (2024), who reported that teacher performance in implementing STAD improved consistently across cycles as a result of ongoing reflection and improvement.

The improvement in student learning process from a poor category (57%) in Cycle I to a good category (81.5%) in Cycle II indicates that the implementation of STAD succeeded in maximizing students' engagement within their groups. This is in line with Johnson and Johnson (2023), who emphasized that positive interdependence among group members is the foundation of successful cooperative learning. In addition, the use of colored images and concrete teaching aids, suited to the characteristics of fourth-grade students who are still at the concrete-operational stage, further supported students' understanding of the plane-figure material (Purnama Sari & Ahmala, 2023).

Improvement of Students' Mathematics Learning Outcomes

The percentage of students' mathematics learning outcome completeness increased from 42.85% at the pre-cycle stage to 64.28% in Cycle I, and reached 85.71% in Cycle II, an increase of 21% from Cycle I to Cycle II. This improvement demonstrates that the STAD model, integrated with digital technology-based media and colored concrete teaching aids, is effective in improving the mathematics learning outcomes of fourth-grade elementary students. According to Slavin (2021), the success of STAD cannot be separated from its five main components, which together encourage students to help one another and take responsibility for understanding the material within their group.

This finding is consistent with the meta-analysis by Capar and Tarim (2021) and the study by Fraysse, Chanquoy, and Tricot (2022), which demonstrated that STAD-type cooperative learning significantly improves mathematics learning outcomes compared with

conventional learning. It is also in line with Asih, Arifin, and Marshanawiah (2024), who reported an increase in fourth-grade mathematics learning outcomes from 56% to 88%; Purnama Sari and Ahmala (2023), who found an increase from 38% to 90% through STAD assisted with fraction-block media; and Ulum (2023), who reported an increase from 53% to 85% among fourth-grade students. The comparison of these results confirms that the integration of learning media, whether digital technology-based or concrete teaching aids, strengthens the effectiveness of STAD in improving elementary students' mathematics learning outcomes. Locally, this finding also reinforces the results of Avana, Wiyoko, and Wulandari (2022) and Maharani and Avana (2025), who demonstrated that cooperative learning positively affects the mathematics learning outcomes of elementary students in Bungo Regency.

The novelty of this study lies in its simultaneous measurement of the learning process and learning outcomes through validated observation instruments, as well as the use of digital technology-based learning media (Wordwall, Quizizz, GeoGebra, and Canva for Education) combined with colored images and concrete teaching aids, appropriate to the characteristics of fourth-grade elementary students who are still at the concrete thinking stage (Nurdiana & Saefudin, 2024; Veloo, Md-Ali, & Chairany, 2022).

CONCLUSION

Based on the results of the classroom action research conducted in a fourth-grade class at a public elementary school in Bungo Regency, it can be concluded that the implementation of the Student Teams Achievement Division (STAD) model improved both the process and the outcomes of students' mathematics learning. Teacher performance in implementing the STAD model increased from 84% (good category) in Cycle I to 94% (very good category) in Cycle II. The student learning process improved from 57% (poor category) in Cycle I to 81.5% (good category) in Cycle II. Students' mathematics learning outcomes on the topic of Plane Figures (Polygons and Triangles Classified by Side) increased from 42.85% at the pre-cycle stage to 64.28% in Cycle I, and reached 85.71% in Cycle II, exceeding the targeted success indicator of at least 75% of students achieving the KKTP (≥ 70).

This study is limited to 14 fourth-grade students at a single elementary school and to one topic area, so the findings cannot yet be generalized to a wider population or to other

mathematics topics. Teachers are advised to continue optimizing balanced group guidance so that all students, including those who tend to be passive, can participate actively at every stage of STAD. Students are advised to increase their courage in expressing opinions and to prepare independently before individual quizzes. Future researchers are advised to apply the STAD model to other topics or subjects with a broader research sample to obtain a more comprehensive picture of its effectiveness in improving the learning process and outcomes of elementary school students.

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