Journal of Education and Learning; Vol. 13, No. 1; 2024
ISSN 1927-5250 E-ISSN 1927-5269
Published by Canadian Center of Science and Education

The Development of the Ability to Solve Mathematical Problems and Academic Achievement Decimal Problem of Prathomsuksa6 Students Through Cooperative Learning Management STAD and KWDL Technique

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Received: August 15, 2023 Accepted: December 10, 2023 Online Published: January 20, 2024

doi:10.5539/jel.v13n1p150 URL: https://doi.org/10.5539/jel.v13n1p150

Abstract

The research aimed to achieve the following objectives: 1)Assess the effectiveness of cooperative learning management utilizing the STAD technique and KWDL technique among PrathomSuksa6 students in solving decimal problems, with a target of achieving a 75/75 criterion. 2) Enhance the problem-solving abilities of grade 6students in mathematics by implementing cooperative learning management using the combined STAD technique and KWDL technique, compared to a 75 percent criterion. 3) Improve the learning achievement in mathematics of grade 6 students in solving decimal problems through cooperative learning management, employing the STAD technique and KWDL technique, in line with a 75 percent criterion. The research was conducted with a selected group of 33 students from Prathomsuksa6/1, first semester, academic year 2022, at Ban Chiang Yuen School. The research tools employed were: 1) a cooperative learning plan incorporating the STAD and KWDL techniques, 2) a mathematics problem-solving ability test, and 3) a mathematics learning achievement test. Data analysis involved the use of percentage, mean, standard deviation, and efficiency (E1/E2).

The findings of the study indicated the following: Cooperative learning management using the STAD technique and KWDL technique exhibited an efficiency of 76.14/75.45, satisfying the 75/75 criterion. The average mathematics score post-intervention was 75.76 percent, surpassing the 75 percent criterion. Mathematics learning achievement, as measured by the average score post-intervention, reached 75.45 percent, fulfilling the 75 percent criterion.

Keywords: cooperative learning management, STAD technique, KWDL technique, problem-solving ability, learning achievement

1. Introduction

The researcher intends to improve students' problem-solving skills and overall mathematics achievement by introducing cooperative learning activities and techniques. The focus is on a learner-centered approach that tailor's education to individual students, allowing them to progress at their own pace.

The average scores of students in Maha Sarakham Province, Thailand, in the basic national educational test (O-NET) for mathematics were found to be lower than the national average. This highlights the need for interventions to enhance students' mathematics learning achievements in the province.

Cooperative learning, particularly in mathematics education, is seen as a suitable approach. It involves students collaborating in groups comprising members of different abilities. This collaborative setting encourages mutual learning through engaging in various mathematical problems. Specifically, the Student Teams Achievement Division (STAD) technique is employed, which emphasizes students helping each other.

To facilitate the problem-solving process, the researcher suggests utilizing the KWDL technique, which stands for "Know, Want to know, Did, and Learned." This technique guides students to reflect on their existing

knowledge, identify what they need to learn or explore, engage in problem-solving activities, and reflect on their acquired knowledge.

The researcher aims to employ cooperative learning activities, specifically utilizing the STAD technique and KWDL technique, to enhance grade 6 students' proficiency in solving decimal problems and improve their overall mathematics achievement. This choice is motivated by the understanding that mathematics plays a crucial role in the 21st-century learning environment, fostering creativity, logical thinking, systematic analysis, and problem-solving skills. Moreover, mathematics finds practical applications in various real-life situations and continues to gain significance with the advancements in economics, social sciences, and technology.

In conclusion, the proposal suggests the implementation of cooperative learning activities, particularly employing the STAD technique and KWDL technique, to enhance grade 6 students' problem-solving abilities and mathematics achievement. This approach aligns with the belief that effective mathematics education should continuously adapt to meet the demands of the 21st century and the rapid progress in diverse fields.

2. Literature Review

Subject research the development of the ability to solve mathematical problems and academic achievement decimal problem of Prathomsuksa6 students through cooperative learning management STAD and KWDL technique, the researcher reviewed relevant documents and research. Summarized and presented in order as follows:

2.1 Mathematics Learning Management

In the realm of mathematics education, the principle proposed by Siriporn Thipkong in 2002 offers a guiding light for educators seeking to nurture a deep understanding and appreciation for the subject. Thipkong's principle emphasizes the importance of teaching mathematics by gradually moving from the concrete to the abstract, starting with what is familiar to students before delving into more distant concepts. This composition explores the key aspects of this teaching approach, which involves logical sequencing, the integration of humor, psychological insights, and motivational techniques.

In the realm of mathematics education, Amporn Makanong's (2003) important teaching principles shed light on effective strategies to foster conceptual understanding, engage learners actively, and create a joyful learning environment. This composition delves into the core principles outlined by Makanong, emphasizing the significance of promoting critical thinking, utilizing concrete examples, considering the learning process, connecting mathematics to real-life contexts, and assessing student progress through interactive methods.

The article summarizes the good principles for teaching mathematics proposed by the Institute for the Promotion of Teaching Science and Technology in 2012. These principles are as follows: Teaching mathematics is a crucial task that requires thoughtful strategies to ensure students' understanding and engagement. The Institute for the Promotion of Teaching Science and Technology has put forth nine good principles to guide educators in this endeavor.

Firstly, active student participation is key. By involving students in the learning process, they can witness the reasoning behind mathematical concepts, leading to improved comprehension and appreciation. Secondly, learning should align with students' developmental stage. When mathematics content is appropriately tailored to their level, it becomes enjoyable and captivating, fostering a positive learning environment. Recognizing that learning builds upon preexisting knowledge is another important principle. Teachers should systematically build upon students' existing understanding, ensuring a smooth progression and deeper comprehension of mathematics. Communication plays a vital role in mathematics education. Encouraging students to communicate with their peers through discussions, writing, and active participation in class activities enhances their understanding and ability to articulate mathematical ideas. Asking good questions is a powerful tool for promoting learning. By allowing students to ask and answer questions, they actively engage with the material, deepening their understanding and critical thinking skills. Integrating practical media into teaching helps students grasp mathematical concepts. By utilizing various concrete materials and practical examples, educators make the abstract nature of mathematics more tangible, enabling students to grasp complex ideas more easily. Metacognition, or self-reflection, plays a crucial role in students' mathematical development. By encouraging students to reflect on their thinking processes and behaviors, they gain the ability to monitor, control, and improve their mathematical skills. Teachers' attitudes greatly influence students' perception of mathematics. A positive and enthusiastic approach to teaching and learning fosters a conducive atmosphere, where students develop a positive attitude and enthusiasm towards mathematics. Lastly, recognizing that experiences can impact students' anxiety towards mathematics is important. Teachers should help alleviate or reduce anxiety, creating a

supportive environment where students feel comfortable and confident in tackling mathematical challenges. By incorporating these principles into mathematics education, teachers can create an engaging and effective learning experience, promoting student understanding, confidence, and positive attitudes towards mathematics.

From the study of relevant documents, it can be concluded that mathematics learning activities should be structured in a way that moves from the concrete to the abstract. This means starting with tangible, real-world examples and gradually introducing more abstract concepts. By beginning with familiar and relatable scenarios, students can grasp the fundamental concepts before moving on to more complex mathematical ideas. Furthermore, it is crucial to sequence learning activities in a manner that progresses from easy to difficult, allowing students to build confidence and gradually tackle more challenging problems. This step-by-step approach enables students to develop a solid foundation in mathematics and fosters a sense of accomplishment as they conquer each level of difficulty. Additionally, effective mathematics learning management takes into account students' prior experiences and basic knowledge. Recognizing their existing understanding of mathematics ensures that instruction is appropriately scaffolded and builds upon their existing skills. By relating new concepts to familiar ones, students can connect the dots and deepen their comprehension of mathematical principles.

2.2 Cooperative Learning

Cooperative learning management, as defined by Suwit Moonkham and OrathaiMoonkham (2002), is a dynamic learning process that fosters collaboration among learners. By forming small groups comprising individuals with diverse abilities, this approach encourages structured cooperation, where opinions are shared, and mutual assistance is provided. It emphasizes both personal and collective responsibility, enabling each group member to contribute towards achieving set goals. Tisana Khamanee (2010) adds that cooperative learning involves small groups consisting of approximately 3 to 6 members with varying abilities, all working together to facilitate learning and accomplish group objectives. This method recognizes the significance of interpersonal relationships among learners, an aspect often overlooked in traditional teaching and learning practices. Research indicates that students' attitudes towards themselves, their peers, teachers, and the overall learning environment profoundly impact the learning process.

According to the Office of Academic and Processing at Roi Et Rajabhat University (2013), cooperative learning management in educational settings aims to foster collaboration among students, encouraging active participation and coordination to achieve subject-specific learning outcomes. By organizing learners into small groups based on their abilities, including those who excel, perform at an average level, or struggle academically, students assume responsibility for their own learning while supporting and assisting their peers. Each group member contributes fully, promoting acceptance, trust, and maximizing the learning potential of all individuals within the group. The components of cooperative learning encompass various elements. Positive interdependence ensures that each group member's success is linked to the success of the entire group, fostering a supportive and cooperative atmosphere. Close consultation, characterized by face-to-face interaction, encourages active engagement and collaboration among learners. Verifiable accountability, emphasizing individual responsibility, ensures that each group member's contributions are measurable and recognized. Interpersonal and small-group skills are cultivated through collaborative efforts, enabling effective communication and cooperation within the group. Lastly, group processing analysis allows for reflection and evaluation of the learning process, facilitating continuous improvement and refinement.

In conclusion, cooperative learning is a powerful educational approach that promotes collaboration, active participation, and shared responsibility among learners. By harnessing the strengths and abilities of each group member, this methodology creates an inclusive and supportive learning environment where all individuals have the opportunity to thrive.

2.3 Collaborative Learning with STAD Model

Cooperative learning, as defined by Sawai Fakkhao in 2001, involves the integration of collaborative activities alongside other teaching and learning approaches. It is implemented after the instructor has conducted whole-class instruction and aims to foster student engagement through group-based study and research. This approach is particularly useful in subjects that require learners to acquire factual knowledge and generate ideas with definitive answers' Sanong Inlakhon, in 2001, emphasized that cooperative learning is achieved by dividing students into small groups comprising individuals with varying abilities. Each group typically consists of one high-achieving student, two to four students with moderate abilities, and one student who may require additional support. The objective is for all students to learn and participate together, engaging in discussions within their groups. The success of each student is viewed as the collective achievement of the entire group. Suwit

Moonkham and OrathaiMoonkham, in 2002, described STAD cooperative learning as a technique similar to the TGT (Team Game Tournament) approach. In this method, learners of diverse abilities are organized into groups of four to five individuals who collaborate on learning tasks. Initially, the groups study the content taught by the instructor, followed by knowledge application through experiments. The individual scores obtained from subsequent tests contribute to the overall team score. Reinforcement techniques, such as rewards and compliments, are employed by instructors to encourage group members to work collectively toward common goals.

The Department of Academic Affairs, in 2001, established five key steps for implementing cooperative learning in the STAD format:

Step 1: Whole-class presentation of the lesson ensures that students receive comprehensive instruction from the teacher, enabling them to develop a solid understanding of the content.

Step 2: Small group learning involves dividing the class into multiple groups within the same classroom. Through collaboration, students support one another in their learning tasks until they achieve success collectively.

Step 3: Sub-Test assesses individual student progress after the completion of specific content. During this phase, students are evaluated based on their individual abilities, without assistance from their peers.

Step 4: Self-improvement points require each student to improve their test scores incrementally compared to their previous performance. This encourages continuous growth and motivates students to strive for success in their learning.

Step 5: Recognition and praise are given to the group that demonstrates exemplary teamwork and achieves outstanding results. This fosters a positive and supportive learning environment.

According to Somchit Hongsa in 2008, cooperative learning using the STAD technique offers several advantages: Learner Responsibility: Students assume individual and group accountability, promoting a sense of ownership for their learning outcomes. Inclusive Learning: Cooperative learning encourages students with varying abilities to collaborate and learn together, promoting a supportive and inclusive classroom environment. Leadership Development: Students take turns in leadership roles within their groups, providing opportunities to develop leadership skills. Social Skill Development: Cooperative learning directly facilitates the practice and acquisition of social skills, empowering students to interact effectively with their peers. Enhanced Engagement: The dynamic and interactive nature of cooperative learning creates an atmosphere of excitement and enjoyment, promoting a love for learning. Incorporating cooperative learning with the STAD model can lead to improved student engagement, collaboration, and academic achievement. By capitalizing on the strengths of each student and fostering a supportive learning community, this approach cultivates a positive and effective learning environment for all.

2.4 Learning Management with KWDL Technique

In their study, Watchara Tuereandee and his team (2017) explored an effective teaching process utilizing the KWDL technique to address mathematical problem-solving. This technique encompasses four distinct steps in teaching and learning activities. Let’s delve into each step as follows

Review:

1.1) Review previous knowledge: The teacher initiates the lesson by revisiting previously covered material, ensuring students have a solid foundation.

1.2) Inform learning objectives: The teacher clearly communicates the goals and objectives of the lesson, providing students with a sense of direction.

1.3) Arouse interest using math games: Engaging math games are employed to captivate students' attention, fostering curiosity and enthusiasm for the upcoming content.

New content tutorial:

2.1) Whole-class problem presentation: The teacher presents mathematical problems to the entire class. Students collectively read and analyze the problems using the KWDL diagram:

K (Know): Teachers and students collaboratively identify and comprehend the information presented in the problem.

W (Want): Teachers and students work together to ascertain what the problem seeks to solve or find out.

D (Do): Teachers and students collaborate to develop strategies and solve the mathematical problems.

L (Learn): Teachers and students share their problem-solving approaches and results.

2.2) Small group practice: Students engage in guided practice within small groups, consisting of approximately 4–5 individuals. Each group follows specific activities outlined on the KWDL activity card, applying the technique to various problems.

Practice skills independently: Students independently practice their newly acquired skills by completing worksheets prepared by the teacher. These worksheets cover math problems related to the subject matter, as well as real-life scenarios.

Lesson Summary and Evaluation:

Students conclude the lesson by taking a unit test that assesses their understanding of the material. In cases where students require additional support, remedial actions are implemented. These actions involve employing the KWDL technique once again, enabling teachers and students to collaborate and reinforce comprehension using clearly illustrated KWDL diagrams. This collaborative approach ensures that everyone actively participates in practice exercises and problem-solving.

By incorporating the KWDL technique into their teaching process, Watchara Tuereandee and his team (2017) provided students with a comprehensive framework to tackle mathematical problems effectively. The combination of whole-class instruction, small group practice, independent skill application, and collaborative evaluation enhances students' understanding and engagement in the learning process.

2.5 Mathematical Problem-Solving Ability

The process of solving mathematical problems encompasses various definitions and techniques proposed by different researchers and educational institutions. The Institute for the Promotion of Teaching Science and Technology (2007) emphasizes that problem-solving in mathematics involves the application of mathematical knowledge, tactics, and experience to find solutions. VanatchanaChoengdee (2012) highlights the importance of understanding the problem, planning a solution, taking appropriate actions, and checking the method and answer. The Ministry of Education (2017) adds that problem-solving entails understanding problems, analytical thinking, planning solutions, selecting suitable methods, and considering the reasonableness and accuracy of the answers.

One widely accepted problem-solving process, based on Polya's concept, consists of four essential steps. First, understanding the problem is crucial, as it sets the foundation for solving it. Next, planning a solution involves devising a strategy or approach. The third step is implementing the plan, putting the chosen method into action. Finally, checking the results ensures the accuracy and validity of the solution.

WeerasakLertsopha (2001) introduces the KWDL technique, a problem-solving approach that aids in the development of intelligence, social skills, and mathematical problem-solving abilities. This technique allows for multiple mathematical implications and encourages students to stay focused on the given problem. By utilizing the KWDL technique, students have the opportunity to compare, distinguish, and draw their own conclusions, thus strengthening their systematic and step-by-step thinking. The KWDL technique comprises four steps:

Find out what you know about the problem: Students work collaboratively in groups to identify the information they already know about the problem, the given question sets, and the desired outcomes. The KWDL teaching technique activity card can be used to facilitate this process.

Determine what you want to know more about the problem: Through group discussions, students identify the additional information they need and establish relationships within the problem. They also determine appropriate methods for solving the problem.

Solve the problem: Students assist one another in solving the problem by representing it in symbolic sentences, finding the solution, and verifying its correctness.

Summarize the acquired knowledge: Each group summarizes the knowledge gained from problem-solving. A representative from the group presents their ideas and solutions, which are then consolidated into a comprehensive summary.

By employing the KWDL technique and following these four steps, students with varying levels of proficiency can enhance their problem-solving abilities and cultivate a systematic and analytical approach to technical problem-solving.

2.6 Achievement

The concept of achievement can be approached from various perspectives, each offering a unique definition and

understanding. In 2002, the Department of Academic Affairs defined achievement as the success or ability demonstrated in any action that requires skill or knowledge in a particular subject. Boonchom Srisa-at, in 2010, expanded on this definition, stating that achievement encompasses the knowledge and abilities a person possesses in academics. These abilities are the outcomes of learning within a specific content area, aligned with the objectives of the subject or curriculum, as assessed through examinations.

Furthermore, OrathaiChandai, also in 2010, added another dimension to the definition of learning achievement. According to OrathaiChandai, learning achievement entails both the acquisition of knowledge and the ability to apply and access that knowledge. It involves the development of skills through coordinated efforts, demanding considerable conscious effort and utilization of statistical elements. Learning achievement can be measured and observed using psychological tools or general achievement tests, which provide quantifiable indications of success.

Taking into account the insights from these documents, we can conclude that learning achievement refers to an individual's knowledge and abilities in academic pursuits. It encompasses both theoretical understanding and practical application, resulting from the learning process. This achievement is often expressed in terms of success and can be observed and measured through psychological tools or general achievement tests.

Overall, the concept of learning achievement is multifaceted, combining knowledge, skills, effort, and measurable outcomes. It serves as an important indicator of a person's academic progress and competence in specific subject areas.

3. Method

In this study, we investigate the problem-solving abilities of Grade 6 students when tackling decimal-related mathematical problems. We aim to enhance their problem-solving skills through a combination of cooperative learning techniques, specifically the Student Teams-Achievement Divisions (STAD) technique and the Know-Want-to-Learn-Did-Learn (KWDL) technique. We present a conceptual framework that illustrates the relationship between the primary variable and the dependent variable, as depicted in Figure 1.

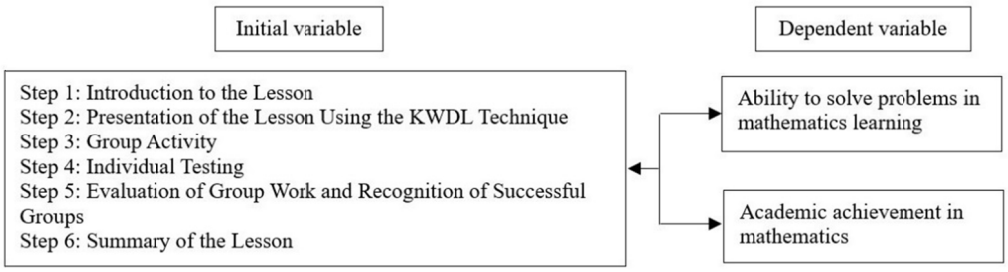

Figure 1. Research concept framework

This research employs a preliminary experimental design, specifically a Single Group Pretest-Posttest Design. The target group consists of 33 Grade 6/1 students from Ban Chiang Yuen School, Semester 1, Academic Year 2022. These students were selected through purposive sampling. There are three data collection tools employed in this study namely the learning management plan utilizes the STAD technique in conjunction with the KWDL technique, aligning with the Basic Education Core Curriculum, B.E. 2008 (revised 2017). A test to measure the ability to solve problems in learning mathematics on the subject of decimal problems. Grade 6 level and Mathematics achievement test on decimal problems Grade 6 level

The research procedure includes the following steps:

Pre-Experiment Phase: The target group of students underwent a pre-test to gauge their problem-solving skills and academic performance in mathematics, specifically concerning decimal problems, prior to commencing the learning sessions.

Learning Arrangements: The researcher implemented a structured learning management plan, featuring cooperative learning sessions using the STAD (Student Teams Achievement Division) format, coupled with KWDL (Know, want to know, Discover, and Learned) techniques. These learning sessions spanned six plans,

each lasting one hour, and occurred during the first semester of the academic year 2022.

Post-Experiment Phase: Following the completion of all six learning activities, the target group of students took post-tests to assess their problem-solving skills and learning achievements in mathematics, specifically with regard to decimal problems.

Data analysis involved assessing the results of the tests measuring problem-solving abilities and mathematics achievement in decimal problems against a 75 percent benchmark. The analysis employed basic statistical methods, including the calculation of percentages, means, and standard deviations.

In summary, this research plan encompasses pre-testing, implementing cooperative learning sessions, conducting post-testing, and analyzing the collected data. The primary objective is to evaluate the impact of the teaching methods on students' problem-solving abilities and mathematics achievement in decimal problems, utilizing basic statistical measures and 75 percent criteria for assessment.

4. Data Collection

The researcher intended to collect data from the target group of students, consisting of 33 grade 6/1 students from Ban Chiang Yuen School in Maha Sarakham Province during the first semester of the 2022 academic year. The data collection process involved the following steps:

Pre-test: Before the start of the lessons, the students took a test designed by the researcher to assess their ability to solve mathematical problems. The test included 5 decimal problem items.

Pre-learning mathematics achievement test: The students also completed a pre-learning mathematics achievement test, consisting of 20 decimal problem items developed by the researcher.

Learning management: The researcher conducted a series of learning sessions using a cooperative learning plan based on the Student Teams Achievement Division (STAD) format and the KWDL technique. This learning management plan spanned a total of 6 hours, divided into 6 one-hour sessions. These sessions took place during the first semester of the 2022 academic year.

Post-test: After completing the 6 learning sessions, the students took a post-test that measured their ability to solve decimal problems. This test comprised 5 items created by the researcher from the original set.

Post-learning mathematics achievement test: In addition, the students completed a post-learning mathematics achievement test consisting of 20 decimal problem items developed by the researcher based on the original set. This test assessed their performance after completing the 6 learning sessions.

Scoring and data analysis: The researcher scored the tests and utilized the obtained information to conduct data analysis. The data analysis process would involve examining the students' performance on the pre-tests and post-tests, comparing their scores, and drawing conclusions based on the findings.

5. Data Analysis

The researcher conducted the following data analysis:

Effectiveness of cooperative learning management: To evaluate the effectiveness of cooperative learning management utilizing the STAD and KWDL techniques, the researcher used the efficiency formula (E1/E2). The criterion for efficiency was set at 75/75. By calculating the efficiency using the formula, the researcher determined the extent to which the cooperative learning management approach achieved the target criterion.

Ability to solve mathematical problems: The researcher analyzed the ability of students who received cooperative learning using the STAD technique and the KWDL technique to solve mathematical problems. This analysis was based on comparing the mean scores of the students after completing the course with a criterion of 75 percent. By calculating the percentage of the mean scores, the researcher assessed how well the students performed in solving mathematical problems in relation to the criterion.

Mathematics achievement: The researcher also analyzed the mathematics achievement of students who received cooperative learning using the STAD technique and the KWDL technique. This analysis involved comparing the mean scores of the students after completing the course with a criterion of 75 percent. By calculating the percentage of mean scores, the researcher evaluated the overall mathematics achievement of the students in relation to the criterion.

These analyses allowed the researcher to determine the effectiveness of cooperative learning management using the STAD and KWDL techniques in achieving the desired efficiency, as well as the impact of this approach on students' ability to solve mathematical problems and their mathematics achievement.

6. Results and Discussion

The research study on the development of the ability to solve mathematical problems and academic achievement decimal problem of Prathomsuksa 6 students through cooperative learning management STAD and KWDL technique, Research Its purpose is to. To assess and compare the problem-solving abilities of Grade 6 students in mathematics when using cooperative learning techniques, specifically STAD and KWDL, in the context of decimal problems, against a criterion of 75 percent. And to evaluate the academic achievements of Grade 6 students in mathematics, particularly in solving decimal problems, through the implementation of cooperative learning techniques, namely STAD and KWDL, with the goal of surpassing the 75 percent criterion. The researcher presents the research findings as follows.

6.1 The Effectiveness of STAD and KWDL Cooperative Learning Management Techniques

The researcher examined the effectiveness of two cooperative learning management techniques, namely STAD and KWDL, in relation to decimal problem-solving among Grade 6 students (Prathomsuksa 6). The analysis involved calculating the mean, percentage, and deviation of scores. The total score obtained by the students during the study had an average of 54.82 out of a maximum score of 72, which corresponds to 76.14% of the total. Additionally, the post-test scores averaged at 15.09 out of 20 points, representing 75.45% of the total score. The efficiency of the learning management techniques was evaluated based on these results, and it was found that both STAD and KWDL techniques were effective is presented in Table 1.

Table 1. The effectiveness of STAD and KWDL cooperative learning management techniques

score	fullscore	$\bar{X}$	S.D.	percentage of average
Scoreduringclass (E_1)	72	54.82	6.15	76.14
Scoreafterclass (E_2)	20	15.09	3.45	75.45
Efficiency of learningmanagement(E_1 / E_2)= 76.14 / 75.45				

The findings suggest that the utilization of cooperative learning through STAD and KWDL techniques enhances the efficiency of students' problem-solving skills. As Table 1 data demonstrates, the cooperative learning approach employing STAD and KWDL techniques for Grade 6 decimal problems yielded an efficiency score of 76.14/75.45, surpassing the predefined criteria.

6.2 Mathematics Problem-Solving Ability Test Results

Regarding the mathematical problem-solving ability test results, the researcher administered a test to the students to evaluate their proficiency in solving mathematical problems. The test was designed by the researcher and the results were then analyzed to compare them with the set criteria. The criteria stated that the students should score an average of 75 percent or more of the full score in order to be considered proficient. The data obtained from the analysis of the results are presented in Table 2.

Table 2. The results of the mathematics problem-solving ability test

situation	**N**	**fullscore**	$\bar{X}$	S.D.	**percentage**
afterschool	33	30	22.73	6.03	75.76

The results suggest that most students demonstrated knowledge and understanding of the problem-solving process and were able to apply concepts or principles to find solutions to problems. According to the data presented in Table 2, it was observed that grade 6 students who underwent a learning program focused on decimal problem-solving exhibited improved mathematical problem-solving abilities. Specifically, when the cooperative learning management technique STAD was combined with the KWDL technique, the students achieved an average score of 22.73, equivalent to a percentage of 75.76. This percentage surpassed the required criterion of 75 percent.

6.3 Achievement in Mathematics

The comparison was made between the learning achievement in mathematics of grade 6 students who were taught using the cooperative learning techniques of STAD and KWDL, with the criterion for success set at 75 percent. The results were determined by calculating the average scores of the students is presented in Table 3.

Table 3. Achievement in mathematics

situation	N	fullscore	$\bar{X}$	S.D.	percentage
afterschool	33	20	15.09	3.45	75.45

The findings suggest that employing cooperative learning methods such as STAD and KWDL can significantly enhance students' academic performance. As illustrated in Table 3, Grade 6 students who were instructed in mathematics using a blended collaborative learning approach encompassing STAD and KWDL techniques achieved an average score of 15.09. This score represents a notable 75.45 percent increase over the established 75 percent benchmark for mathematics proficiency.

7. Conclusion

The following is a summary of the cooperative learning management techniques, STAD and KWDL, and their impact on The development of the ability to solve mathematical problems and academic achievement decimal problem of Prathomsuksa6 students through cooperative learning management STAD and KWDL technique.

The combination of the STAD technique and KWDL technique in cooperative learning management was found to be efficient for grade 6 students in solving decimal problems, with an efficiency rating of 76.14/75.45, meeting the criteria of 75/75. The management of learning, including equipment, outcomes, content, and time, aligns with the desired goals and facilitates the learners' maximum development (Chavalit Chukampang, 2010). The procurement and utilization of learning materials, as well as the measurement and evaluation methods, are in accordance with the approach presented by Suwit Munkham and OrathaiMunkham (2017). The cooperative learning plan utilizing the STAD and KWDL techniques is also consistent with the curriculum and teaching guidelines of the Ministry of Education, ensuring suitability for learners and providing a comprehensive coverage of topics within the allotted time (ArpornJaithiang, 2007). The learning management plan includes a range of activities, media, and assessment strategies that are coherent, with opportunities for students to practice and apply their process skills in real-life contexts, as emphasized by SamleeRaksuthi (2010). This approach is supported by the research of NatthanipaPrathumchat (2017), who focused on the development of mathematics learning activities using cooperative learning, STAD techniques, and KWDL techniques.

The utilization of the cooperative learning techniques STAD and KWDL for PrathomSuksa 6 students resulted in an average score of 75.76 percent (mean = 22.73, standard deviation = 6.03), surpassing the 70 percent threshold. The collaborative use of STAD and KWDL techniques fosters a step-by-step thinking approach according to KWDL, enabling learners to analyze problem definitions. This approach facilitates the development of critical thinking skills, problem-solving abilities, effective communication, creative thinking, curiosity, and a perception that mathematics is not daunting. Learners actively participate in the process, leading to a deeper mathematical understanding. These findings align with the research conducted by PatiparnChartpattanathan (2020), which explores the relationship between mathematical problem-solving ability and academic achievement in mathematics. By implementing cooperative learning activities with the STAD and KWDL techniques, the study reveals that students' mathematical problem-solving skills surpassed the 70% criteria with statistical significance at the .05 level. This finding is consistent with the research of Chotika Singh Pong (2019), who investigated the enhancement of mathematical problem-solving skills through the implementation of the cooperative learning management method with the STAD model combined with the KWDL technique. The results indicate a significant improvement in students' problem-solving skills after participating in the cooperative learning activities.

The use of collaborative learning techniques, specifically STAD and KWDL, in mathematics education has led to significant achievements in decimal problem-solving. Prathomsuksa 6 students who participated in these techniques achieved an average score of 75.45% (mean = 15.09, standard deviation = 3.45), surpassing the 75% criterion. This approach fosters critical thinking skills, problem-solving abilities, self-confidence, collaborative skills, and a broader perspective, ultimately enhancing social adaptation (Lakhana Siriwat, 2014). It encourages students to take responsibility for their own learning and promotes social skills development, making the learning process enjoyable and engaging (Somchit Hongsa, 2008). These findings align with previous research by WaruneeLaksanachan (2016), which demonstrated the superior learning outcomes of students in a mathematics learning group that implemented collaborative learning using STAD and KWDL techniques. The study showed a significant improvement in student achievement compared to an average score of 70%, with statistical significance at the 0.01 level. Similarly, Janya Hanprom (2017) found that the implementation of STAD and KWDL techniques in mathematics education resulted in higher learning outcomes and improved group work behavior, with statistical significance at the 0.01 level.

8. Recommendation

8.1 Suggestions for Practical Implementation

1) Based on the research findings, it is recommended that teachers consider the following factors when applying the cooperative learning model with STAD and KWDL techniques: the appropriateness of the content, grade level, available resources and equipment, and the students' abilities. These techniques should be utilized in mathematics courses and extended to other subjects to facilitate students' critical thinking processes, enhance their academic achievements, and improve their problem-solving skills across different subjects.

8.2 Suggestions for Future Research

1) It is recommended to investigate the impact of cooperative learning management utilizing STAD and KWDL techniques on various variables such as associative ability, creativity, and reasoning skills.

2) In addition to the KWDL learning management technique, other cooperative learning management techniques such as TGT, Jigsaw, and TAI should be combined and studied to assess their influence on students' problem-solving abilities and academic achievements.

Acknowledgments

This research project was financially supported by Mahasarakham University. We greatly appreciate the valuable contributions of our community advisory committee members. We would also like to thank the Assoc. Prof Dr. Boonchom Srisa-ard, Assoc. Prof Dr. Songsak Phusee-orn, Prof Dr. Sirichai Kanjanawasee, Prof Dr. Suwimon Wongwanich, Assoc. Prof Dr. Chowwalit Chookhampaeng, Assoc. Prof Dr. Kanyarat Cojorn and Assist. Prof Dr. Kanyarat Sonsupap and every team member who took the time to participate in this study.

Authors' contributions

Not applicable.

Funding

Not applicable.

Competing interests

Not applicable.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Canadian Center of Science and Education.

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.

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