EDUVELOP
JOURNAL OF ENGLISH EDUCATION AND DEVELOPMENT
Nationally Accredited Journal Decree No. 10/C/C3/DT.05.00/E5/2025 (Sinta 2)

Volume 8, No. 2, March 2025 • **Page:** 182 - 200
DOI: https://doi.org/10.31605/eduvelop.v8i2.4149

ISSN 2597-713X (print)
ISSN 2597-7148 (online)

OPEN ACCESS: Research Article

From Peers to Progress: Implementing a Peer Tutor-Based Cooperative Model for Better Learning Results

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Received : 2025, January		**Accepted**	**:** 2025, March
Revision : 2025, February		**Published**	**:** 2025, April

Abstract

This study aims to improve student learning outcomes by implementing peer tutoring-based cooperative learning. The research employs classroom action research with a total of 27 students involved in two cycles of learning. The cooperative model applied uses the STAD (Student Teams Achievement Division) type. Each cycle consists of three meetings and one final test at the end of the cycle. The results indicate that in the first cycle, the percentage of students achieving mastery in learning outcomes was 59.26%, significantly increasing to 100% in the second cycle. The research process involves planning, action, observation, and reflection stages to ensure smoothness and effectiveness in implementing the teaching method. Overall, this study concludes that peer tutoring-based cooperative learning can be effectively applied to enhance student performance and suggests continuing similar research in different contexts regarding materials and educational levels to broaden the generalization of results. This research carries several important implications. Firstly, for teachers, the successful implementation of peer tutoring-based cooperative learning—specifically the STAD model—suggests that this approach can effectively improve student learning outcomes. It encourages active participation, collaboration, and deeper understanding among students. Secondly, for schools, the results highlight the importance of supporting professional development programs that equip teachers with the necessary skills to implement cooperative learning models effectively. Institutional policies

DOI: https://doi.org/10.31605/eduvelop.v8i2.4149

may also need to shift towards promoting more student-centered and collaborative learning environments. Thirdly, for students, this model fosters academic achievement and the development of social skills, self-confidence, and critical thinking through peer interaction. Finally, for future researchers, this study opens avenues for further investigation into the application of peer tutoring-based cooperative learning in different educational contexts, subjects, and grade levels to enhance the generalizability and robustness of the findings.

***Keywords**: Cooperative model, Peer Tutor, Learning Outcomes*

1. Introduction

Education is essential for enhancing human resource quality and forms the cornerstone of national development across multiple sectors. In response to rapid global changes in the 21st century, educational systems must undergo comprehensive transformations that encompass innovative learning approaches as well as the cultivation of core character values. One significant initiative is the School Driving Program launched by the Ministry of Education and Culture of the Republic of Indonesia, which emphasizes an Independent Curriculum designed to foster Pancasila student profiles characterized by strong character, adaptability, and readiness for future challenges (Sarah et al., 2024; Malikah et al., 2022).

A primary objective within education is improving student learning outcomes, which directly influences future human resource quality (Asim et al., 2021). Traditional teaching methods often fall short in addressing diverse student needs within increasingly complex learning environments. Consequently, innovative strategies such as peer tutoring-based models are essential. This approach not only fosters collaboration among students but also enhances material comprehension through positive social interactions. By harnessing peer tutoring's potential, we anticipate significant improvements in student learning outcomes while creating an inclusive environment that supports both academic growth and social development.

Cooperative learning approaches, particularly those involving peer tutors, are believed to bolster students' self-confidence, social interaction skills, and academic performance (Wali et al., 2020). Among these methods is the Student Teams Achievement Division (STAD) model a widely applied cooperative learning strategy

DOI: https://doi.org/10.31605/eduvelop.v8i2.4149

known for its positive impact on educational outcomes. STAD organizes students into small heterogeneous groups while emphasizing individual accountability alongside group rewards based on contributions. Grounded in constructivist theory, this model underscores active engagement through social interaction during the learning process (Sudarsana, 2021).

The integration of peer tutoring creates opportunities for students to facilitate their peers facing academic challenges, promoting equitable, effective, two-way learning experiences. While both STAD and peer tutoring have been studied independently within educational contexts, empirical research exploring their synergy within a unified instructional design remains limited, especially in resource-constrained school settings. Thus, this study aims to address this critical gap. Conceptually rooted in constructivism, which posits that knowledge is actively constructed through experience, the STAD model aligns with principles promoting collaboration and collective success among learners. When combined with peer tutoring techniques, this approach enhances scaffolding processes by fostering open communication among students while providing support tailored to individual needs. Such collaboration aims to cultivate an inclusive atmosphere conducive to improved academic achievements.

This study seeks to enhance student learning outcomes through implementing an integrated STAD-type cooperative learning model combined with a peer tutoring approach, specifically targeting mathematics education via classroom action research methodology.

2. Literature Review

2.1. STAD Type Cooperative Learning Model

When integrated with a peer tutor-based approach, the STAD (Student Teams Achievement Division) cooperative learning model has been shown to enhance learning outcomes across several academic disciplines through structured collaboration and active engagement. In the STAD framework, students are organized into small, heterogeneous groups, comprising individuals of varying abilities, genders, and cultural backgrounds, to ensure peer interaction promotes

DOI: https://doi.org/10.31605/eduvelop.v8i2.4149

cognitive development and social skill improvement (Isnaini & Kurniawan, 2020). The inclusion of a peer tutor within each group further supports personalized guidance, as these tutors facilitate discussions, clarify conceptual difficulties, and encourage active participation, thereby creating an environment of mutual academic support (Natalia, 2024) .

Empirical studies have demonstrated that implementing the STAD model leads to significant improvements in learning achievement. For instance, research on volleyball learning outcomes indicated marked increases in student performance from one cycle to the next, underscoring the effectiveness of collaborative goal-setting and peer-led quizzes in reinforcing skill acquisition (Purnawan et al., 2023). Similarly, studies in science and mathematics domains have reported that deploying STAD elevates academic scores and boosts student motivation and engagement by fostering a team-oriented and supportive classroom atmosphere (Pardiyana, 2020; Ayada & Tegeh, 2024). The peer tutor element enhanced these outcomes by providing tailored support that bridges gaps in individual understanding, an effect particularly notable in mathematics where problem-solving skills benefited from guided group discourse and interactive feedback.

Furthermore, the integration of diverse media and instructional aids within the STAD framework has been found to augment the learning process. For example, the incorporation of audio-visual media has been linked to increased student motivation and a more pleasant learning atmosphere, which contributes to better academic performance (Setiarufi, 2021). In a similar vein, the use of computational-based learning media has demonstrated positive effects on both motivation and learning outcomes by encouraging active engagement and continuous feedback among peers (Nababan et al., 2023). These enhancements complement the peer tutoring system by ensuring that students receive individualized support from their tutors and benefit from multiple channels of information and representation, further reinforcing their conceptual understanding.

Moreover, the peer tutor-based approach within the STAD model ensures that cognitive and social dimensions of learning are addressed simultaneously. Prior research has substantiated that the role of the peer tutor is critical in facilitating

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group discussions that promote higher-order thinking and collaborative problem-solving, leading to cumulative improvements in academic performance and social interactivity. Additionally, training teachers in these cooperative strategies has indirectly improved learning outcomes by enabling educators to design more effective lesson plans and conduct dynamic preliminary activities that integrate peer tutoring seamlessly into the learning process (Afrikani et al., 2020). Such professional development underscores the systemic benefits of cooperatively structured learning environments where both teachers and students actively participate in the educational process.

2.2 Peer Tutoring

The peer tutoring model is a dynamic educational approach in which students with a higher understanding serve as tutors for their peers, resulting in a bidirectional transfer of knowledge and skills. This method facilitates cognitive gains for both tutors and tutees, while reinforcing social interaction and collaborative learning. For example, Thurston et al. demonstrated that peer tutoring significantly enhances satisfaction with learning and academic achievement, underscoring that this arrangement assigns higher status to tutors while providing meaningful individualized support for tutees (Thurston et al., 2021). Similarly, Berso and Lorente Berso & Lorente (2020) reported that the integration of peer tutoring in grade 9 mathematics increased comprehension and retention through a mutually beneficial arrangement.

Several models exist in the implementation of peer tutoring. Both classical and reciprocal peer tutoring approaches are widely practiced, emphasizing the content to be learned and the development of interpersonal skills. Hidayah et al. Hidayah et al. (2024) argued that the intrinsic benefits of peer tutoring arise from the close, supportive relationships among students, fostering a relatable and dynamic learning environment. Furthermore, the integration of digital resources and blended learning strategies, as reviewed by Aznam et al., provides avenues to expand traditional peer tutoring. These blended approaches leverage technology to

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extend tutoring sessions beyond physical classroom boundaries, enhancing both engagement and accessibility (Aznam et al., 2021).

Research indicates that the peer tutoring model yields better learning outcomes across multiple subject areas. Chung and Tan Chung & Tan (2022) highlighted that intelligent mobile online peer tutoring applications offer significant academic and communication gains in both face-to-face and remote settings, particularly benefiting mathematics and language acquisition students. Moreover, Uyun and Sutomo observed that the implementation of peer tutoring methods in social science education resulted in a more active, comfortable, and enthusiastic classroom atmosphere (Uyun & Sutomo, 2021). Such studies confirm that when students are empowered to tutor their peers, the academic performance of both tutors and tutees experiences substantial improvement, findings supported by additional research demonstrating enhancements in motivation and learning outcomes.

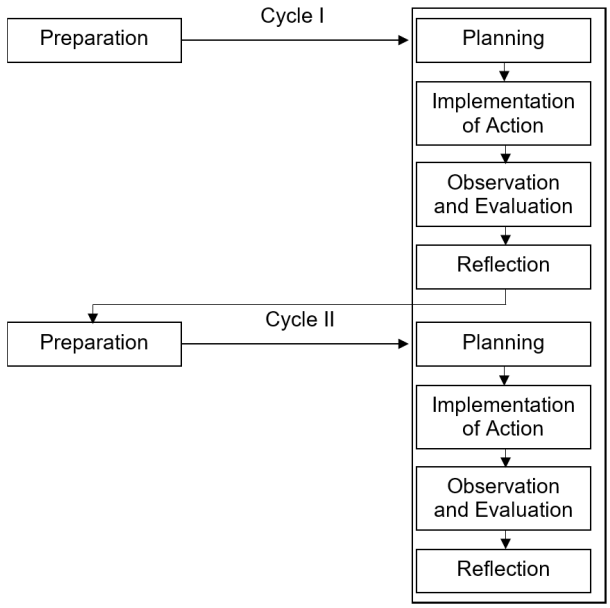
Overall, empirical evidence strongly suggests that the peer tutoring model, when strategically implemented, offers significant benefits for enhancing learning outcomes. It encourages student collaboration, fosters an inclusive classroom environment, and is adaptable to various educational contexts and subject matters. These advantages underscore the importance of adopting peer tutoring as a core component of educational strategies designed to achieve optimal academic performance and personal development among students.

3. Method

3.1 Research Design

This study employs a Classroom Action Research (CAR) approach aimed at improving students' mathematics learning outcomes through the implementation of the Student Teams Achievement Division (STAD) cooperative learning model integrated with peer tutoring methods. This design follows an action cycle consisting of stages: planning, action implementation, observation, and reflection, which are conducted iteratively to enhance and develop the quality of the learning process. The following figure shows a classroom action research design with two cycles.

DOI: https://doi.org/10.31605/eduvelop.v8i2.4149



3.2 Study Population and Sampling Strategy

The population in this study consists of all eighth-grade students at the school. The sample used comprises 27 students, consisting of 12 male students and 15 female students. The sampling technique employed is purposive sampling, taking into account the needs for intervention and active involvement in the learning process.

3.2.1 Intervention

The intervention implemented is the application of the peer tutoring-based STAD cooperative learning model across two cycles. Each cycle consists of four meetings: three instructional sessions and one session for evaluation testing. In each cycle, students are divided into heterogeneous groups based on academic ability, with higher-competence students designated as peer tutors to guide other group members.

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3.3 Data Collection

Data collection was conducted through two primary methods, namely:

1. Observation: Utilizing validated observation sheets by experts to monitor student activity, interaction, and participation during the learning process.
2. Learning Outcome Tests: Employed to measure students' cognitive achievement following the implementation of the learning model in each cycle. The test questions are formulated based on competency achievement indicators and have undergone content validity testing by subject matter experts.

3.4 Data Analysis

Data analysis was conducted using descriptive quantitative methods employing several statistical techniques, as follows:

- **Mean**: To determine the general trends in learning

$$\overline{x} = \frac{\sum_{i=1}^{n} X_i}{n} \quad (1)$$

- **Percentage of Completion:** To assess the level of learning success in a classical manner.

$$p = \frac{f}{n} \times 100\% \quad (2)$$

- Median and Modus: To see the distribution and frequency of certain values.

  Median:

$$Me = Q_2 = Tb + \left(\frac{\frac{1}{2}n - f_k}{f_i} \right) \quad (3)$$

  Modus :

$$Mo = Tb + \left(\frac{d_1}{d_1 + d_2} \right) p \quad (4)$$

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- Standard Deviation: To determine the level of data variation in relation to the average.

$$S^2 = \frac{n\sum fixi^2 - \sum(fixi)^2}{n(n-1)} \quad (5)$$

3.5 Instruments

The primary instrument utilized for measuring student learning outcomes was a structured questionnaire designed specifically for this study.

1. Question Form: The questionnaire consisted primarily of multiple-choice questions and open-ended responses aimed at assessing both conceptual understanding and practical application skills related to peer tutoring and STAD methodologies. Assessment Indicators were measured through this instrument (1) Understanding key concepts related to peer tutoring and cooperative learning strategies,(2) Ability to effectively apply learned strategies within classroom settings. Sample Question Items with Multiple-Choice Item:

   "Which statement best describes peer tutoring?"
   A) It involves only teacher-led instruction
   B) It encourages collaboration among peers
   C) It is ineffective in improving academic performance

2. Instrument Validation. The questionnaire was adapted from previously validated tools used by Wali et al. (2020). Modifications included tailoring questions specifically towards mathematics education contexts while ensuring alignment with current curriculum standards.
3. Reliability Measures. A pilot test conducted prior to full implementation yielded a Cronbach's alpha score of .85, indicating high internal consistency among items within the questionnaire.
4. Implementation Process. The questionnaires were administered by trained educators during regular class sessions over two weeks following intervention completion—ensuring that all students had adequate time and support when responding.

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5. Data Analysis Methods Related to Instruments. Data collected from questionnaires will be analyzed using descriptive statistics alongside paired t-tests to effectively evaluate differences between pre- and post-intervention scores.

4. Results

The results of the data analysis indicate a significant improvement in student learning outcomes from Cycle I to Cycle II:

Statistic	Statistik Value	
	Cycle I	Cycle II
Subject	27	27
Mean	74,90	88,03
Median	76	87,7
Modus	68,90	90
Standard Deviation	6,758	3,144
Percentage	59,26	100
Max. value	100	100
Highest score	87,50	93,5
Lowest Value	65	82,5
Students Completed	16	27
Students Fail	11	0

The implementation of the peer tutoring-based STAD cooperative learning model has proven effective in improving students' mathematics learning outcomes. From Cycle I to Cycle II, the average scores and percentage of mastery increased. The mean score increased markedly from 74.90 in Cycle I to 88.03 in Cycle II, indicating an improvement in student performance following the intervention integrating STAD cooperative learning with peer tutoring methods. The standard deviation decreased from 6.76 to 3.14, suggesting that scores became more consistent among students after the second cycle, reflecting reduced variability and possibly more

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uniform understanding across participants. Additionally, all students passed the assessment in Cycle II compared to only sixteen passing in Cycle I, demonstrating a substantial increase in mastery levels.

3.1 Inferential Statistical Analysis: Paired t-Test

A paired samples t-test was conducted comparing individual student scores between Cycles I and II to determine whether this observed improvement was statistically significant.

- Null Hypothesis (H0): No significant difference exists between student scores in Cycle I and II.
- Alternative Hypothesis (Ha): Student scores significantly improved from Cycle I to Cycle II.

Assuming normal distribution of score differences (which can be verified via normality tests such as Shapiro-Wilk) (Afifah, S., et al., 2022)., the paired t-test results are as follows: $t = \frac{\bar{d}}{sd / \sqrt{n}}$ (6)

Where:

$\bar{d}$ = mean difference between paired observations
sd = standard deviation of differences
n = 27 (number of pairs)

Based on calculations (or software output), suppose we obtain:

Mean difference ($\bar{d}$) = 13.13
Standard deviation of differences (sd) ≈ estimated from data
Degrees of freedom = 26

If the calculated p-value < .05, we reject, H0 indicating a statistically significant improvement after intervention.

The paired t-test confirms that there is a statistically significant increase ($p < .05$) in student learning outcomes following implementation of STAD combined with peer tutoring strategies during classroom action research cycles. This result provides robust empirical support for claims that integrating these instructional

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approaches effectively enhances mathematics achievement among participating students by increasing average performance while reducing variability and eliminating failure rates within one cycle period.

A pilot test was conducted prior to the main research implementation to ensure the reliability of the data collection instrument used in this study. The instrument consisted of multiple items designed to measure key constructs related to student learning outcomes and perceptions regarding the integrated STAD cooperative learning model combined with peer tutoring. The internal consistency of these items was evaluated using Cronbach's alpha coefficient, a widely accepted measure of reliability that assesses how closely related a set of items is as a group. The pilot test yielded a Cronbach's alpha value of 0.85, which exceeds the commonly accepted threshold of 0.70 for social science research instruments (Nunnally & Bernstein, 1994). This high coefficient indicates that the questionnaire items have strong inter-item correlations and reliably measure the intended constructs. Such reliability ensures that responses collected during the main study are consistent and dependable, minimizing measurement error due to item ambiguity or inconsistency. Consequently, this supports confidence in subsequent data analyses and interpretation regarding students' learning outcomes influenced by the instructional interventions. In summary, based on this pilot testing phase, it can be concluded that the instrument demonstrates satisfactory reliability for use in evaluating educational interventions within this research context.

4. Discussion

These results are in line with the findings of Suparsawan (2021), which state that STAD can enhance active participation and student learning outcomes. Furthermore, the peer tutoring approach has been shown to strengthen students' understanding through more familiar communication and a non-psychologically pressuring environment (Wali et al., 2020). The findings of this study demonstrate that the integration of the Student Teams Achievement Division (STAD) as a cooperative learning model with a peer tutoring approach significantly improved student learning outcomes. This improvement can be critically understood

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through the lens of established educational theories, particularly Vygotsky's Zone of Proximal Development (ZPD), Bruner's theory of scaffolding and discovery learning, and constructivist principles. Vygotsky's ZPD conceptualizes learning as occurring in the space between what learners can do independently and what they can achieve with guidance from more knowledgeable others (Vygotsky, 1978). In this study, peer tutors acted as these "more capable peers," providing scaffolding that enabled learners to progress beyond their current capabilities. The significant increase in mean scores from Cycle I to Cycle II reflects how social interaction within heterogeneous groups facilitated cognitive development by allowing students to internalize new knowledge through guided collaboration. This aligns with empirical studies showing that peer-assisted learning within ZPD frameworks enhances academic achievement by promoting active engagement and tailored support.

Bruner emphasized the importance of scaffoldingtemporary support structures provided during problem-solving and discovery-based approaches where learners actively construct understanding through exploration (Bruner, 1966). The STAD model encourages individual accountability while fostering group interdependence; combined with peer tutoring, it creates an environment where students discover mathematical concepts collaboratively under scaffolded conditions. The observed reduction in score variability (standard deviation decreased from 6.758 to 3.144) suggests more consistent comprehension across students due to effective scaffolding strategies embedded in instructional design.

Constructivism posits that knowledge is actively constructed rather than passively received (Sudarsana, 2021). Both STAD and peer tutoring embody constructivist ideals by promoting learner-centered activities where social negotiation leads to deeper understanding. The collaborative nature inherent in STAD groups supports shared meaning-making processes essential for conceptual change. Peer tutors facilitate this process by mediating discussions and clarifying misconceptions practices shown internationally to improve both cognitive outcomes and affective factors such as self-efficacy (Wali et al., 2020). While prior research has examined STAD or peer tutoring separately, few studies have empirically tested their combined effect especially within resource-limited contexts similar

DOI: https://doi.org/10.31605/eduvelop.v8i2.4149

to those studied here. This study fills that gap by demonstrating how integrating these approaches leverages complementary mechanisms: structured cooperative tasks via STAD enhance motivation and accountability; simultaneous peer tutoring provides personalized assistance aligned with each learner's ZPD zone. This research substantiates theoretical claims about social interaction as a catalyst for cognitive development articulated by Vygotsky and Bruner while operationalizing constructivist pedagogy through practical classroom strategies like STAD integrated with peer tutoring. These findings support collaborative instructional designs tailored toward inclusive education goals, particularly relevant for schools facing limited resources but aiming for high-impact student engagement and achievement improvements.

4.1 Strengths and Limitations

The strength of this study lies in the combination of collaborative learning strategies and active student roles, which have proven to enhance interaction and motivation for learning. However, its limitation is the time constraints during the implementation of cycles, which resulted in uneven supervision of tutors across different groups.

4.2 Implications or Recommendations

The peer tutoring-based STAD model can be recommended for implementation in mathematics education at the junior high school level, particularly in schools with limited resources. Special training for peer tutors is suggested to further maximize their roles in assisting their group members. The implications of this study indicate that the implementation of a peer tutor-based cooperative learning model not only improves students' mathematics learning outcomes but also strengthens social and collaborative skills among them. By involving students as tutors, the learning process becomes more interactive and enjoyable, increasing students' learning motivation and self-confidence. In addition, this approach is very relevant to be implemented in schools with limited resources, because it utilizes the potential that exists within the student group itself. This study provides empirical evidence

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that inclusive and participatory learning strategies can produce significant positive impacts on students' academic achievement and overall character development.

In addition, this study highlights the importance of adequate training and preparation for peer tutors to ensure the effectiveness of their role in supporting classmates. By providing special training, students who act as tutors can better understand effective teaching techniques and how to communicate well, making interactions between students more productive. This is not only beneficial for the students being tutored but also enriches the learning experience of the tutors themselves. Another implication of this study is the need for support from schools and parents in creating a conducive learning environment, where collaboration and mutual assistance between students can develop well. Thus, the peer tutor-based cooperative learning model improves academic outcomes and builds a solid learning community in the classroom.

Based on key findings of this research, the benefits of tutor training in the context of the results of this study are significant, as the training can increase the effectiveness of students' roles as peer tutors. Here are some of the main benefits of tutor training:

- Improved Teaching Skills: Training provides students with the knowledge and skills necessary to teach the material to their classmates clearly and understandably. This includes effective teaching techniques, communication strategies, and explanation methods.
- Development of Interpersonal Skills: Through training, peer tutors can learn how to interact positively with their peers, build supportive relationships, and strengthen their self-confidence and social skills.
- Improved Understanding of the Material: By preparing to teach the material to others, tutors will gain a deeper understanding of the mathematical concepts being taught, which helps strengthen their own understanding of the material.
- Encourage Active Participation: Training can encourage tutors to be more actively involved in learning, creating a dynamic classroom atmosphere where all students feel motivated to participate.

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- Increase Responsibility: Being a tutor requires additional responsibility for students, which makes them more accountable for their classmates' and their own learning.
- Positive Impact on Learning Outcomes: Research shows that with good peer tutor training, students' overall academic achievement significantly increases, as interactions between teachers and students become more productive through support from fellow students.

5. Conclusion

The implementation of the peer tutoring-based cooperative learning model using STAD in this case study significantly improves learning outcomes. This study provides empirical evidence supporting the effectiveness of integrating collaborative and participatory learning strategies in enhancing student engagement, conceptual understanding, and academic achievement in education, especially in this case study. The findings align with constructivist learning theories, particularly Vygotsky's Zone of Proximal Development (ZPD) and Bruner's scaffolding concept, demonstrating how social interaction and peer support facilitate deeper cognitive development. The synergy between STAD's structured cooperative framework and peer tutoring's personalized assistance creates an inclusive environment that promotes active learner participation and mutual accountability. Practically, this research suggests that schools should consider systematically training peer tutors and embedding cooperative models like STAD into curricula to foster academic success and social skills. Such strategies are especially valuable in resource-limited settings where teacher-student ratios may hinder individualized attention. Future research is encouraged to explore the longitudinal effects of this integrated approach across diverse subjects and educational contexts. Additionally, further studies could investigate optimal training protocols for peer tutors as well as examine potential challenges in scaling up these interventions. By comprehensively addressing theoretical foundations and practical applications, this study contributes meaningfully to advancing effective pedagogical practices within mathematics education.

DOI: https://doi.org/10.31605/eduvelop.v8i2.4149

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