



SYSTEMATIC LITERATURE REVIEW: THE EFFECT OF THE STUDENT TEAMS ACHIEVEMENT DIVISION COOPERATIVE LEARNING MODEL ON JUNIOR HIGH SCHOOL STUDENTS' MATHEMATICS LEARNING OUTCOMES

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Abstract

The low mathematics learning outcomes of students highlight the need for learning models that can enhance student engagement and conceptual understanding. One of the cooperative learning models widely implemented is the Student Teams Achievement Division (STAD) model. This study aimed to analyze and synthesize previous research on the implementation of the STAD model in improving junior high school students' mathematics learning outcomes. This study employed the Systematic Literature Review (SLR) method following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Articles were retrieved from Google Scholar using the Publish or Perish application, focusing on publications from 2021 to 2025. The selection process resulted in 14 articles that met the inclusion criteria. The findings revealed that most studies were conducted with eighth-grade students, focused on geometry topics, and employed classroom action research. In addition, the implementation of the STAD model consistently showed positive effects on students' mathematics learning outcomes across various mathematics topics and research designs, as indicated by improvements in mean scores, learning mastery, N-Gain scores, and statistically significant test results. Therefore, the Student Teams Achievement Division (STAD) cooperative learning model can serve as an effective alternative instructional model for improving junior high school students' mathematics learning outcomes.

Keywords: *Mathematics Learning Outcomes; STAD Cooperative Learning Model; Systematic Literature Review*

Abstrak

Rendahnya hasil belajar matematika siswa mendorong perlunya penerapan model pembelajaran yang mampu meningkatkan keaktifan dan pemahaman konsep siswa. Salah satu model yang banyak digunakan adalah model pembelajaran kooperatif tipe *Student Teams Achievement Division* (STAD). Penelitian ini bertujuan menganalisis dan mensintesis hasil penelitian mengenai penerapan model STAD terhadap hasil belajar matematika siswa SMP. Penelitian menggunakan metode *Systematic Literature Review* (SLR) dengan pedoman *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA). Artikel ditelusuri melalui *Google Scholar* menggunakan aplikasi *Publish or Perish* pada publikasi tahun 2021–2025. Hasil seleksi menghasilkan 14 artikel yang memenuhi kriteria inklusi. Hasil sintesis menunjukkan bahwa penelitian didominasi oleh siswa kelas VIII, materi geometri, dan metode penelitian tindakan kelas. Selain itu, penerapan model STAD secara konsisten memberikan pengaruh positif terhadap hasil belajar matematika siswa pada berbagai materi dan desain penelitian, yang ditunjukkan oleh peningkatan nilai rata-rata, ketuntasan belajar, skor N-Gain, dan hasil uji statistik yang signifikan. Dengan demikian, model pembelajaran kooperatif tipe STAD merupakan salah satu alternatif model pembelajaran yang efektif untuk meningkatkan hasil belajar matematika siswa SMP.

Kata kunci: Hasil Belajar Matematika; Kajian Literatur Sistematis, Model Pembelajaran Kooperatif Tipe STAD

INTRODUCTION

Mathematics is one of the core subjects that plays an important role in developing students' logical, analytical, and systematic thinking skills (Nurhaswinda & Parisu, 2025). However, in classroom practice, mathematics learning outcomes remain a persistent challenge. Students' difficulties in understanding abstract mathematical concepts often result in low mathematics achievement (Lubis et al., 2025). Therefore, an instructional model that actively engages students in the learning process is needed to improve both conceptual understanding and mathematics learning outcomes.

One of the instructional models widely implemented in mathematics education is the Student Teams Achievement Division (STAD) cooperative learning model. This model organizes students into heterogeneous groups, allowing them to interact, discuss, and collaborate in understanding the learning materials (Zakarsih, 2026). The implementation of STAD is consistent with the principles of cooperative learning, which emphasize students' active participation, peer collaboration, and individual accountability throughout the learning process (Lily & Nisa, 2025). Through these characteristics, STAD is considered capable of creating a more active learning environment that enhances students' understanding of mathematical concepts.

Numerous studies have investigated the implementation of the STAD cooperative learning model in mathematics education. Overall, the findings indicate that STAD effectively improves students' mathematics learning outcomes, as evidenced by higher average scores, increased learning mastery, high N-Gain scores, and statistically significant differences in learning achievement (Purba et al., 2025; Setyawan et al., 2025; Simanjuntak et al., 2025; Tias et al., 2025). These findings suggest that the STAD cooperative learning model has considerable potential to improve mathematics learning outcomes across various mathematics topics and educational levels. Nevertheless, these findings are derived from individual studies with diverse characteristics, making it necessary to synthesize the existing evidence to obtain a more comprehensive understanding of the implementation of STAD in mathematics education.

Several Systematic Literature Review (SLR) studies have examined the implementation of the Student Teams Achievement Division (STAD) cooperative learning model and its effect on students' learning outcomes. Soleha (2024) reviewed the implementation of STAD across various subjects at the elementary school level, Tsabita et al. (2023) examined its implementation across different educational levels, whereas Mustika et al. (2023) specifically reviewed mathematics learning outcomes at the senior high school level. However, no Systematic Literature Review (SLR) has specifically synthesized studies investigating the implementation of STAD in improving mathematics learning outcomes among junior high school students. Therefore, a Systematic Literature Review (SLR) is needed to integrate the findings of previous studies and provide a more comprehensive understanding of the effectiveness of STAD in improving junior high school students' mathematics learning outcomes.

Based on this research gap, the present study aims to synthesize previous research on the implementation of the Student Teams Achievement Division (STAD) cooperative learning model and its effect on junior high school students' mathematics learning outcomes. Unlike previous Systematic Literature Reviews (SLRs), which included multiple educational levels or focused exclusively on elementary or senior high school students, this study specifically integrates research findings within the context of mathematics learning at the junior high school level. The synthesis not only describes the characteristics of previous studies based on grade level, mathematics topics, and research methods but also integrates their findings to identify the overall trend regarding the effectiveness of the STAD cooperative learning model in improving junior high school students' mathematics learning outcomes. Specifically, this study addresses four research questions: (RQ1) At which grade level has research on the implementation of STAD been conducted most frequently? (RQ2) Which mathematics topics have been most frequently investigated? (RQ3) Which research methods have been predominantly employed? (RQ4) What is the

overall effect of the implementation of the STAD cooperative learning model on junior high school students' mathematics learning outcomes?

METHOD

This study employed the Systematic Literature Review (SLR) method, a research approach conducted through a structured process of identifying, reviewing, evaluating, and synthesizing previous studies relevant to the research topic (Soebiartika & Rindaningsih, 2023). The literature search was conducted on June 3, 2026, using the Google Scholar database through Publish or Perish version 8. Google Scholar was selected because it indexes a wide range of national educational journals relevant to the focus of this study. The article search strategy is presented in Table 1.

Table 1. Article Search Process

Database	Search String	Publication Year Range	Maximum Results	Articles Retrieved
<i>Google Scholar</i>	STAD mathematics	2021-2025	200	100
	Student Teams Achievement Division mathematics	2021-2025	200	100
	STAD learning model mathematics	2021-2025	200	100
Total Articles Retrieved				300

The 300 articles retrieved through the search process presented in Table 1 were subsequently screened using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. These guidelines consist of four stages: identification, screening, eligibility, and inclusion (Sastypratiwi & Nyoto, 2020). The selection process was conducted based on predefined inclusion and exclusion criteria developed in accordance with the objectives of this study. The detailed inclusion and exclusion criteria are presented in Table 2.

Table 2. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Articles published between 2021 and 2025	Articles published before 2021
Articles investigating the Student Teams Achievement Division (STAD) cooperative learning model and measuring mathematics learning outcomes	Articles that do not investigate the Student Teams Achievement Division (STAD) cooperative learning model or do not measure mathematics learning outcomes
Articles involving junior high school (SMP/MTs) students as the research participants	Articles involving participants other than junior high school (SMP/MTs) students
Articles written in Indonesian	Articles written in languages other than Indonesian
Articles in the field of mathematics education	Articles outside the field of mathematics education
Research articles published in peer-reviewed scientific journals	Publications other than journal articles, such as conference proceedings, undergraduate theses, master's theses, doctoral dissertations, and other types of publications

Based on the inclusion and exclusion criteria presented in Table 2, the article selection process was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. These guidelines were employed to ensure that the studies included in the review were relevant to the research objectives and met the predetermined eligibility criteria. The article selection process at each stage of the PRISMA framework is illustrated in Figure 1.

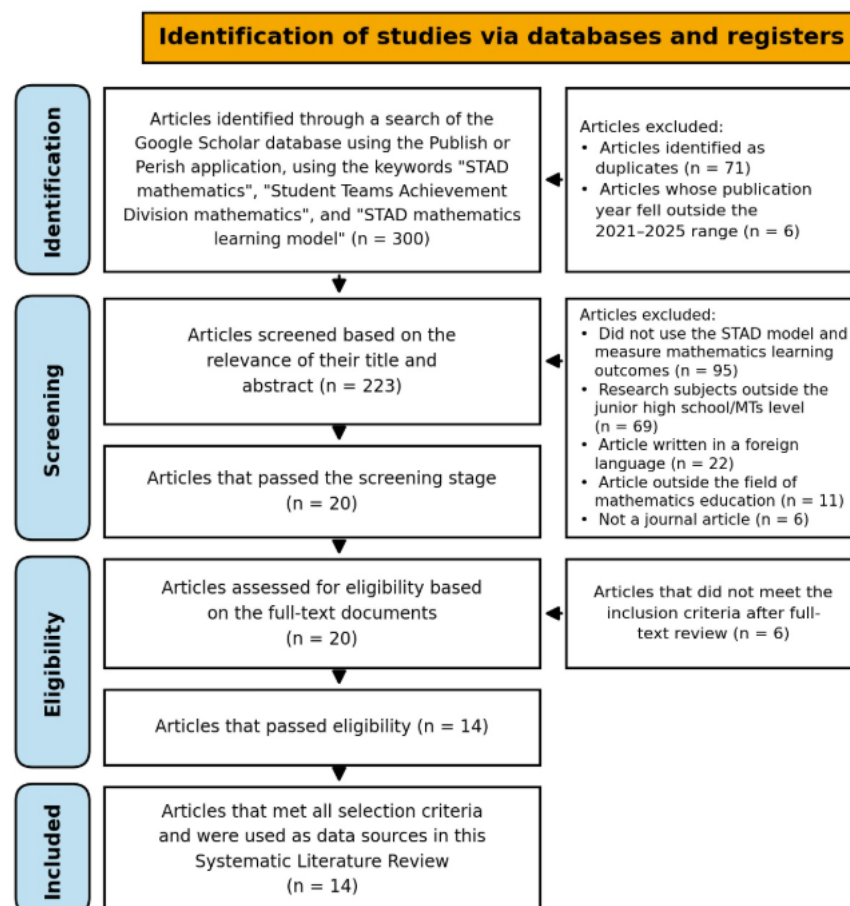


Figure 1. PRISMA Analysis

Based on the selection process in Figure 1, the initial search through Google Scholar with the help of the Publish or Perish application yielded 300 articles. At the identification stage, all search results from each search string were combined, and then an examination was carried out to identify duplicate articles and filter based on the year of publication. As a result, as many as 71 duplicate articles and 6 articles published outside the 2021–2025 range were eliminated, leaving 223 articles. Furthermore, at the screening stage, a selection was carried out based on the suitability of the title and abstract with the inclusion criteria, so that 20 articles were obtained, which were continued to the eligibility stage. At the eligibility stage, a review of the full-text document was carried out to assess the suitability of the article with the inclusion criteria. The results of the review showed that 6 articles did not meet the criteria and were eliminated. Thus, as many as 14 articles met all inclusion criteria and were used as data sources in this study.

Data from each article that met the inclusion criteria were then extracted using a data extraction sheet compiled by the researcher. The information extracted included the author's name and year of publication, grade level, mathematical material, research methods, and research findings regarding the effect of the application of the Student Teams Achievement Division (STAD) type cooperative learning model on mathematics learning outcomes of junior high school students.

RESULTS AND DISCUSSION

Based on the selection process using the PRISMA guidelines, 14 articles met the inclusion criteria and were included as the data sources for this study. The characteristics of each article were extracted based on the authors and year of publication, grade level, mathematics topic, research method, and research findings

regarding the implementation of the Student Teams Achievement Division (STAD) cooperative learning model on junior high school students' mathematics learning outcomes. A summary of the extracted data is presented in Table 3.

Table 3. Summary of the Selected Studies

No.	Author(s) and Year	Grade	Mathematics Topic	Research Method	Main Findings
1.	Abidin (2023)	VII MTs	Circles	Quasi-Experimental	The implementation of the Student Teams Achievement Division (STAD) cooperative learning model had a positive effect on Grade VII students' mathematics learning outcomes in the topic of circles. The experimental group's mean posttest score (81.33) was higher than that of the control group (60.17), indicating a statistically significant difference.
2.	Lestari et al. (2021)	Grade VII Junior High School	Quadrilaterals (Rhombus and Kite)	Classroom Action Research	The implementation of the STAD cooperative learning model improved Grade VII students' mathematics learning outcomes in the topic of quadrilaterals. The mean score increased from 63 to 72 in Cycle I and to 81 in Cycle II, while classical learning mastery improved from 53.6% to 89.3%.
3.	Sabri et al. (2025)	Grade VIII Junior High School	Three-Dimensional Figures with Flat Faces	Quasi-Experimental	The STAD cooperative learning model assisted by Quizizz Paper Mode produced better mathematics learning outcomes than the Think-Pair-Share (TPS) model using the same media. The experimental group achieved a high N-Gain score of 0.76.
4.	Putri et al. (2024)	Grade VII Junior High School	Lines and Angles	Classroom Action Research	The implementation of the STAD cooperative learning model improved Grade VII students' mathematics learning outcomes. The mean score increased from 70.4 to 87.5, while learning mastery increased from 56.25% to 96.87%.
5.	Mafa & Napitupulu (2024)	Grade IX Junior High School	Geometric Transformations	Quasi-Experimental	The STAD cooperative learning model produced better learning outcomes than conventional instruction. The experimental group's mean posttest score was 77.88, compared with 73.94 in the control group.
6.	Rhamayanti et al. (2025)	Grade VII Junior High School	Fractions	Classroom Action Research	The implementation of the STAD cooperative learning model improved Grade VII students' mathematics learning outcomes in fractions. The mean score increased from 71.1 to 81, while classical learning mastery improved from 71.4% to 89.3%.
7.	Sisdaila et al. (2022)	Grade VII Junior High School	Algebra	Quasi-Experimental	The implementation of the STAD cooperative learning model assisted by puzzle media positively affected students' learning outcomes in algebra. The mean score increased from 60.32 on the pretest to 74.57 on the posttest, with a statistically significant difference.
8.	Ade (2023)	Grade VIII Junior High	Algebraic Fractions	Classroom Action	The implementation of the STAD cooperative learning model improved

No.	Author(s) and Year	Grade	Mathematics Topic	Research Method	Main Findings
		School		Research	mathematics learning outcomes in the addition and subtraction of algebraic fractions. The mean score increased from 63.2 to 82.6, while learning mastery improved from 44% to 92%.
9.	Maulidi (2022)	Grade VII Junior High School	One-Variable Linear Equations	Classroom Action Research	The implementation of the STAD cooperative learning model assisted by a variable cup manipulative improved learning outcomes in one-variable linear equations. The mean score increased from 64.45 to 66.6, while learning mastery improved from 54.55% to 66.7%.
10.	Mamo (2022)	Grade VIII Junior High School	Pythagorean Theorem	Classroom Action Research	The implementation of the STAD cooperative learning model improved mathematics learning outcomes in the Pythagorean Theorem. Learning mastery increased from 54.84% in Cycle I to 90.32% in Cycle III.
11.	Tansala & Suyantana (2022)	Grade VIII Junior High School	Number Patterns	Classroom Action Research	The implementation of the STAD cooperative learning model improved Grade VIII students' mathematics learning outcomes in number patterns. The mean score increased from 64.48 in Cycle I to 72.87 in Cycle II.
12.	Shalehuddin et al. (2022)	Grade VIII Junior High School	Pythagorean Theorem	Quasi-Experimental	The implementation of the STAD cooperative learning model assisted by recreational mathematics and the Pupytha teaching aid produced better learning outcomes than conventional instruction. The experimental group's mean score reached 86.00, compared with 71.30 in the control group.
13.	Arifin et al. (2023)	Grade VIII Junior High School	Two-Variable Linear Equation Systems	Pre-Experimental	The STAD cooperative learning model integrated with the Card Sort method positively affected mathematics learning outcomes in two-variable linear equation systems. The mean score increased from 58.91 on the pretest to 85.34 on the posttest, indicating a statistically significant difference.
14	Wulandari & Hasibuan (2023)	Grade VIII Junior High School	Linear Equations	Quasi-Experimental	The implementation of the STAD cooperative learning model assisted by GeoGebra positively affected mathematics learning outcomes in linear equations. The experimental group's mean posttest score (85.94) was higher than that of the control group (73.78), indicating a statistically significant effect.

The results of the analysis in Table 2 are then grouped into several aspects, namely the grade level that is the subject of the research, the mathematics materials used, the research methods applied, and the effect of the application of the STAD-type cooperative learning model on the mathematics learning outcomes of junior high school students.

Application of the STAD Type Cooperative Learning Model to Students' Mathematics Learning Outcomes Based on Junior High School Students' Class Levels

The grade levels that are the subject of the study are grouped based on the junior high school/MTs level, namely grades VII, VIII, and IX. The distribution of grade levels in the study of the application of the STAD-type cooperative learning model to the mathematics learning outcomes of junior high school students is presented in Figure 2.

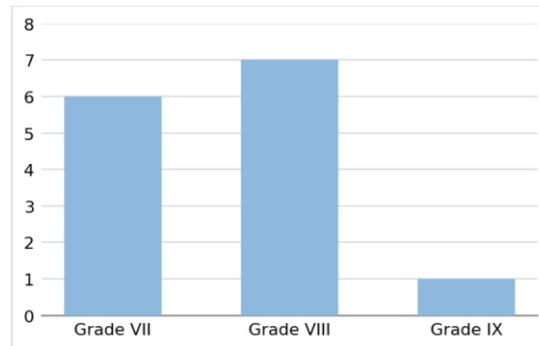


Figure 2. Class Level Distribution

Based on Figure 2, research on the application of the STAD-type cooperative learning model to the mathematics learning outcomes of junior high school students was most carried out on grade VIII students with a total of 7 articles (50.00%). The study involving grade VII students was found in 6 articles (42.86%), while grade IX students were only found in 1 article (7.14%). These results show that studies on the application of the STAD model in junior high school mathematics learning tend to be more carried out in grade VII and VIII students than in grade IX.

The dominance of research in grades VII and VIII indicates that researchers focus more on applying STAD during the phase when students are building basic mathematical concepts. In this phase, interaction between students through group discussions is seen as able to help the concept construction process before students enter more complex material in grade IX. On the other hand, the number of studies in grade IX is relatively small, which is suspected to be related to the school's focus on preparing the final assessment, so the space to conduct experimental research becomes more limited.

Application of the STAD Type Cooperative Learning Model to Students' Mathematics Learning Outcomes Based on Mathematics Teaching Materials

The mathematical material used in the analyzed articles is grouped into three main domains, namely geometry, algebra, and numbers. This grouping was carried out to see the tendency of the materials that are most often used in research regarding the application of the STAD-type cooperative learning model in mathematics learning at the junior high school level. The distribution of learning materials is presented in Figure 3.

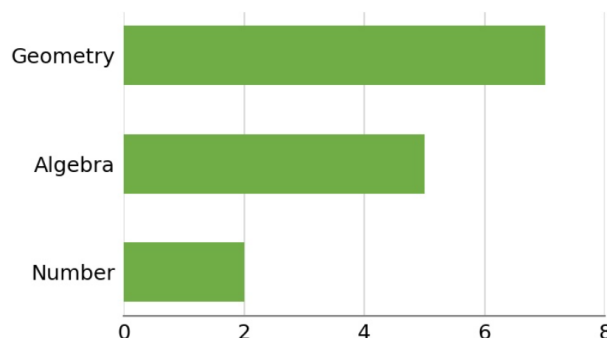


Figure 3. Distribution of Learning Materials

Based on Figure 3, geometry material is the most widely used material in research on the application of the STAD-type cooperative learning model, which is as many as 7 articles (50.00%). Furthermore, algebraic material was found in 5 articles (35.71%), while number material was only found in 2 articles (14.29%). These results show that the application of the STAD model is more often studied in geometric materials than in algebraic and number materials.

The dominance of research on geometry materials shows that the STAD-type cooperative learning model is quite widely applied to materials that require understanding of concepts, visualization, and discussion between students. Through group study activities, students can exchange ideas and help understand geometric concepts that are often considered abstract. Therefore, geometry material is one of the most frequently used materials in research on the application of the STAD model in junior high school mathematics learning. These findings indicate that the characteristics of the material are also one of the considerations in the selection of the learning model used by the researcher.

Application of the STAD Type Cooperative Learning Model to Students' Mathematics Learning Outcomes Based on the Applied Research Methods

Articles that met the research criteria were then grouped based on the research method used. The methods consist of classroom action research (PTK), quasi-experimental, and pre-experimental. The distribution of research methods in the analysed articles is presented in Figure 4.

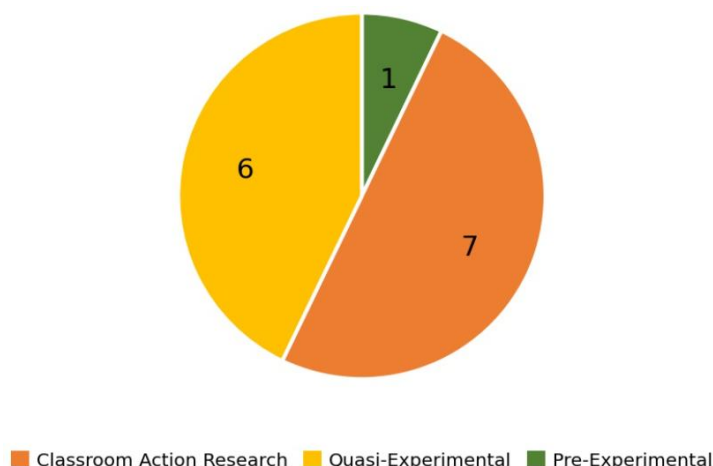


Figure 4. Distribution of Research Methods

Based on Figure 4, the most widely used research method is class action research (PTK) with a total of 7 articles (50.00%). Furthermore, the quasi-experimental method was used in 6 articles (42.86%), while the pre-experimental method was only found in 1 article (7.14%). These results show that research on the application of the STAD-type cooperative learning model to the mathematics learning outcomes of junior high school students is more often conducted through PTK and quasi-experiment compared to the pre-experimental method.

The dominance of the use of Classroom Action Research (CAR) shows that research on the application of the STAD model is mostly directed at efforts to improve the learning process in the classroom directly. Meanwhile, the use of quasi-experimental methods shows a tendency to test the influence of the STAD model on learning outcomes through comparisons between experimental classes and control classes. The pre-experimental method is relatively rarely used because the pre-experimental design does not provide adequate control over external variables, so the ability to compare treatment effectiveness is relatively more limited than quasi-experimental.

Synthesis of the Influence of the STAD Type Cooperative Learning Model on Mathematics Learning Outcomes of Junior High School Students

The synthesis of the 14 selected studies revealed that all of the included research reported a positive effect of implementing the Student Teams Achievement Division (STAD) cooperative learning model on junior high school students' mathematics learning outcomes. Although the studies employed different research designs, mathematics topics, and instructional media, they consistently demonstrated improved learning outcomes following the implementation of STAD. This positive effect was observed across various research designs, including Classroom Action Research (CAR), quasi-experimental, and pre-experimental studies, as well as across different mathematics topics, such as geometry, algebra, and number concepts. These findings indicate that the effectiveness of STAD is not limited to specific research characteristics but remains consistent across various contexts of mathematics learning in junior high schools. The improvement in learning outcomes was reflected in higher mean achievement scores, increased learning mastery, moderate to high N-Gain scores, and statistically significant differences between the experimental and control groups or between pre-implementation and post-implementation conditions.

The findings further indicate that the effectiveness of the STAD cooperative learning model in improving mathematics learning outcomes is closely related to its instructional characteristics, which emphasize collaboration in heterogeneous groups. These findings can be explained by Slavin's cooperative learning theory. According to Slavin, as cited in Risda et al. (2026), the effectiveness of STAD is supported by team study, individual accountability, individual quizzes, and team recognition, all of which encourage every student to actively participate in the learning process. During group discussions, students have opportunities to exchange ideas, assist peers who encounter learning difficulties, and express their opinions, thereby promoting a deeper understanding of mathematical concepts (Patimah et al., 2024). This mechanism is consistent with the findings of the present synthesis, which demonstrate that the implementation of STAD consistently contributes to improving junior high school students' mathematics learning outcomes.

In addition to the characteristics of the STAD model itself, several studies also reported that the use of instructional media, such as puzzles, Card Sort, GeoGebra, Quizizz Paper Mode, and manipulative teaching aids, enhanced students' engagement during the learning process (Arifin et al., 2023; Maulidi, 2022; Sabri et al., 2025; Shalehuddin et al., 2022; Sisdaila et al., 2022; Wulandari & Hasibuan, 2023). These instructional media helped visualize mathematical concepts and created a more engaging learning environment, thereby encouraging students' active participation. Therefore, the improvement in mathematics learning outcomes was influenced not only by the instructional procedures of the STAD model but also by the appropriate use of instructional media that matched the characteristics of the mathematics topics being taught.

Although all of the studies included in this review reported positive findings, the effectiveness of STAD depends on the quality of its implementation. Poorly constructed heterogeneous groups, low levels of participation among group members, and ineffective facilitation of group discussions by teachers may reduce the effectiveness of the STAD cooperative learning model. Furthermore, selecting instructional media and teaching strategies that are not aligned with the characteristics of the mathematics content may limit the achievement of the intended learning objectives. Therefore, teachers should carefully consider students' characteristics, mathematics topics, and group management to maximize the effectiveness of the STAD cooperative learning model.

CONCLUSION

Based on the results of the *Systematic Literature Review* (SLR) of 14 articles, it can be concluded

that research on the application of the *Student Teams Achievement Division (STAD) type cooperative learning model* to mathematics learning outcomes of junior high school students is dominated by research in grade VIII, followed by grade VII, while research on grade IX is still limited. The most studied material is geometry and the most frequently used research method is classroom action research (PTK). The results of the synthesis show that the application of the STAD model consistently has a positive influence on students' mathematics learning outcomes as shown through an increase in average scores, learning completeness, N-Gain scores, as well as significant statistical test results on various research materials and designs. These findings strengthen the evidence that the STAD-type cooperative learning model is one of the effective learning alternatives to improve mathematics learning outcomes of junior high school students.

Theoretically, this study complements the study on the application of the STAD-type cooperative learning model by presenting a synthesis that specifically focuses on the mathematics learning outcomes of junior high school students. Practically, the results of this research can be a reference for mathematics teachers in choosing the appropriate learning model and become a consideration for curriculum developers in encouraging the implementation of student-centered learning. This study has limitations because it only uses articles sourced from *Google Scholar*, in Indonesian, published in the 2021–2025 period, and involves 14 articles that meet the inclusion criteria. Therefore, further research is recommended to expand the search database, involve international articles, use a wider range of publication times, and examine the effectiveness of STAD at the educational level and other learning variables in order to obtain a more comprehensive synthesis.

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