

**Collaborative learning and problem-solving strategies in mathematics 10 instruction:
Utilization, effectiveness, and implementation challenges**

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ABSTRACT

Mathematics education plays a vital role in developing learners' critical thinking, analytical reasoning, and problem-solving skills necessary for academic success and everyday life. Despite the recognized importance of these competencies, many Filipino learners continue to demonstrate low performance in mathematics, as reflected in international assessments, highlighting the need to examine instructional approaches to enhance learning outcomes. This study determined the effectiveness of collaborative learning and problem-solving strategies in Mathematics 10 instruction in public secondary schools in Legislative District 5, Isabela, during the School Year 2025–2026. Using a descriptive-normative research design, data were gathered from 40 Mathematics 10 teachers through a researcher-made questionnaire, unstructured interviews, and documentary analysis. Findings revealed that collaborative learning strategies were often utilized (WM = 3.85) and perceived as effective (WM = 3.80), whereas problem-solving strategies were also often utilized (WM = 3.59) and perceived as moderately effective (WM = 3.40). The Mathematics 10 MELCs were generally realized (WM = 3.79). Although teachers encountered serious implementation challenges (WM = 3.73), the coping mechanisms employed were effective (WM = 3.98). The study recommends sustained professional development, strengthened instructional support, and improved resource provision to enhance the implementation of collaborative and problem-solving approaches in mathematics instruction.

Keywords: Collaborative learning, problem-solving strategies, mathematics instruction, learning competencies, teacher challenges.

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INTRODUCTION

Mathematics is both an interesting and challenging subject. It is used in everyday life, whether in budgeting money, measuring ingredients, or solving real-life problems. To truly understand mathematics, students must not only know how to solve problems but also understand the processes behind the solutions. Developing problem-solving skills fosters critical thinking, creativity, and independent learning. Students who can solve problems effectively tend to be more confident and better prepared for both academic tasks and

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real-world situations. Thus, helping students understand and solve mathematical problems is a fundamental goal of education, particularly in high school, where learners establish strong foundations for future learning.

However, international assessments indicate that many Filipino students continue to struggle in mathematics. In both the 2018 and 2022 Programme for International Student Assessment (PISA), the Philippines ranked near the bottom among participating countries (OECD, 2023). These assessments measure how well 15-year-old students can apply their knowledge and skills to real-life situations. The results revealed that many Filipino students have difficulty solving even basic mathematical problems, suggesting that they are not fully grasping the concepts being taught. These findings highlight the need to improve mathematics instruction in schools. Teachers must employ more effective strategies to deepen students' understanding, increase their confidence, and prepare them for everyday challenges.

One effective approach to improving student learning is collaborative learning. This instructional method allows students to work in small groups where they can communicate, share ideas, and learn from one another. When students explain their thinking and listen to different perspectives, they develop a deeper understanding of the lesson. Collaborative learning also promotes communication skills, teamwork, and active participation in the learning process (Salma, 2020). This approach creates a supportive and interactive classroom environment. Rather than merely listening to the teacher, students become active participants in constructing their own knowledge. Teachers serve as facilitators who guide students in exploring and understanding concepts together (Staples, 2007). In mathematics, group work enables students to explore different problem-solving methods and correct misconceptions with the assistance of their peers (Amo-Asante & Bonyah, 2023).

Another effective instructional approach involves the use of problem-solving strategies. These strategies are techniques that help students analyze and solve mathematical problems. Examples include drawing diagrams, constructing tables, identifying patterns, and working backward. When students are taught a variety of problem-solving techniques, they become more confident and flexible thinkers (Syaiful et al., 2020). Problem-solving encourages learners to move beyond mere memorization of formulas and develop critical-thinking skills. It teaches students to persevere when faced with difficult tasks and to learn from their mistakes (Aini et al., 2019). Teachers must create a supportive environment where students feel comfortable exploring new ideas and learning through feedback. In this way, students develop a deeper understanding of mathematics and recognize its relevance in everyday life (Azinar et al., 2020).

Combining collaborative learning and problem-solving strategies in Mathematics 10 instruction can provide a powerful means of enhancing student learning. Working collaboratively on authentic mathematical problems encourages students to think critically, ask questions, and justify their reasoning. This approach makes learning more engaging and meaningful. It also helps students develop stronger mathematical understanding and greater interest in learning. For these strategies to be effective, teachers must carefully plan group activities, facilitate productive discussions, and ensure that all students actively participate in the learning process (Students' Collaborative Problem Solving in Mathematics Classrooms, 2024).

The integration of these strategies offers numerous benefits. Students improve not only their mathematical competencies but also their communication, leadership, and teamwork skills. These competencies are essential both in school and in everyday life. Students become more confident and willing to tackle challenging problems because they receive support from their peers. A classroom that incorporates collaborative learning and problem-solving strategies becomes an environment where students enjoy learning, remain motivated, and develop both academically and socially (Vale & Barbosa, 2023).

The purpose of this study is to determine the effectiveness of collaborative learning and problem-solving strategies in teaching Mathematics 10. Specifically, it seeks to examine how these approaches contribute to students' understanding of mathematics, enhance their problem-solving abilities, and increase their interest in learning. Furthermore, the study aims to provide teachers with practical insights and instructional strategies that can make mathematics teaching more meaningful, engaging, and effective.

Statement of the problem

The study aimed to evaluate the effectiveness of collaborative learning and problem-solving strategies in teaching Mathematics 10 in Legislative District 5, Isabela, during the School Year 2025–2026.

Specifically, it sought answers to the following questions:

1. What is the profile of the respondents in terms of age, gender, civil status, highest educational attainment, present position, latest performance rating, length of service, and level of in-service training attended?
2. To what extent are collaborative learning and problem-solving strategies utilized and perceived as effective in Mathematics 10 instruction?
3. What is the extent of the realization of the Most Essential Learning Competencies (MELCs) in Mathematics 10?
4. To what extent do teachers encounter challenges in implementing collaborative learning and problem-solving strategies in terms of teacher related factors, time management, student related factors, and resource related factors?
5. What coping mechanisms do teachers employ to address the challenges encountered in implementing collaborative learning and problem-solving strategies?

METHODOLOGY

This study investigated the effectiveness of collaborative learning and problem-solving strategies in Mathematics 10 instruction in public secondary schools within Legislative District 5, Isabela, during the School Year 2025–2026. A descriptive-normative research design was employed because it is appropriate for examining existing instructional practices, identifying prevailing trends, and describing naturally occurring educational conditions without manipulating variables. The study was grounded in the works of Habaridot (2019), Kaiser, Wismath and Orr (2015), Christiani (2016), Klang et al. (2021), Allen et al. (2011), Short (2023), Maelasari and Wahyudin (2017), Intaros et al. (2014), and Azinar et al. (2020), who emphasized the usefulness of descriptive and normative approaches in documenting educational practices, collaborative learning, and problem-solving processes.

The research was conducted in selected public secondary schools located in the municipalities of Aurora, Burgos, Luna, Mallig, Quezon, Quirino, Roxas, and San Manuel in Legislative District 5, Isabela. The respondents consisted of 40 Mathematics 10 teachers, selected through purposive sampling, with five teachers representing each district.

Data were gathered using three instruments: a researcher-made questionnaire, unstructured interviews, and documentary analysis. The questionnaire collected information on respondents' profiles, the use and effectiveness of collaborative learning and problem-solving strategies, the realization of the Most Essential Learning Competencies (MELCs), challenges encountered in instruction, and coping mechanisms employed by teachers. The instrument underwent pilot testing among Mathematics 10 teachers from a neighboring municipality and

was refined based on expert feedback before final administration. Unstructured interviews were conducted to validate responses, while documentary analysis of lesson plans, curriculum guides, and related records was used to verify questionnaire data.

The researcher secured approval from the Schools Division Superintendent and school heads before administering the instruments. Data collection involved the personal distribution and retrieval of questionnaires to ensure completeness and accuracy of responses.

For data analysis, the study utilized frequency counts and percentages to describe the respondents' profile and weighted mean to analyze responses regarding the use and effectiveness of instructional strategies, realization of learning competencies, challenges encountered, and coping mechanisms. These statistical tools enabled the researcher to organize, summarize, and interpret the data in relation to the objectives of the study.

RESULTS AND DISCUSSION

The study involved 40 Mathematics 10 teacher-respondents from public secondary schools in Legislative District 5, Isabela. Most respondents were in the 31–35 age group (25.00%), followed by those aged 36–40 (22.50%) and 26–30 (20.00%), indicating that the teaching force was largely composed of early- to mid-career teachers. Females slightly outnumbered males, with 55.00% female and 45.00% male respondents. Most were married (75.00%), and a majority had pursued graduate education, particularly those with MAEd units (52.50%) and MAEd graduates (25.00%). Most respondents held Teacher III positions (80.00%), and 85.00% had an Outstanding performance rating, suggesting a professionally stable and competent teaching group.

In terms of teaching experience, most respondents had served for 6–10 years (40.00%) and 11–15 years (32.50%), showing that the teachers had sufficient classroom exposure to implement varied instructional strategies. All respondents had attended school-level in-service training, while others had participated in division, regional, national, and international training. This indicates continuing professional development, although broader exposure to higher-level training was still limited.

The use of instructional strategies was generally positive. Collaborative learning strategies were used more frequently, with an average weighted mean of 3.85, while problem-solving strategies obtained 3.59. Overall, the use of both strategies had an average weighted mean of 3.72, interpreted as Often. Peer tutoring was the most frequently used collaborative strategy, while working backward was the most frequently used problem-solving strategy. This suggests that teachers preferred structured, familiar, and easily manageable strategies that allow learners to participate actively while still keeping instruction organized.

The perceived effect of the strategies was also favorable. Collaborative learning obtained a weighted mean of 3.80, while problem-solving strategies obtained 3.40, with an overall mean of 3.60. This indicates that the strategies contributed positively to Mathematics 10 instruction, particularly in promoting interaction, participation, and conceptual understanding. However, the lower rating for problem-solving strategies suggests that these may require stronger instructional scaffolding, clearer modeling, and more time for guided practice.

The mathematics 10 Most Essential Learning Competencies were generally realized across all quarters, with an overall weighted mean of 3.79. The first quarter obtained the highest mean of 3.89, followed by the third quarter with 3.79, fourth quarter with 3.76, and second quarter with 3.70. These results imply that collaborative and problem-solving strategies helped support the attainment of learning competencies, especially in topics that involve patterns, sequences, probability, and measures of position. However, lower means in more abstract and

application-heavy competencies suggest the need for additional reinforcement in problem-solving, theorem proving, graphing, and research-based statistical tasks.

Despite these positive findings, teachers encountered serious challenges, with an overall weighted mean of 3.73. The most serious challenge involved student-related factors (3.97), followed by curriculum content (3.78), resource-related factors (3.71), time management (3.65), and teacher-related factors (3.53). These findings show that implementation difficulties were not caused by teacher unwillingness alone but by broader instructional realities, including varied student ability, overdependence on stronger classmates, limited resources, crowded curriculum demands, and insufficient time for collaborative and problem-based activities.

The coping mechanisms used by teachers were rated Effective, with an average weighted mean of 3.98. The most effective practices included integrating short group tasks into existing lessons, using rubrics for both group and individual performance, using visual and bilingual supports, applying real-life examples, breaking competencies into observable skills, and setting clear time limits. These results suggest that teachers were able to manage implementation barriers by simplifying strategies, making activities more structured, and adapting instruction to classroom realities. Overall, the findings indicate that collaborative learning and problem-solving strategies are useful in Mathematics 10 instruction, but their success depends on adequate time, resources, student readiness, and sustained teacher support.

CONCLUSION

Based on the findings of the study, it is concluded that the mathematics 10 teachers in Legislative District 5, Isabela are generally composed of professionally competent and academically motivated educators. Most are in the early to middle stages of their teaching careers, have pursued graduate studies, hold Teacher III positions, and have consistently obtained high performance ratings. Their active participation in professional development activities reflects a commitment to continuous learning and instructional improvement.

The findings further show that collaborative learning and problem-solving strategies are regularly incorporated into Mathematics 10 instruction. Their consistent use demonstrates teachers' recognition of the value of learner-centered approaches in promoting active engagement, cooperation, critical thinking, and mathematical reasoning. The effectiveness ratings obtained by these strategies suggest that they contribute positively to students' understanding of mathematical concepts and the development of essential academic and interpersonal skills.

The study likewise established that the Mathematics 10 Most Essential Learning Competencies (MELCs) were generally realized across all quarters. This indicates that collaborative learning and problem-solving approaches provide meaningful support in achieving intended learning outcomes. However, some competencies that require higher-order reasoning and complex problem-solving may still require additional instructional reinforcement and carefully structured learning experiences.

Despite these positive outcomes, teachers continue to face considerable challenges in implementing these approaches. Difficulties related to student participation, curriculum demands, limited instructional time, workload, and the availability of learning resources remain significant concerns. These constraints highlight the need for stronger institutional support and more favorable teaching conditions to maximize the benefits of collaborative and problem-solving instruction.

Nevertheless, the coping mechanisms employed by teachers were found to be effective in mitigating these challenges. Strategies such as integrating manageable collaborative activities, utilizing appropriate assessment tools, adapting available resources, and participating in professional learning opportunities have helped sustain the implementation of these instructional approaches.

In view of these findings, schools should continue encouraging the use of collaborative learning and problem-solving strategies in Mathematics 10 and provide teachers with adequate training, instructional resources, and administrative support to strengthen their implementation. Efforts to address challenges related to time management, curriculum demands, and resource limitations should be prioritized to improve classroom practice and learner outcomes. Furthermore, teachers should be encouraged to sustain and refine the coping mechanisms that have proven effective in addressing instructional difficulties. Future studies may expand the scope of investigation by including teachers from other grade levels and educational settings and by examining the relationship between these instructional strategies and students' academic performance in mathematics. Such studies may provide deeper insights into how collaborative and problem-solving approaches can be further optimized to improve mathematics education.

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