

Structured Cooperative Learning: Its Effects on the Academic Achievement of Grade 11 Students

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Abstract—This study investigated the impact of structured cooperative learning on the academic achievement of Grade 11 students in mathematics. The research employed a correlational design to examine the relationship between cooperative learning dimensions, including promotive interaction, interpersonal skills, group processing, and students' academic achievement. The findings revealed a significant positive correlation between these factors and academic achievement, indicating that cooperative learning contributes to students' success in mathematics. However, the study also highlighted the importance of other variables, such as motivation and self-efficacy, in shaping students' attitudes and performance. The results suggest that a combination of structured cooperative learning, a supportive classroom environment, and individual student support can optimize learning outcomes in mathematics. Based on these findings, it is recommended that educators continue to implement cooperative learning strategies and provide interventions to enhance students' motivation and self-efficacy. Future research should explore the interplay between various factors to further refine educational practices in mathematics.

Keywords— Structured cooperative learning, academic achievement.

I. INTRODUCTION

The Philippine Department of Education (DepEd), through the K to 12 program, underscores the development of skills, knowledge, and competencies across learning areas, including mathematics, to equip students for academic and life challenges. The K to 12 mathematics curriculum, specifically, promotes skills in visualization, modeling, representation, communication, application, and critical thinking to address real-world issues [1]. These essential skills are designed to help students navigate complex situations and solve problems, aligning with the program's objective to develop critical thinking and problem-solving abilities in mathematics [1]. To achieve these aims, the curriculum integrates high-level processes, values, and tools tailored to the diverse needs of Filipino students, addressing challenges like varying levels of readiness and different learning paces among students.

Despite these goals, many students still perceive mathematics as complex and daunting, often struggling to engage with and fully grasp the subject matter. Research increasingly highlights the role of structured cooperative learning in addressing these challenges by fostering a supportive environment that engages students and enhances their comprehension. Structured cooperative learning, characterized by small-group learning where students work interdependently to achieve shared academic goals, has shown

significant benefits for students' academic performance and motivation, particularly in mathematics [2, 3]. This approach moves beyond passive learning by actively involving students, creating opportunities for peer support and mutual engagement in problem-solving processes [2].

Studies in different educational contexts have reinforced the benefits of cooperative learning across various subjects, especially mathematics. For instance, Tran [4] found that structured cooperative learning strategies in Vietnamese classrooms enhanced both students' knowledge retention and academic achievement. His study suggests that cooperative learning facilitates deeper engagement with material, which in turn reinforces understanding and improves retention. Similarly, a meta-analysis by Kyndt et al. [5] highlighted that cooperative learning environments, in contrast to traditional instructional methods, led to significant improvements in students' academic outcomes and retention, particularly in subjects requiring critical thinking and collaborative problem-solving skills.

In mathematics specifically, structured cooperative learning has demonstrated particular efficacy. Research by Hossain and Rezal [6] shows that students in cooperative learning environments, especially those employing methods like the structured cooperative learning and unstructured cooperative learning, consistently outperform those taught through traditional methods. Chan and Idris [7] emphasize that structured cooperative learning models, such as Student Teams Achievement Division (STAD), are highly effective in promoting positive attitudes toward mathematics and improving academic achievement, as these models enable students to support each other and approach challenging concepts collaboratively. Moreover, Karali and Aydemir [8] found that cooperative learning models incorporating structured team roles, like TPT-supported STAD, lead to significant gains in students' understanding and application of mathematical concepts.

Beyond academic gains, structured cooperative learning is also associated with improved social and emotional outcomes. Gillies [9] emphasizes that cooperative learning fosters essential interpersonal skills, such as communication and conflict resolution, which are critical for effective teamwork. Students involved in cooperative learning activities often report higher levels of motivation and engagement, particularly in challenging subjects like mathematics [10]. The collaborative nature of these settings helps reduce anxiety and allows students to approach learning tasks with greater

confidence, ultimately creating a more supportive classroom environment [9].

To implement structured cooperative learning effectively, Johnson et al. [2] identified five essential components: positive interdependence, individual and group accountability, promotive interaction, social skills, and group processing. Without these components, simply grouping students does not ensure productive learning. Structured cooperative learning requires deliberate activities that promote each student’s accountability and contribution, thus supporting both individual learning and group success. This structure is particularly beneficial in mathematics, where peer-assisted learning helps reduce cognitive load and makes complex problem-solving more accessible [11].

This study aims to investigate the impact of structured cooperative learning on the academic achievement of Grade 11 students in mathematics at a private, non-sectarian, and co-educational institution in Cagayan de Oro City, Philippines. Through examining students' performance across three terms, this research contributes to the existing literature on cooperative learning’s role in mathematics achievement, specifically for students who find mathematics challenging. Findings from this study may inform teaching practices that foster a more inclusive and supportive learning environment, particularly for students who may otherwise struggle to succeed in traditional settings.

II. METHODS

This study employed a descriptive research method to collect, analyze, and interpret data, using means and percentages to summarize findings. Descriptive statistics facilitated an overview of the respondents' profiles and their mathematics performance, revealing potential implications for Grade 11 learners. The analysis also sought to uncover any significant differences in students’ performance, providing insights into the impacts of structured cooperative learning on academic achievement.

The research took place at a private, non-sectarian, and co-educational institution in Cagayan de Oro City, Philippines, during the academic year 2019-2020. Established in August 1981, the institution offers pre-college programs and is recognized as an independent school in Cagayan de Oro. Known for its large senior high school population, the school remains dedicated to delivering affordable and high-quality education.

Participants in this study included 89 Grade 11 STEM students from two sections, selected through purposive sampling. The respondents comprised 37 students in one section and 52 in another, with a gender distribution of 58% male (50 students) and 42% female (39 students), all aged 15–19. Each participant attended a three-hour General Mathematics class weekly. Consent for participation was obtained from all respondents, ensuring their agreement for their responses to be analyzed.

Data collection involved a survey adapted from Gonzales and Torres [12], which was tailored to assess students’ attitudes toward structured cooperative learning. Approval for the study was obtained from the Academic Supervisor and

Principal of the school, allowing for survey administration among Grade 11 STEM students. Following approval, the survey was distributed to respondents at the end of morning and evening sessions, with the study's purpose and potential benefits for mathematics instruction strategies clearly explained.

The research instrument was a questionnaire divided into three sections: Part 1 assessed communication-related skills that support student collaboration; Part 2 evaluated relationship skills crucial for effective teamwork; and Part 3 focused on group management skills that foster open communication and cooperative learning. Each section contained five items, providing a structured evaluation of student interactions in cooperative settings.

The study’s variables included the independent variable of structured cooperative learning, assessed on a Likert scale with categories ranging from "Strongly Agree" to "Strongly Disagree," scored from 4 to 1. The dependent variable, academic performance, was categorized as "Outstanding" to "Did Not Meet Expectations," scored from 5 to 1.

For statistical treatment, descriptive measures such as mean and standard deviation were used to analyze quantitative data, especially from the survey’s Likert scale responses. Inferential statistics, specifically the Pearson correlation (two-tailed at a 0.05 significance level), were employed to examine the relationship between structured cooperative learning and students' quarterly mathematics scores, identifying any significant correlations between these variables.

III. RESULTS AND DISCUSSIONS

TABLE 1. Students’ Level on Structured Cooperative Learning

Structured Cooperative Learning	Mean	SD	Verbal description
Face-to-face Promotive Interaction	3.48	.555	Strongly Agree
Interpersonal Skills	3.47	.542	Strongly Agree
Group Processing	3.52	.527	Strongly Agree

The results presented in Table 1 reveal a strong consensus among student respondents on the effectiveness of face-to-face promotive interaction in cooperative learning, with an overall mean score of 3.48, corresponding to a “strongly agree” response. This finding highlights the value students place on cooperative learning methods that emphasize direct, in-person engagement, where they actively help and support each other’s learning.

The mean of 3.48 of Face-to-Face Promotive Interaction, with a standard deviation of 0.555, reflects students’ strong agreement with the effectiveness of face-to-face promotive interaction. This method encourages students to engage in real-time communication, foster mutual support, and build collaborative learning experiences. Research supports this approach, indicating that face-to-face promotive interaction not only improves academic performance but also enhances motivation and social skills by promoting a supportive learning environment [13].

Face-to-face promotive interaction has been shown to lead to deeper learning, improved interpersonal skills, and increased participation in class activities [14]. Studies also suggest that, compared to computer-mediated interactions, face-to-face engagement results in higher motivation and

academic achievement [15]. Furthermore, students involved in face-to-face promotive interaction tend to engage more deeply with the material and can apply their knowledge in new contexts, making this approach especially effective in fostering both academic and personal growth.

This type of cooperative learning approach also helps students develop essential social skills and supports academic success [16]. For example, cooperative methods like teamwork and student-to-student interaction foster stronger relationships and improve both social and professional skills [17]. Encouraging students to interact regularly allows cooperative learning to reduce stress and promote emotional well-being, providing benefits that extend beyond academics.

The second aspect assessed, interpersonal skills, received a mean of 3.47 with a standard deviation of 0.542, also falling into the “strongly agree” category. This score suggests that students believe that cooperative learning significantly improves their interpersonal skills, such as effective communication, conflict resolution, and teamwork. Research indicates that cooperative learning requires students to negotiate ideas and work toward shared goals, which fosters interpersonal competence [18].

Cooperative learning is particularly effective in enhancing social and communication skills compared to more traditional group learning [19]. Studies also show that cooperative, problem-based learning improves students’ interpersonal skills in a measurable way [20]. Integrating cooperative learning strategies within structured educational frameworks, such as the 5E inquiry model, has been shown to significantly boost interpersonal competence, especially in high school students [21].

The development of these skills is critical not only in academic settings but also in professional environments, where collaboration is often essential for success. Cooperative learning, therefore, plays a dual role in supporting students’ academic progress and in preparing them for future teamwork-oriented work environments by instilling values like empathy, active listening, and mutual respect.

The aspect of group processing received the highest mean score (3.52) with a standard deviation of 0.527, indicating strong agreement on its value. Group processing involves structured reflection and feedback within student groups, allowing members to discuss their collaborative experiences, assess each other’s contributions, and strategize for improvement. Research underscores the importance of structured group processing as a critical component of cooperative learning, as it encourages self-awareness, role clarity, and effective team dynamics [22].

Structured group processing helps students develop a sense of accountability for both individual and group success, fostering a positive group climate that supports collaborative achievements. Structured roles within cooperative learning have been shown to increase motivation, improve content knowledge, and enhance student responsibility [23]. This method is particularly effective in larger classrooms, where role clarity can decrease attrition rates and improve student performance [24]. High-structured cooperative learning, characterized by clear roles and responsibilities, significantly

enhances the effectiveness of teamwork by increasing both academic motivation and engagement [25].

These findings align with existing research on cooperative learning, underscoring its role in fostering both academic achievement and social skills development. Each component—promotive interaction, interpersonal skills, and group processing—addresses different aspects of cooperative learning that contribute to a holistic educational experience. Face-to-face promotive interaction creates a supportive environment for learning, interpersonal skill development fosters communication and collaboration, and group processing enables reflective, accountable teamwork. Together, these elements highlight the positive impact of cooperative learning on students’ academic and personal growth, emphasizing that structured group activities are instrumental in creating effective and meaningful learning experiences.

TABLE 2. Students’ Academic Achievement in Math

Academic Achievement in Mathematics	f	%
Outstanding	29	33
Very Satisfactory	44	49
Satisfactory	16	18
Fairly Satisfactory	0	0
Did not Meet Expectation	0	0
Total	89	100

The results in Table 2 indicate a high level of academic achievement among the student-respondents in mathematics, with 33% achieving an "Outstanding" rating and 49% attaining a "Very Satisfactory" rating. Only 18% of the students were rated as "Satisfactory," and no students fell below this level. These findings suggest that the majority of students are performing well academically in mathematics, with more than 80% achieving at least a "Very Satisfactory" rating. This high level of achievement can be attributed to various factors supported by existing literature.

Research shows that cooperative learning strategies, such as face-to-face promotive interaction, can significantly enhance students’ academic achievement, particularly in mathematics. Tran [4] emphasizes that students engaged in cooperative learning environments often achieve higher levels of understanding and retention compared to those in traditional classroom settings, as cooperative learning fosters active engagement and collaborative problem-solving skills. Similarly, Singh et al. [26] highlight that students’ motivation and positive attitudes toward mathematics play a critical role in their academic success. A supportive and interactive environment, where students feel confident and motivated, contributes to higher performance in mathematics, as evidenced by the large percentage of students in the "Outstanding" and "Very Satisfactory" categories in Table 2.

Additionally, Hattie’s [27] comprehensive meta-analysis points to the importance of varied instructional strategies in enhancing academic outcomes. Teachers who create interactive, engaging classrooms and incorporate diverse methods can help students build a solid conceptual understanding of mathematics, which is crucial for achieving high scores. Patrick et al. [28] further reinforce the impact of a

positive classroom environment on student achievement. Their study indicates that a supportive social environment, with clear feedback and opportunities for cooperative learning, fosters engagement and motivation, leading to improved academic performance.

Moreover, self-efficacy—the belief in one’s ability to succeed—is closely linked to academic success in mathematics. According to Pajares and Graham [29], interventions aimed at boosting students' confidence in their mathematical abilities can lead to substantial improvements in performance. This aligns with the findings in Table 2, where no students rated "Fairly Satisfactory" or below, suggesting that students may feel capable and well-supported in their math studies, further contributing to their high achievement.

Hence, the high levels of academic achievement observed in Table 2 align with research suggesting that cooperative learning, a positive classroom environment, motivation, and self-efficacy play critical roles in students’ success in mathematics. Fostering these conditions allow instructors to support students in achieving outstanding performance, as evidenced by the majority of students performing at or above a "Very Satisfactory" level.

TABLE 3. The relationship between structured cooperative learning and students’ academic achievement

Structured Cooperative Learning	Academic Achievement		
	(r)	Interpretation	Sig (2 tailed)
Face to Face promotive Interaction	0.328	Indicates low or slight relationship	.002*
Interpersonal Skills	0.349	Indicates low or slight relationship	.001*
Group processing	0.369	Indicates low or slight relationship	.000*

* significant at 0.05 level of significance

Table 3 examines the relationship between elements of structured cooperative learning—namely, face-to-face promotive interaction, interpersonal skills, and group processing—and students’ academic achievement. The correlation coefficients (r) for these variables are .328, .349, and .369, respectively, indicating a "low or slight relationship" with academic achievement. Although these correlations are relatively low, they are statistically significant at the 0.05 level, as indicated by the p-values (.002, .001, and .000), which suggests that there is a meaningful, albeit slight, association between these cooperative learning elements and academic performance.

Research supports the idea that even low correlations in educational settings can have practical significance, especially when multiple factors contribute to learning outcomes. For instance, Johnson et al. [30] emphasize that face-to-face promotive interaction, where students support each other’s learning in a close setting, fosters academic engagement. Although the relationship with academic performance might be subtle, the social support and encouragement students provide each other can lead to improved understanding and retention of material. This interaction also creates a positive learning environment, contributing to students' motivation and willingness to engage with challenging tasks.

Interpersonal skills also show a slight yet significant correlation with academic achievement, reflecting the importance of communication, empathy, and conflict resolution in cooperative learning. Lavasani et al. [11] found that students who work on their interpersonal skills through cooperative learning tend to perform better academically, as they can navigate group dynamics effectively, share ideas, and develop critical thinking through constructive dialogue. These skills are fundamental not only for learning but also for fostering a supportive classroom culture where students feel comfortable sharing their thoughts and actively participating in discussions.

Group processing, which involves students reflecting on their group’s performance and identifying areas for improvement, is another element with a slight positive association with academic achievement. Group processing allows students to evaluate both their successes and challenges, reinforcing accountability and encouraging them to refine their approach to tasks [4]. Although the correlation with academic achievement is low, group processing helps students develop a growth mindset, where they view challenges as learning opportunities. This reflective process is essential for continuous improvement and long-term academic success, as students learn to identify and address their strengths and weaknesses.

While each of these elements—face-to-face promotive interaction, interpersonal skills, and group processing—has only a slight relationship with academic achievement individually, collectively they contribute to a collaborative and supportive learning environment that fosters academic growth. When structured cooperative learning strategies are integrated thoughtfully, they can enhance students' learning experiences, gradually building a foundation for improved academic outcomes. As such, even slight relationships can be meaningful in the context of educational research, where multiple small factors work together to support student achievement.

IV. CONCLUSION AND RECOMMENDATION

This correlational study showed the effects of structured collaborative learning on students’ mathematics achievement, highlighting factors such as face-to-face promotive interaction, interpersonal skills, and group processing. The results showed that students demonstrated high levels of academic achievement, with a significant percentage attaining “Outstanding” and “Very Satisfactory” ratings in mathematics. Although the correlations between cooperative learning dimensions and academic achievement were statistically significant, they indicated only slight positive relationships. These findings suggest that while cooperative learning contributes to students' performance, it may not be the sole determining factor of high achievement in mathematics. The students’ success in mathematics can likely be attributed to a combination of cooperative learning, motivation, a positive classroom environment, teacher support, and students' self-efficacy.

The study supports existing literature that emphasizes the role of interactive, collaborative learning environments in

fostering academic success. Cooperative learning strategies, such as promotive interaction and group processing, have proven effective in building essential social and cognitive skills, which enhance students' engagement and comprehension. Moreover, factors such as motivation and self-efficacy play a critical role in shaping students' attitudes towards mathematics and their overall academic success. This study underscores the need for educational practices that prioritize both structured cooperative learning and support for students' confidence and motivation in mathematics.

Based on the findings, it is recommended that educators continue to implement structured cooperative learning strategies, such as promotive interaction and group processing, to support students' academic achievement in mathematics. To further enhance these strategies, teachers should foster a positive and supportive classroom environment that encourages collaboration, peer support, and active participation. Educators are also encouraged to offer varied instructional methods that address different learning styles, helping students develop a deeper understanding of mathematical concepts.

Additionally, interventions should be developed to strengthen students' motivation and self-efficacy in mathematics, as these factors significantly influence academic performance. Schools might consider incorporating motivational workshops and confidence-building exercises to help students view mathematics as an achievable and engaging subject. Future research could explore the impact of other variables, such as individual learning preferences and teacher-student interactions, on academic achievement. Combining structured cooperative learning with individualized support allows schools to provide a more holistic approach to improving student outcomes in mathematics.

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