Enhancing Measurement Education in Schools: A Study on the Efficacy of STAD (Student Teams Achievement Division) in Undergraduate Mathematics Education

Sawitree Ranmechai[1] & Apantee Poonputta[1,*]

[1]Mahasarakham University, Mahasarakham, Thailand

*Correspondence: Mahasarakham University, Mahasarakham, Thailand. E-mail: oomsin.putta@gmail.com

Abstract

This study examines the effectiveness of the Student Teams Achievement Division (STAD) cooperative learning technique in enhancing the teaching skills of mathematics pre-service teachers in the context of school-level measurement. The primary objectives were to assess the impact of STAD on learning achievement related to measurement concepts and to investigate the learning experiences of participants. Employing a one-group pre-post test design, 25 mathematics education major students in a Thai public university engaged in STAD activities. The instruments were a set of learning activities designed using the principles of STAD (Student Teams Achievement Division), learning achievement test, and a satisfaction questionnaire. The results reveal that STAD significantly improved learning achievement and generated highly satisfactory learning experiences among the participants. Academic and pedagogical recommendations are made, while acknowledging limitations related to the need for qualitative data collection and the exploration of teaching evaluation assessments in future research. This study underscores the potential of STAD as a valuable tool in teacher preparation programs, contributing to the development of effective educators.

Keywords: STAD, collaborative learning, teacher education

1. Introduction

The utilization of cooperative learning methodologies in contemporary teacher education is advantageous (Laal & Laal, 2012). This program facilitates the acquisition of teamwork skills among aspiring educators, enabling them to effectively collaborate with their peers in order to achieve educational objectives by leveraging the unique abilities and strengths of each team member. One of the established strategies is the Student Teams Achievement Division (STAD) technique. The technique entails the organization of students into small teams or groups, with each team deliberately composed of individuals possessing varying levels of abilities (Slavin, 2008). These teams collaborate in order to facilitate mutual learning and accomplish shared educational goals.

Moreover, the utilization of STAD has demonstrated its efficacy as a pedagogical strategy in fostering diverse teaching competencies among educators, notably within the realm of mathematics instruction (Rattanatumma & Puncreobutr, 2016). This collaborative learning technique not only improves teachers' abilities in classroom management but also develops their capacity to efficiently oversee classroom activities. In addition, the implementation of the approach facilitates the cultivation of successful instructional methodologies, hence enabling pre-service teachers with the necessary skills and resources to proficiently deliver mathematics curriculum. Through engaging in collaborative work with diverse student teams, instructors are able to enhance their own comprehension of mathematical concepts (Hermawan et al., 2020). This heightened understanding then equips them with the ability to effectively transmit this information to their students. The focus of STAD on promoting active student involvement, peer support, and individual accountability renders it a potent instrument in cultivating comprehensive and proficient mathematics educators capable of facilitating significant learning encounters within the classroom (Maelasari & Wahyudin, 2017).

Measurement is undeniably a crucial topic in school-level mathematics education. At the contextual level, the significance of this subject is further underscored by its inclusion in the core curriculum at both the primary and

secondary school levels of Thai education (The Ministry of Education, 2008). With various measurement-related topics integrated into the curriculum, mathematics teachers in the Thai educational context face the imperative of honing their abilities to effectively teach these topics. The ability to instruct students in measurement not only equips them with fundamental mathematical skills but also cultivates their practical problem-solving abilities, which are essential for everyday life. Hence, in Thailand's educational landscape, the development of teachers' proficiency in teaching measurement is pivotal for ensuring that students acquire a strong foundation in mathematics and its real-world applications.

However, despite the importance of measurement in Thai mathematics education, it has been observed that this topic can pose significant challenges for both students and educators. Learning measurement can be daunting for students due to its abstract nature and the need for precise understanding and application of units, conversions, and various measurement tools. The intricate concepts involved, such as area, volume, and units of measurement, often demand a higher level of cognitive engagement from learners (Karali, 2022). From a teacher's perspective, imparting the skill of teaching measurement can also be a formidable task (Golding, 2018). This difficulty arises primarily because measurement requires a multifaceted approach that goes beyond theoretical instruction. Teachers must find effective ways to bridge the gap between abstract mathematical concepts and practical, real-world applications, which can be challenging for students to grasp. Additionally, tailoring instruction to meet the diverse learning needs of students in a classroom setting can be complex, particularly when addressing measurement-related misconceptions and fostering a deep and lasting understanding of the topic. Therefore, while measurement is a vital component of the curriculum, it presents both learners and educators in Thailand with substantial hurdles in the pursuit of mathematical proficiency.

In light of these challenges surrounding the teaching and learning of measurement in Thailand's mathematics education, utilizing the STAD technique may offer a promising solution. The collaborative nature of STAD fosters a dynamic learning environment where mathematics pre-service teachers can engage with measurement concepts not only theoretically but also through practical, real-world applications. By working together within diverse teams, they can benefit from peer support, clarify doubts, and collectively explore different problem-solving strategies, thus gaining a deeper understanding of measurement. Therefore, the current study leveraged the STAD technique within the context of a measurement teaching course for mathematics education students at school levels. The primary objectives were to assess the effectiveness of STAD in enhancing students' learning achievements in measurement and to gauge their satisfaction with this cooperative learning approach. Through this research, we aim to shed light on the potential of STAD as a valuable pedagogical tool in addressing the challenges posed by the teaching and learning of measurement in Thailand's mathematics education landscape.

2. Theoretical Framework

2.1 Collaborative Learning and Teacher Education

In the realm of teacher education, collaborative learning stands as a cornerstone, imparting invaluable lessons to aspiring educators. Central to this pedagogical approach is the cultivation of teamwork—a skill that transcends the classroom walls and takes center stage in the realm of teaching (Musanti & Pence, 2010). Through collaborative learning experiences, student teachers come to realize that cooperation among educators is not merely a beneficial attribute but an absolute necessity for creating a nurturing and productive learning environment. These shared endeavors underscore the profound impact of teamwork on not only individual professional growth but also the collective success of educational communities. Within the context of collaborative learning, student teachers are provided with a unique platform for in-depth discussions with their peers. These dialogues encompass a broad spectrum of topics, ranging from classroom management strategies to innovative instructional techniques (Methlagl, 2022). These exchanges serve as a crucible for refining understanding about classroom dynamics, student behavior, and the complex interplay of factors that shape the educational landscape. By leveraging the collective wisdom of their fellow student teachers, individuals can gain a more comprehensive and nuanced understanding of the multifaceted nature of teaching, which is indispensable as they embark on their own teaching journeys. Moreover, collaborative learning empowers student teachers to embark on an expedition of skill development (Burton, 2015). It offers them a supportive and reflective environment to experiment with various teaching approaches, receive constructive feedback, and fine-tune their instructional methods. This iterative process is not merely about acquiring pedagogical proficiency but also instilling a sense of adaptability and perpetual growth—a hallmark of effective educators. The collaborative setting fosters a culture of continuous improvement, nurturing student teachers' ability to respond adeptly to the evolving needs of their future students.

2.2 STAD (Student Teams Achievement Division)

STAD (Student Teams Achievement Division) is a cooperative learning strategy that fosters collaborative engagement among students to achieve common learning goals (Slavin, 1995). In STAD, students are organized into diverse teams, each consisting of members with varying levels of ability. The strategy revolves around shared learning experiences, where students work together to understand and master subject matter (Slavin, 1994). According to Slavin (2008), four-step processes are included in the STAD technique. The idea is to involve students working in small teams to learn and master academic content.

Step 1: The teacher presents the new material to the class.

Step 2: The students break into small teams and work together to learn and master the material.

Step 3: Each student takes a quiz individually.

Step 4: The students' quiz scores are used to determine their team's score. Teams with higher scores are rewarded.

The benefits of STAD are rooted in cognitive theory, which posits that active engagement and participation in the learning process enhances retention and understanding. When students collaborate within heterogeneous teams, they are exposed to multiple perspectives and problem-solving approaches (Khansir & Alipour, 2015). Furthermore, STAD aligns with sociocultural theory, emphasizing the role of social interaction in the learning process. By working collaboratively, students construct shared knowledge, drawing from their collective experiences. In the context of collaborative learning, STAD underscores the importance of cooperation and teamwork. It encourages students to take ownership of their learning and provides a space for peer support, which enhances self-efficacy and motivation (Handayani et al., 2017).

2.3 Previous Studies

Numerous studies (e.g. Ardiyani, Gunarhadi, & Riyadi, 2018; Baydar & Şimşek, 2018; Kurniati, Mujahidin, Suciari, Hestari, & Susilo, 2021; Okumus, Özdilek, & Arslan, 2020; Rattanatumma & Puncreobutr, 2016; Syakur & Sabat, 2020; Yusuf, Natsir, & Hanum, 2015) have investigated the effectiveness of the Student Teams Achievement Division (STAD) technique in teacher education, and their findings collectively underscore its efficacy. For instance, Ardiyani et al. (2018) demonstrated that STAD, when compared to other cooperative learning models, can yield superior learning outcomes, emphasizing its potency in enhancing students' learning activities. Yusuf et al. (2015) showcased the adaptability of STAD in EFL (English as a Foreign Language) classrooms, emphasizing the teacher's role in customizing the technique to suit the unique needs of students. Syakur and Sabat (2020) reported significant improvements in preservice teachers' TOEFL scores through the application of STAD and PBL (Problem-Based Learning), highlighting its impact on language learning outcomes. Rattanatumma and Puncreobutr (2016) discovered that STAD outperformed other teaching methods in improving mathematics learning achievement and problem-solving abilities among undergraduate students. Kurniati et al. (2021) successfully combined STAD with a competitive game to enhance communication and collaboration skills among mathematics pre-service teachers. Finally, Baydar and Şimşek (2018) found that STAD was more effective than the jigsaw method in enhancing academic achievement among social studies pre-service teachers.

Therefore, the Student Teams Achievement Division (STAD) appears to be a beneficial approach for teacher education. In the field of mathematics education, there exists a scarcity of research studies dedicated to this particular subject matter. The present study aims to utilize the STAD technique as a means to instruct pre-service mathematics instructors in pedagogical techniques related to the theme of measurement at a school level. This would have a positive impact on the field, as it would expand the applicability of the technique in enhancing teaching abilities, as opposed to focusing solely on improving working skills, as observed in the study conducted by Kurniati et al. (2021). As a result, the primary objectives of this study were twofold: firstly, to examine the impact of the Student Teams Achievement Division (STAD) collaborative technique on the learning achievement of pre-service teachers in the domain of school level measurement; and secondly, to assess the level of satisfaction among participants regarding their learning experience with the STAD approach.

3. Methodology

3.1 Research Design

The present study is designed as a one-group pre-posttest research design. In this research approach, a single group of pre-service teachers in a mathematics education program underwent both a pre-test assessment to establish their baseline measurement teaching skills and a post-test assessment following an intervention involving the

implementation of the Student Teams Achievement Division (STAD) collaborative technique. This design allows for the evaluation of any changes or improvements in the participants' teaching skills related to measurement topics.

3.2 Participants

The study's participants consist of 25 mathematics pre-service teachers enrolled in a public university in Thailand. These participants were selected using a cluster random sampling method from a population of 90 mathematics pre-service teachers who met the study's criteria. All participants are at the second year of a four-year curriculum in their teacher education program, positioning them at an intermediate stage of their teacher preparation journey. Additionally, it's noteworthy that all participants have received their primary and secondary education in regular Thai public schools. This educational background helps ensure a common foundation in Thai educational practices and curriculum, contributing to the homogeneity of the sample. None of the participants reported having prior teaching experience abroad. Ethical considerations were of paramount importance throughout the study. Participants were informed about the research process, the purpose of data collection, and the nature of their involvement in the study. Importantly, it is emphasized that the data collected did not impact their grades or academic standing in any way, ensuring that their participation was voluntary and without any coercive influence.

3.3 Instruments

3.3.1 STAD (Student Teams Achievement Division)

The primary instrument employed in this study is the Student Teams Achievement Division (STAD), a cooperative learning technique designed in accordance with the principles outlined by Slavin (1971). The STAD activities were specifically structured to impart knowledge of measurement topics, as outlined in the Thai school curriculum, to mathematics pre-service teachers. These topics encompass teaching measurement concepts at various grade levels, including Grades 1 through 6, 8, 9, and 11, while excluding Grades 7, 10, and 12, as these levels do not include measurement in their mathematics coursework.

The STAD activities are organized into four distinct steps:

Step 1: The teacher presents new material related to measurement to the entire class.

Step 2: Subsequently, students divide into small teams, collaborating to collectively comprehend and master the presented material.

Step 3: Following the group learning phase, each student individually takes a quiz, assessing their understanding of the measurement concepts.

Step 4: Team performance is evaluated based on the individual quiz scores, with teams achieving higher scores receiving rewards.

To ensure the quality and appropriateness of the instrument, the activity plan underwent rigorous evaluation by three scholars and experts in the field of mathematics education. Their consensus revealed a high level of appropriateness, with a mean rating of 4.83 out of 5, affirming the effectiveness and relevance of the STAD activities in teaching measurement concepts to mathematics pre-service teachers.

3.3.2 Learning Achievement Test

The purpose of the test is to assess the participants' level of learning achievement in the area of measurement instruction. The assessment consists of two components: a multiple-choice section of 30 items, resulting in a total of 30 points; and a written section consisting of 5 things, each worth 4 points, contributing to a total of 20 points. Hence, the maximum score is equivalent to 50 points. In order to conduct an item analysis, a content validity test was administered using the Index of Item Objective Congruence (IOC) with the participation of three experts. The purpose of this test was to assess the extent to which the multiple-choice items were congruent with the intended content. The IOC (Index of Coincidence) for each item is 1.00. The level of difficulty can be calculated by subtracting 0.80 from 0.42. The level of discrimination, as measured by the range of scores between 0.23 and 0.77. The reliability of the test, assessed using the Lovett reliability method, is determined to be 0.91. The written test item's IOC is 1.0, indicating a strong alignment between the item and the intended learning objective. The difficulty level of the item falls within the range of 0.73 to 0.77, suggesting that it is moderately challenging for test takers. The discrimination index, which measures the item's ability to differentiate between high and low performers, ranges from 0.25 to 0.43, indicating a moderate to high discriminatory power. Additionally, the test item demonstrates a satisfactory level of internal consistency, as indicated by Cronbach's alpha reliability coefficient of 0.78.

3.3.3 Satisfaction Questionnaire

This questionnaire is designed to measure satisfaction with the implementation of the STAD (Student Teams Achievement Division) cooperative learning approach in teaching measurement topics in mathematics at the school level. It employs a Likert scale with 5 levels, in accordance with the method of Likert. There are a total of 10 items in the questionnaire, which were presented to three experts in the field for content validation. The results indicated an The IOC of 1.00 for all 10 items, demonstrating their high content validity.

3.4 Data Collection and Data Analysis

The data was gathered during the second semester of the school year 2022. The participants completed a pre-test, engaged in a learning activity, and then completed a post-test. Subsequently, the participants completed a satisfaction questionnaire. The study justifies its conclusions by utilizing a comparison of pre and posttest scores, as well as an interpretation of the questionnaire. The data underwent descriptive statistical analysis, and a paired-samples t-test was utilized to identify differences in pre and post-test scores. In the case of questionnaire data, mean scores were assessed against the following satisfaction level criteria: 1.00 – 1.49 denoting a very low satisfaction level, 1.50 – 2.49 representing a low satisfaction level, 2.50 – 3.49 indicating a moderate satisfaction level, 3.50 – 4.49 signifying a high satisfaction level, and 4.50 – 5.00 corresponding to a very high satisfaction level.

4. Result

The data from both the pretest (p=.2) and posttest (p= .157) measurements exhibit a normal distribution test by Kolmogorov-Smirnova. Consequently, to assess the significance of the differences between these paired measurements, a paired-samples t-test, a parametric statistical method, was employed in this study.

Table 1. The Participants' Learning Achievement before and after the STAD Technique

	Fullmark	Mean	SD	t-test	p
Pretest	50	9.16	2.51	55.21*	.00
Posttest	50	44.44	3.84		

*p<.05

The results of the study indicate the positive effects of the STAD technique on participants' learning achievement of teaching measurement. A paired samples t-test indicate the significant difference between the average score of posttest ($\bar{x}$ = 44.44. S.D = 3.84) and pretest ($\bar{x}$ = 9.16. S.D = 2.51), *t=55.21, p= 0.00*. It could be observed that, from initially having very little knowledge about teaching measurement, STAD has effectively enabled them to develop a strong understanding of the topic.

Table 2. The Participants' Satisfaction with the STAD Technique

	Question items	Mean	SD	Interpretation
1	Students are actively involved in learning activities.	4.92	0.29	Very high satisfaction
2	Learning activities encourage students to express themselves.	4.58	0.67	Very high satisfaction
3	Students collaborate with their peers in group work.	4.83	0.39	Very high satisfaction
4	Activities promote students' willingness to listen to others' opinions.	4.75	0.45	Very high satisfaction
5	Learning activities enhance students' understanding of the content.	4.33	0.78	High satisfaction
6	Learning activities foster teamwork.	4.67	0.49	Very high satisfaction
7	Activities promote positive relationships with peers.	4.83	0.39	Very high satisfaction
8	There is diversity in teaching materials.	4.67	0.49	Very high satisfaction
9	Teaching materials align with the activities.	4.75	0.45	Very high satisfaction
10	Grading in activity assessment is fair and impartial.	4.75	0.45	Very high satisfaction
	Overall	4.71	0.51	Very high satisfaction

The results indicate that the participants expressed a very high level of satisfaction ($\bar{x}$ = 4.71, S.D = 0.51) with the STAD approach. They believed that it facilitated their learning about teamwork, providing them with rewarding

learning experiences and enabling them to enhance their knowledge of teaching measurement using the STAD method.

5. Discussion

The results of the study underscore the effectiveness of the STAD (Student Teams Achievement Division) method in enhancing the teaching skills of pre-service teachers in the context of school-level measurement. These findings align with prior research studies (e.g. Ardiyani, Gunarhadi, & Riyadi, 2018; Baydar & Şimşek, 2018; Kurniati, Mujahidin, Suciari, Hestari, & Susilo, 2021; Okumus, Özdilek, & Arslan, 2020; Rattanatumma & Puncreobutr, 2016; Syakur & Sabat, 2020; Yusuf, Natsir, & Hanum, 2015) that has consistently highlighted the efficacy of the STAD technique in teacher education.

One of the key reasons behind the effectiveness of the STAD method in developing teachers' skills lies in its emphasis on cooperative learning. By organizing students into diverse teams and encouraging collaborative problem-solving and knowledge sharing, STAD fosters an environment where participants actively engage with the subject matter. This collaborative dimension aligns with both cognitive and sociocultural learning theories, promoting critical thinking, dialogue, and social interaction as essential components of the learning process (Slavin, 1971).

Moreover, the satisfaction expressed by the participants regarding the STAD method can be attributed to several factors. Firstly, the STAD approach promotes active student engagement and participation. Through group activities and individual assessments, participants are given opportunities to take ownership of their learning, contributing to a sense of autonomy and responsibility. Secondly, the technique's ability to provide satisfying learning experiences stems from its student-centered nature. It tailors the learning process to accommodate diverse learning styles and preferences, accommodating both individual and collective growth. Lastly, the measurable improvement in the participants' teaching skills regarding measurement topics underscores the tangible benefits of the STAD method, reinforcing their satisfaction.

Therefore, this study corroborates previous research by affirming the effectiveness of the STAD technique in teacher education, particularly in the context of teaching measurement at the school level. The success of STAD can be attributed to its alignment with well-established learning theories and its capacity to create a dynamic, student-centric learning environment. The participants' high level of satisfaction further attests to the method's ability to deliver engaging and rewarding learning experiences while enhancing their teaching skills. These findings emphasize the potential of the STAD method as a valuable tool in teacher preparation programs, contributing to the development of effective educators.

6. Conclusion

The primary objectives of this study were to examine the effects of implementing the STAD (Student Teams Achievement Division) technique on the learning achievement of mathematics pre-service teachers regarding the teaching of measurement concepts at the school level and to investigate the learning experiences associated with this technique. The STAD technique was applied to a class of 25 mathematics education major students enrolled in a public university in Thailand. The study's outcomes reveal that the implementation of STAD was highly effective, resulting in improved learning achievement and fostering highly satisfactory learning experiences among the participants.

From an academic and pedagogical standpoint, the findings of this study offer valuable insights. Firstly, it is recommended that teacher education programs consider the incorporation of the STAD technique as a pedagogical tool to enhance the teaching skills of pre-service teachers, particularly in mathematics education. Secondly, further research is encouraged to explore the applicability of the STAD method across various subjects and educational contexts to assess its broader impact.

Despite the valuable insights gained from this study, certain limitations should be acknowledged. Notably, the research primarily relied on quantitative data, with limited qualitative data collection. Future studies may benefit from incorporating interviews or focus group discussions to delve deeper into the participants' experiences and provide a richer understanding of how learning occurs within the STAD framework. Additionally, the study did not explore teaching evaluation assessments, which could reveal interesting facets of investigation, such as the effectiveness of the STAD method in real-world classroom settings and its impact on student performance. These limitations suggest avenues for further research and exploration in the realm of cooperative learning techniques and

their implications for teacher education.

References

Ardiyani, S. M., Gunarhadi, & Riyadi. (2018). Realistic Mathematics Education in Cooperative Learning Viewed from Learning Activity. *Journal on Mathematics Education*, *9*(2), 301-310. https://doi.org/10.22342/jme.9.2.5392.301-310

Baydar, A., & Şimşek, U. (2018). *The impact of Jigsaw and STAD on social studies pre-service teachers' academic achievement*. Retrieved from http://openaccess.artvin.edu.tr/xmlui/handle/11494/2582

Burton, T. (2015). *Exploring the impact of teacher collaboration on teacher learning and development* [Doctoral Dissertation]. University of South Carolina - Columbia.

Golding, J. (2018). Mathematics education in the spotlight: Its purpose and some implications. *London Review of Education*, *16*(3), 460-473. https://doi.org/10.18546/LRE.16.3.08

Handayani, S., Purwaningsih, Y., & Murtini, W. (2017, October). *The Application of STAD Cooperative Learning Using Picture as the Media to Improve Students' Learning Outcomes and Motivation in Learning Social Science*. 650-659. Atlantis Press. https://doi.org/10.2991/ictte-17.2017.74

Hermawan, C. M., Rosfiani, O., Suheti, & Susanti, S., F. (2020). STAD type cooperative learning model: An action in learning mathematics. *International Journal of Scientific & Technology Research*, *9*(4), 1871-1875.

Karali, Y. (2022). Difficulties Classroom Teachers Encounter in Teaching Mathematics: A Phenomenological Study. *International Journal of Progressive Education*, *18*(5), 75-99. https://doi.org/10.29329/ijpe.2022.467.5

Khansir, A., & Alipour, T. (2015). The Impact of Students Team Achievement Divisions (STAD) on Iranian EFL Learners' Listening Comprehension. *Theory and Practice in Language Studies*, *5*(8), 1710. https://doi.org/10.17507/tpls.0508.23

Kurniati, E., Mujahidin, A., Suciari, N. K. D., Hestari, S., & Susilo, H. (2021). STAD-jeopardy games: A strategy to improve communication and collaboration skills' mathematics pre-service teachers. *AIP Conference Proceedings*, *2330*(1), 040015. https://doi.org/10.1063/5.0043170

Laal, M., & Laal, M. (2012). Collaborative learning: What is it? *Procedia - Social and Behavioral Sciences*, *31*, 491−495. https://doi.org/10.1016/j.sbspro.2011.12.092

Maelasari, E., & Wahyudin. (2017). Effects of Cooperative Learning STAD on Mathematical Communication Ability of Elementary School Student. *Journal of Physics: Conference Series*, *895*(1), 012090. https://doi.org/10.1088/1742-6596/895/1/012090

Methlagl, M. (2022). Patterns of teacher collaboration, professional development and teaching practices: A multiple correspondence analysis of TALIS 2018. *International Journal of Educational Research Open*, *3*, 100137. https://doi.org/10.1016/j.ijedro.2022.100137

Musanti, S. I., & Pence, L. (2010). Collaboration and Teacher Development: Unpacking Resistance, Constructing Knowledge, and Navigating Identities. *Teacher Education Quarterly*, *37*(1), 73-89.

Okumus, S., Özdilek, Z., & Arslan, A. (2020). The Effect of Cooperative Learning Methods and Individual Learning Method on Pre-Service Science Teachers' Sub-Micro Level Conceptual Understanding at Equilibrium Chemistry. *Educational Policy Analysis and Strategic Research*, *15*(3), 394-425. https://doi.org/10.29329/epasr.2020.270.19

Rattanatumma, T., & Puncreobutr, V. (2016). Assessing the Effectiveness of STAD Model and Problem Based Learning in Mathematics Learning Achievement and Problem Solving Ability. *Journal of Education and Practice*, *7*(12), 194-199.

Slavin, R. (1994). *A Practical Guide to Cooperative Learning*. Allyn and Bacon.

Slavin, R. E. (1995). *Cooperative Learning: Theory, Research and Practice* (2nd ed.). Pearson.

Slavin, R. E. (2008). Cooperative learning, success for all, and evidence-based reform in education. *Éducation et Didactique*, *2*(2), 149-157. https://doi.org/10.4000/educationdidactique.334

Syakur, A., & Sabat, Y. (2020). The Effectiveness of Coopertative Learning (STAD and PBL type) on E-learning Sustainable Development in Higher Education. *Journal of Development Research*, *4*(1), 53-61. https://doi.org/10.28926/jdr.v4i1.98

The Ministry of Education. (2008). *The basic education core curriculum*. The Ministry of Education.

Yusuf, Y. Q., Natsir, Y., & Hanum, L. (2015). A Teacher's Experience in Teaching with Student Teams-Achievement Division (STAD) Technique. *International Journal of Instruction*, *8*(2), 99-112. https://doi.org/10.12973/iji.2015.828a

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Sciedu Press.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.