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Impact of Collaborative Learning Strategy Toward Learning Mathematics Concepts Among Junior High School Learners at Sulu State University Laboratory High School

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Index Terms:

collaborative learning strategy, learning mathematics concepts, junior high school, cognitive understanding, self-efficacy

Abstract. This study examined the impact of a collaborative learning strategy on learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School. A descriptive–correlational research design was employed involving 120 students selected through purposive sampling during the School Year 2025–2026. The study assessed the extent of the impact of a collaborative learning strategy on learning mathematics concepts, including cognitive understanding, problem-solving skills, and confidence and self-efficacy. It also identified significant differences in the extent of the impact of the collaborative learning strategy across age, gender, grade level, parents' educational attainment, and parents' average monthly income. Furthermore, the study examined the significant correlation among the subcategories subsumed under the impact of collaborative learning strategy toward learning mathematics concepts. Results showed that the majority of respondents were aged 14–15 and that female students comprised the largest proportion. The respondents were evenly distributed across Grades 7, 8, 9, and 10. Most students reported that their parents were college graduates and that their families earned an average monthly income of 10,001–15,000 pesos. Findings revealed that the impact of a collaborative learning strategy on learning mathematics concepts was generally interpreted as Agree regarding cognitive understanding, problem-solving skills, and confidence and self-efficacy. Statistical analyses indicated that there were generally no significant differences in the extent of the impact of the collaborative learning strategy across groups defined by their socio-demographic profiles. Correlation analysis further revealed significant positive Correlation among cognitive understanding, problem-solving skills, and confidence and self-efficacy. Based on the findings, it is recommended that mathematics teachers strengthen the use of collaborative learning strategies to enhance students' conceptual understanding, problem-solving abilities, and confidence in mathematics. School administrators may support the implementation of collaborative instructional practices through training and classroom initiatives. Students are encouraged to actively participate in cooperative learning activities to improve their mathematical competence. At the same time, future researchers may explore additional variables such as mathematics anxiety, motivation toward learning mathematics, prior mathematical knowledge, classroom learning environment, and access to instructional materials and educational technology in relation to collaborative learning and mathematics achievement.

Introduction

In recent years, educational practice has increasingly focused on approaches that place learners at the center of the teaching and learning process. One widely recognized approach that supports this shift is collaborative learning. This instructional strategy involves students working together in structured groups to accomplish shared academic tasks. Collaborative learning promotes interaction, communication, and mutual support among students. These interactions help create a learning environment that enhances motivation, engagement, and overall academic development (Mari & Al-Haila, 2002). According to Al-Saadi (2008), collaborative learning groups often include students with varied performance levels, including high, medium, and low achievers, thereby maximizing learning opportunities for everyone. Al-Omar (2000) describes collaborative learning as a method in which small groups work together to enrich each member's educational experience.

Researchers have also highlighted that collaborative learning differs from traditional instructional models because learners in collaborative settings share responsibilities and work toward common goals. This process encourages meaningful participation and accountability (Al-Wadaei, 2000; Khader, 2006; Al-Baghdadi, 2005). Yaqoub (1995) explains that a group's success depends on each member's willingness to contribute and support others. Toaima and Al-Shuaibi (2006) and Zaitoun (2003) further describe collaborative learning as a strategy that organizes student interactions to improve learning outcomes and teamwork skills.

In mathematics, a subject often regarded as abstract and challenging, collaborative learning can transform the learning environment. Mathematics learning is increasingly viewed not only as an individual cognitive process but also as a social activity. Through interaction with peers, students have opportunities to share strategies, explain their reasoning, and clarify misconceptions. Sharan (1980) noted the effectiveness of collaborative approaches compared to traditional methods. Group problem-solving, peer tutoring, jigsaw activities, Think-Pair-Share, and problem-based learning allow students to participate actively and develop deeper mathematical understanding.

Several studies have shown that collaborative learning supports stronger comprehension of mathematical concepts. Group discussions help students verbalize their thinking, leading to clearer understanding and the correction of errors. Research also shows that collaborative learning improves performance on complex problem-solving tasks and enhances retention of mathematical ideas (Johnson & Johnson, 2009). Students in collaborative environments also tend to show higher motivation, confidence, and self-efficacy. These factors are important in mathematics because many learners experience anxiety or lack confidence in their abilities.

Although collaborative learning offers many benefits, it must be carefully implemented. Teachers need to structure group activities to promote equal participation and meaningful interaction. When well facilitated, collaborative learning can strengthen students' cognitive skills, enhance their problem-solving abilities, and build confidence in mathematics.

Given the importance of improving mathematics instruction in the local context, this study aims to determine the impact of collaborative learning strategies on junior high school learners at Sulu State University Laboratory High School. The study focuses on three areas of learning outcomes. These areas are cognitive understanding of mathematical concepts, problem-solving skills, and confidence or self-efficacy in mathematics. Understanding the effects of collaborative learning in these areas will help teachers and school administrators identify effective instructional practices that support improved mathematics learning and positive student attitudes.

Research Questions

The study aimed to determine the impact of a collaborative learning strategy on learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School. Specifically, it sought to answer the following questions:

1. What is the socio-demographic profile of the respondents in terms of:
1.1 Age;
1.2 Gender;
1.3 Grade Level;
1.4 Parents' Educational Attainment; and
1.5 Parents' Average Monthly Income?

2. What is the extent of the impact of collaborative learning strategy toward learning mathematics concepts among junior high school learners in terms of:
2.1. Cognitive;
2.2. Problem-Solving Skills; and
2.3. Confidence and Self-Efficacy?

3. Is there a significant difference in the extent of the impact of collaborative learning strategy toward learning mathematics concepts at Sulu State University Laboratory High School when the data are grouped according to:
3.1. Age;
3.2. Gender;
3.3. Grade Level;
3.4. Parents' Educational Attainment; and
3.5. Parents' Average Monthly Income?

4. Is there a significant correlation among the sub-categories subsumed under the extent of the impact of collaborative learning strategy toward learning mathematics concepts at Sulu State University Laboratory High School?

Methodology

In this section, to present a well-organized approach in conducting the study, the researcher adopted the nine components of research methods, such as research design, research locale, respondents of the study, sampling design, data gathering procedure, research instrument, validity and reliability, statistical treatment of data, and ethical considerations.

Research Design

This study used a descriptive-correlational research design to explore the impact of a collaborative learning strategy on learning mathematics concepts among junior high school students at Sulu State University Laboratory High School. The research explored three characteristics: cognitive understanding, problem-solving skills, and confidence and self-efficacy. According to McCurney and White (2009), as cited by Ivy Panda (2023), descriptive-correlational designs are employed in research investigations that seek to identify relationships between variables and present static depictions of settings.

Research Locale

The study was conducted at Sulu State University Laboratory High School. The target respondents were students in Grades 7A–C, 8A–C, 9A–C, and 10A–C. The school was located in the Walled City of Jolo, Sulu, Philippines.

Respondents of the Study

The total sample size of respondents was 120 junior high school students from a population of 561 students. The chosen respondents were from Sulu State University Laboratory High School who were officially enrolled during the academic year 2025-2026. The table below shows the distribution of respondents by grade level and section.

Grade and Section	Number of Respondents
7-A	10
7-B	10
7-C	10
8-A	10
8-B	10
8-C	10
9-A	10
9-B	10
9-C	10
10-A	10
10-B	10
10-C	10
Total	**120**

Table 1. Distribution of the Respondents according to Grade and Section

Sampling Design

In this study, the researchers used purposive sampling to select the respondents. It is used to select respondents most likely to yield appropriate and useful information (Kelly, 2010) and to identify and select cases that use limited research resources effectively (Palinkas et al., 2015).

Data Gathering Procedure

The researchers obtained a letter of permission from the Dean's Office of Graduate Studies to launch the questionnaire. After securing the letter of permission from the Dean's Office of Graduate Studies, the researcher will immediately proceed to seek the letter of approval from the office of the president at Sulu State University. After receiving approval from the concerned authority at Sulu State University to administer the instrument, the researcher will present the approved letter to the Principal of Sulu State University Laboratory High School to inform him that the data for the study will be collected.

Then, the principal agreed and permitted the researcher to administer the instruments to the sample respondents listed and retrieved on the same day.

Research Instrument

A survey questionnaire in checklist form was used in this study. It was adopted, patterned, and revised from the instruments and models developed by Johnson and Johnson (2009). Entitled "An educational psychology success story: Social interdependence theory and cooperative learning & Slavin, R. E. (2011). Instruction based on cooperative learning, which measured the effectiveness of a collaborative learning strategy toward learning mathematics concepts at Sulu State University Laboratory High School.

The questionnaire was divided into two parts: Part one contains the personal data of the respondents, while Part two consists of three subcategories of collaborative learning strategies for learning mathematics concepts: cognitive, problem-solving skills, and confidence and self-efficacy.

The questionnaire was answered by the respondents using a 5-point Likert Scale, with responses such as Strong Agree (SA), Agree (A), Undecided (U), Disagree (D), and Strongly Disagree (SD).

Rating Scale	Rating Interval	Verbal Description
1	1:00-1:49	Strongly Disagree
2	1:50- 2:49	Disagree
3	2:50- 3:49	Undecided
4	3:50- 4:49	Agree
5	4:50-5:00	Strongly Agree

Table 2. Rating Scale and Intervals with the Verbal Description

Validity and Reliability

The instrument used in this study was adopted, patterned, and revised from the instruments and models developed by Johnson, D. W., & Johnson, R. T. (2009) and entitled, "An educational psychology success story: Social interdependence theory and cooperative learning & Slavin, R. E. (2011), which measured the effectiveness of the impact of collaborative learning strategy toward learning mathematics concepts. However, to suit the instrument to the local setting of this study, a slight modification will be made and reviewed by at least two authorized research experts from the faculty of the School of Graduate Studies of Sulu State University.

Statistical Treatment of Data

The following statistical tools were used to analyze the gathered data.

1. For Problem No. 1, which states: What is the demographic profile of the respondents in terms of age, gender, grade level, parents' educational attainments, and parents' average monthly income? The statistical tools used were Frequency and Percentage.

2. For Problem No. 2, which states: What is the extent of the impact of collaborative learning strategy toward learning mathematics concepts among junior high school learners in terms of cognitive, problem-solving skills, and confidence and self-efficacy? The statistical tools used were Weighted Mean and Standard Deviation.

3. For Problem No. 3, which states: Is there a significant difference in the extent of the impact of collaborative learning strategy toward learning mathematics concepts at Sulu State University Laboratory High School when the data are grouped according to age, gender, grade level, parents' educational attainment, and parents' average monthly income? The statistical tools used were the T-test for gender and Analysis of Variance (ANOVA) for the remaining profile variables to determine significant differences.

4. For Problem No. 4, which states: Is there a significant correlation among the sub-categories subsumed under the extent of the impact of collaborative learning strategy toward learning mathematics concepts at Sulu State University Laboratory High School? The statistical tool used was the Pearson Product-Moment Correlation to determine the significant correlation among variables.

Ethical Considerations

Upholding ethical standards was essential to maintain the reliability, validity, and integrity of the research process. All data collected for analysis and interpretation will strictly conform to recognized ethical guidelines.

Specifically, the researcher observed the following ethical protocols in the conduct of the study:

1. Informed Consent – Participants were fully informed about the study's purpose, procedures, and scope. Their voluntary participation will be sought through a signed consent form, and they will be free to withdraw at any time without penalty.

2. Confidentiality and Anonymity – The identity of the participants and the institutions involved was kept strictly confidential. No identifying information appeared in any report, presentation, or publication related to this study.

3. Voluntary Participation – Participation in the study was entirely voluntary. No form of coercion, pressure, or undue influence will be used to obtain participation.

4. Integrity of Data – The researcher ensured that all data were gathered, recorded, analyzed, and reported truthfully and accurately. Fabrication, falsification, or misrepresentation of data will be strictly avoided.

5. Respect for Persons – The researcher upholds participants' rights, dignity, and well-being, ensuring their views and experiences are valued throughout the research process.

6. Beneficence and Non-Maleficence – The study was conducted with the intent to benefit participants and the community, ensuring that no harm—physical, psychological, or social—comes to those involved.

7. Compliance With Institutional Guidelines – The conduct of this research adhered to the ethical policies and procedures of the School of Graduate Studies, Sulu State University (SSU), as well as relevant national and international ethical standards for educational research.

8. Ethical Clearance – Before administering the survey questionnaire, the researcher secured official Ethical Clearance from the Research Ethics Committee or the authorized body of Sulu State University (SSU) to ensure that the study meets all institutional and professional ethical requirements.

Results and Discussion

This section presents the analysis, interpretation, and presentation of the data gathered to address the study's research problems on the impact of a collaborative learning strategy on learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School. It begins with a presentation of the respondents' demographic profile, including age, gender, grade level, parents' educational attainment, and parents' average monthly income. Furthermore, this chapter presents the extent of the impact of a collaborative learning strategy on learning mathematics concepts, particularly in cognitive understanding, problem-solving skills, and confidence and self-efficacy. It also determines whether there are significant differences in the extent of the collaborative learning strategy's impact across demographic groups. In addition, this chapter examines the significant correlation among the subcategories subsumed under the impact of collaborative learning strategy toward learning mathematics concepts, specifically cognitive understanding, problem-solving skills, and confidence and self-efficacy. The results presented in this chapter serve as the empirical basis for the study's summary of findings, conclusions, and recommendations.

The presentations, analyses, and interpretations of results are based on proper scoring and statistical treatment of the data for each research question outlined in this study.

1. What is the socio-demographic profile of the respondents in terms of: 1.1 Age; 1.2 Gender; 1.3 Grade Level; 1.4 Parents' Educational Attainment; and 1.5 Parents' Average Monthly Income?

1.1 In terms of Age

Table 3 presents the demographic profile of the Junior High School learner respondents at Sulu State University Laboratory High School, by age. The data show that of 120 respondents, 68 students (56.7%) are 14–15 years old, while 37 students (30.8%) are 13 years old or younger. Meanwhile, 15 students (12.5%) fall within the 16-year-old-and-above age group.

This indicates that the majority of respondents are aged 14–15, comprising more than half of the total sample, whereas students aged 16 and above represent the smallest proportion.

Age	Number of respondents	Percent
13 years old and below	37	30.8%
14-15 years old	68	56.7%
16 years old and above	15	12.5%
Total	**120**	**100%**

Table 3. Demographic Profile of the Junior High School Learners in Terms of Age

1.2 In terms of Gender

Table 4 presents the demographic profile of the Junior High School learner respondents at Sulu State University Laboratory High School, by gender. The data show that of 120 respondents, 77 (64.2%) are female, while 43 (35.8%) are male. This indicates that the majority of respondents are female, comprising more than half of the total sample, whereas male students represent a smaller proportion.

Gender	Number of respondents	Percent
Male	43	35.8%
Female	77	64.2%
Total	**120**	**100%**

Table 4. Demographic Profile of the Junior High School Learners in Terms of Gender

1.3 In terms of Grade Level

Table 5 presents the demographic profile of the Junior High School learner respondents at Sulu State University Laboratory High School, by grade level. The data show that out of 120 respondents, 30 students (25.0%) are from Grade 7, 30 students (25.0%) are from Grade 8, 30 students (25.0%) are from Grade 9, and 30 students (25.0%) are from Grade 10. This indicates that the respondents are evenly distributed across the four grade levels, with each grade level comprising an equal proportion of the total sample.

Grade Level	Number of respondents	Percent
Grade 7	30	25.0%
Grade 8	30	25.0%
Grade 9	30	25.0%
Grade 10	30	25.0%
Total	**120**	**100%**

Table 5. Demographic Profile of the Junior High School Learners in Terms of Grade Level

1.4 In terms of Parents' Educational Attainment

Table 6 presents the demographic profile of the Junior High School learner respondents at Sulu State University Laboratory High School regarding their parents' educational attainment. The data show that among 120 respondents, 53 parents (44.2%) are college graduates, the largest proportion. This is followed by 32 parents (26.7%) who have obtained a master's degree, and 23 parents (19.2%) who have completed secondary level education. Meanwhile, 10 parents (8.3%) have attained a doctorate, while only 2 parents (1.7%) have reached the elementary level. This indicates that the majority of respondents' parents have attained college-level education, while only a small proportion have attained elementary-level education.

Parents' Educational Attainment	Number of respondents	Percent
Elementary level	2	1.7%
Secondary level	23	19.2%
College graduate	53	44.2%
Masters' degree	32	26.7%
Doctorate degree	10	8.3%
Total	**120**	**100%**

Table 6. Demographic Profile of the Junior High School Learners in Terms of Parents' Educational Attainment

1.5 In terms of Parents' Average Monthly Income

Table 7 presents the demographic profile of the Junior High School learner respondents at Sulu State University Laboratory High School, by parents' average monthly income. The data show that among 120 respondents, 51 parents (42.5%) have an average monthly income of 10,001–15,000 pesos, the largest proportion. This is followed by 38 parents (31.7%) whose average monthly income ranges from 5,001–10,000 pesos, while 31 parents (25.8%) reported an income of 15,001 pesos and above. This indicates that the majority of respondents' parents fall within the 10,001–15,000-peso income bracket, whereas the smallest proportion belongs to the 15,001-peso-and-above bracket.

Parents' Average Monthly Income	Number of respondents	Percent
5,001 - 10,000 pesos	38	31.7%
10,001 – 15,000 pesos	51	42.5%
15,001 pesos and above	31	25.8%
Total	**120**	**100%**

Table 7. Demographic Profile of the Junior High School Learners in Terms of Parents' Average Monthly Income

2. What is the extent of the impact of collaborative learning strategy toward learning mathematics concepts among junior high school learners in terms of: 2.1. Cognitive; 2.2. Problem-Solving Skills; and 2.3. Confidence and Self-Efficacy?

2.1 In the context of Cognitive

Table 8 presents the extent of the impact of the collaborative learning strategy on learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School, in terms of cognitive. The results show a weighted mean of 3.8108 and a standard deviation of 0.63759, corresponding to an overall interpretation of Agree. This indicates that the respondents generally perceive collaborative learning as helpful in improving their cognitive understanding of mathematical concepts. Through collaborative activities, students can exchange ideas, clarify misunderstandings, and construct knowledge through interaction with their peers.

Among the indicators, the highest mean score is observed for the statement "I believe collaborative learning is essential for achieving academic success in mathematics" ($\bar{x}$ = 4.05), followed by "Collaborative learning activities make mathematics more enjoyable and engaging" ($\bar{x}$ = 3.91) and "Collaborative learning activities promote a positive learning environment in mathematics classes" ($\bar{x}$ = 3.91), all interpreted as Agree. Other statements such as "Collaborative strategy enhances my ability to analyze mathematical problems" ($\bar{x}$ = 3.88), "Working with peers enhances my problem-solving skills in mathematics" ($\bar{x}$ = 3.83), and "Collaborative learning helps me identify and correct mistakes in my mathematical work" ($\bar{x}$ = 3.83) also obtained Agree interpretations, indicating that students recognize the value of peer interaction in understanding mathematical concepts. However, the statement "I prefer working individually rather than in groups during mathematics classes" had the lowest mean score ($\bar{x}$ = 3.47), which is interpreted as Neutral, suggesting that some students still demonstrate a moderate preference for independent learning.

The findings suggest that collaborative learning strategies enhance students' cognitive development in mathematics. Johnson and Johnson (2018) highlighted that cooperative learning enhances academic achievement by encouraging interaction, shared responsibility, and active engagement among learners.

	Statements	Mean	SD	Interpretation
1	Collaborative learning helps me understand mathematical concepts better.	3.80	.958	Agree
2	Working with peers enhances my problem-solving skills in mathematics.	3.83	.999	Agree
3	Collaborative strategy improves my ability to apply mathematical concepts to real-life situations.	3.66	1.033	Agree
4	Collaborative learning helps me identify and correct mistakes in my mathematical work.	3.83	1.042	Agree
5	Collaborative learning activities make mathematics more enjoyable and engaging.	3.91	1.053	Agree
6	Collaborative strategy enhances my understanding of mathematical concepts and relationships.	3.78	.965	Agree
7	I prefer working individually rather than in groups during mathematics classes.	3.47	1.229	Neutral

8	Collaborative strategy enhances my ability to analyze mathematical problems.	3.88	.822	Agree
9	Collaborative learning activities promote a positive learning environment in mathematics classes.	3.91	.944	Agree
10	I believe collaborative learning is essential for achieving academic success in mathematics.	4.05	.951	Agree
	Total Weighted Mean	**3.8108**	**.63759**	**Agree**

Legend: (5) 4.50-5.00=Strongly Agree; (4) 3.50-4.49=Agree; (3) 2.50- 3.49=Neutral; (2) 1.50- 2.49=Disagree; (1) 1.00- 1.49=Strongly Disagree

Table 8. Extent of the Impact of Collaborative Learning Strategy Toward Learning Mathematics Concepts in Terms of Cognitive

2.2 In the context of Problem-Solving Skills

Table 9 presents the extent of the impact of the collaborative learning strategy on learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School in terms of problem-solving skills. The results show a weighted mean of 3.6825 and a standard deviation of 0.56504, corresponding to an overall interpretation of Agree. This indicates that the respondents generally perceive that collaborative learning strategies help enhance their problem-solving skills in mathematics through group interaction, discussion, and shared reasoning during mathematical tasks.

Among the indicators, the highest mean score is observed for the statement "We ensure everyone in the group understands the solution strategies" ($\bar{x}$ = 3.98), followed by "Some members of my group are often confused about the math concepts being discussed" ($\bar{x}$ = 3.95) and "We find mutually acceptable solutions when there are conflicting ideas" ($\bar{x}$ = 3.88), all interpreted as Agree. Other statements such as "I understand the mathematical explanations of others in my group" ($\bar{x}$ = 3.85), "I actively participate in group discussions to solve math problems" ($\bar{x}$ = 3.73), and "I can clearly explain my mathematical ideas to my group members" ($\bar{x}$ = 3.72) also obtained Agree interpretations, indicating that students actively exchange ideas and participate in collaborative problem-solving processes. However, the statements "I have difficulty expressing my ideas in the group" ($\bar{x}$ = 3.20) and "I prefer to work on math problems individually rather than in a group" ($\bar{x}$ = 3.40) obtained Neutral interpretations, suggesting that some students still experience minor challenges in expressing ideas or may occasionally prefer independent problem-solving. The results imply that collaborative learning strategies help improve students' problem-solving abilities by encouraging discussion, reasoning, and shared understanding of mathematical solutions. Subia et al. (2020) explained that mathematical problem-solving requires cognitive processes such as analyzing, evaluating, and applying knowledge to reach appropriate solutions. Likewise, Fuchs et al. (2019) emphasized that cooperative problem-solving strategies allow students to verbalize their reasoning and evaluate different approaches, thereby strengthening their understanding and analytical thinking in mathematics.

	Statements	Mean	SD	Interpretation
1	I can clearly explain my mathematical ideas to my group members.	3.72	.936	Agree
2	I understand the mathematical explanations of others in my group.	3.85	.866	Agree
3	I have difficulty expressing my ideas in the group.	3.20	1.105	Neutral
4	I actively participate in group discussions to solve math problems.	3.73	1.122	Agree
5	I prefer to work on math problems individually rather than in a group.	3.40	1.198	Neutral
6	I question the reasoning and solutions presented by others in my group to ensure accuracy.	3.59	1.025	Agree
7	We ensure everyone in the group understands the solution strategies.	3.98	.799	Agree
8	I can address disagreements constructively within my group.	3.53	.860	Agree
9	We find mutually acceptable solutions when there are conflicting ideas.	3.88	.891	Agree
10	Some members of my group are often confused about the math concepts being discussed.	3.95	.977	Agree
	Total Weighted Mean	**3.6825**	**.56504**	**Agree**

Legend: (5) 4.50-5.00=Strongly Agree; (4) 3.50-4.49=Agree; (3) 2.50- 3.49=Neutral; (2) 1.50- 2.49=Disagree; (1) 1.00- 1.49=Strongly Disagree

Table 9. Extent of the Impact of Collaborative Learning Strategy Toward Learning Mathematics Concepts in Terms of Problem-Solving Skills

2.3 In the context of Confidence and Self-Efficacy

Table 10 presents the extent of the collaborative learning strategy's impact on learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School, as measured by confidence and self-efficacy. The results show a weighted mean of 3.7442 and a standard deviation of .73437, corresponding to an overall interpretation of Agree. This indicates that the respondents generally perceive that collaborative learning strategies help enhance their confidence and self-efficacy in learning mathematics through peer interaction, shared problem-solving, and supportive group engagement.

Among the indicators, the highest mean score is observed for the statement "I feel confident in my ability to learn new mathematical concepts" ($\bar{x}$ = 4.07), followed by "I learn a lot from working with others on math problems" ($\bar{x}$ = 4.02) and "Working in a group increases my confidence in my mathematical abilities" ($\bar{x}$ = 3.89), all interpreted as Agree. Other statements such as "I feel more self-assured when solving math problems collaboratively" ($\bar{x}$ = 3.80), "I feel my ideas are valued by my group members" ($\bar{x}$ = 3.73), and "I am less confident when I have to rely on others to solve math problems" ($\bar{x}$ = 3.73) also received Agree interpretations, indicating that collaborative activities contribute to students' sense of confidence in mathematics. Meanwhile, statements related to hesitation and self-doubt, such as "I believe I can explain difficult math concepts to my group members" ($\bar{x}$ = 3.50) and "I hesitate to share my ideas because I'm afraid they might be wrong" ($\bar{x}$ = 3.50), obtained relatively lower mean scores but still fall under the Agree interpretation, suggesting that some students may still experience uncertainty while participating in collaborative tasks.

The findings imply that collaborative learning strategies help strengthen students' confidence and belief in their mathematical abilities. Mazana et al. (2018) reported that collaborative learning improves students' attitudes toward mathematics and enhances their self-efficacy.

	Statements	Mean	SD	Interpretation
1	I feel confident in my ability to learn new mathematical concepts.	4.07	1.010	Agree
2	I often doubt my mathematical abilities.	3.58	1.090	Agree
3	I believe I can explain difficult math concepts to my group members.	3.50	1.100	Agree
4	I worry that I won't be able to contribute effectively to my group's problem-solving efforts.	3.63	1.122	Agree
5	I feel my ideas are valued by my group members.	3.73	1.027	Agree
6	I hesitate to share my ideas because I'm afraid they might be wrong.	3.50	1.328	Agree
7	I learn a lot from working with others on math problems.	4.02	1.045	Agree
8	Working in a group increases my confidence in my mathematical abilities.	3.89	1.114	Agree
9	I feel more self-assured when solving math problems collaboratively.	3.80	1.074	Agree
10	I am less confident when I have to rely on others to solve math problems.	3.73	1.145	Agree
	Total Weighted Mean	**3.7442**	**.73437**	**Agree**

Legend: (5) 4.50-5.00=Strongly Agree; (4) 3.50-4.49=Agree; (3) 2.50- 3.49=Neutral; (2) 1.50- 2.49=Disagree; (1) 1.00- 1.49=Strongly Disagree

Table 10. Extent of the Impact of Collaborative Learning Strategy Toward Learning Mathematics Concepts in Terms of Confidence and Self-Efficacy

3. Is there a significant difference in the extent of the impact of collaborative learning strategy toward learning mathematics concepts at Sulu State University *Laboratory High School when the data are grouped according to: 3.1. Age; 3.2. Gender; 3.3. Grade Level; 3.4. Parents' Educational Attainment; and 3.5. Parents' Average Monthly Income?*

3.1 According to Age

Table 11 presents the differences in the extent of the impact of the collaborative learning strategy on learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School, when the data are grouped by age. The table shows the computed F-values and corresponding significance (Sig.) values for the three domains, namely cognitive, problem-solving skills, and confidence and self-efficacy.

For cognitive, the computed F-value is 0.878 with a significance value of 0.418, which is greater than the 0.05 level of significance. This indicates that there is no significant difference in the extent of cognitive impact from the collaborative learning strategy across age groups.

In terms of problem-solving skills, the computed F-value is 1.106 with a significance value of 0.334, which is also higher than the 0.05 level of significance. This result shows that there is no significant difference in the extent of the collaborative learning strategy's impact on students' problem-solving skills across age groups.

For confidence and self-efficacy, the computed F-value is 0.111 with a significance value of 0.895, which is greater than the 0.05 level of significance. This indicates that there is no significant difference in the extent of the collaborative learning strategy's impact on students' confidence and self-efficacy across age groups.

The findings reveal that age does not significantly influence the extent of the impact of collaborative learning strategy toward learning mathematics concepts across the domains of cognitive understanding, problem-solving skills, and confidence and self-efficacy. Therefore, the null hypothesis stating that "There is no significant difference in the extent of impact of collaborative learning strategy toward learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School when the data are grouped according to age" is accepted.

Sources of Variation		Sum of squares	df	Mean Square	F	Sig.	Description
Cognitive	Between Groups	.716	2	.358	.878	.418	Not Significant
	Within Groups	47.66	117	.407			
	Total	48.38	119				
Problem-Solving Skills	Between Groups	.705	2	.353	1.106	.334	Not Significant
	Within Groups	37.288	117	.319			
	Total	37.993	119				
Confidence and Self-Efficacy	Between Groups	.122	2	.061	.111	.895	Not Significant
	Within Groups	64.054	117	.547			
	Total	64.176	119				

*Note. * Significant at alpha 0.05*

Table 11. Difference in the Extent of the Impact of Collaborative Learning Strategy Toward Learning Mathematics Concepts When the Data are Grouped According to Age

3.2 According to Gender

Table 12 presents differences in the extent of the collaborative learning strategy's impact on learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School, when the data are grouped by gender. The table shows the computed t-values and corresponding significance (Sig.) values for the three domains, namely cognitive, problem-solving skills, and confidence and self-efficacy.

For cognitive, the computed t-value is 0.755, with a p-value of 0.452, which is greater than the 0.05 level of significance. This indicates that there is no significant difference in the extent of cognitive impact from the collaborative learning strategy when respondents are grouped by gender.

In terms of problem-solving skills, the computed t-value is 1.711, with a p-value of 0.092, which is also higher than the 0.05 level of significance. This result shows that there is no significant difference in the extent of the collaborative learning strategy's impact on students' problem-solving skills across gender groups.

For confidence and self-efficacy, the computed t-value is -1.06, with a p-value of 0.290, which is greater than the 0.05 level of significance. This indicates that there is no significant difference in the extent of the collaborative learning strategy's impact on students' confidence and self-efficacy across gender groups.

The findings reveal that gender does not significantly influence the extent of the impact of collaborative learning strategy toward learning mathematics concepts across the domains of cognitive understanding, problem-solving skills, and confidence and self-efficacy. Therefore, the null hypothesis stating that "There is no significant difference in the extent of impact of collaborative learning strategy toward learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School when the data are grouped according to gender" is accepted.

Variables	Grouping	Mean	SD	Mean Difference	T	Sig.	Description
Cognitive	Male	3.870	.6749	.09185	.755	.452	Not Significant
	Female	3.778	.6179				
Problem-Solving Skills	Male	3.809	.6615	.19761	1.711	.092	Not Significant
	Female	3.612	.4939				
Confidence and Self-Efficacy	Male	3.649	.7827	-.14857	-1.06	.290	Not Significant
	Female	3.797	.7056				

*Note. * Significant at alpha 0.05*

Table 12. Difference in the Extent of the Impact of Collaborative Learning Strategy Toward Learning Mathematics Concepts When the Data are Grouped According to Gender

3.3 According to Grade Level

Table 13 presents differences in the extent of the collaborative learning strategy's impact on learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School, grouped by grade level. The table shows the computed F-values and corresponding significance (Sig.) values for the three domains, namely cognitive, problem-solving skills, and confidence and self-efficacy.

For cognitive, the computed F-value is 0.272 with a significance value of 0.845, which is greater than the 0.05 level of significance. This indicates that there is no significant difference in the extent of cognitive impact from the collaborative learning strategy across grade levels.

In terms of problem-solving skills, the computed F-value is 2.356 with a significance value of 0.075, which is also higher than the 0.05 level of significance. This result shows that there is no significant difference in the extent of the collaborative learning strategy's impact on students' problem-solving skills across grade levels.

For confidence and self-efficacy, the computed F-value is 2.131 with a significance value of 0.100, which is greater than the 0.05 level of significance. This indicates that there is no significant difference in the extent of the collaborative learning strategy's impact on students' confidence and self-efficacy across grade levels.

The findings reveal that grade level does not significantly influence the extent of the collaborative learning strategy's impact on learning mathematics concepts across the domains of cognitive understanding, problem-solving skills, and confidence and self-efficacy. Therefore, the null hypothesis stating that "There is no significant difference in the extent of impact of collaborative learning strategy toward learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School when the data are grouped according to grade level" is accepted.

Sources of Variation		Sum of squares	df	Mean Square	F	Sig.	Description
Cognitive	Between Groups	.338	3	.113	.272	.845	Not Significant
	Within Groups	48.04	116	.414			
	Total	48.38	119				
Problem-Solving Skills	Between Groups	2.182	3	.727	2.356	.075	Not Significant
	Within Groups	35.811	116	.309			
	Total	37.993	119				
Confidence and Self-Efficacy	Between Groups	3.352	3	1.117	2.131	.100	Not Significant
	Within Groups	60.824	116	.524			
	Total	64.176	119				

*Note. * Significant at alpha 0.05*

Table 13. Difference in the Extent of the Impact of Collaborative Learning Strategy Toward Learning Mathematics Concepts When the Data are Grouped According to Grade Level

3.4 According to Parents' Educational Attainment

Table 14 presents differences in the extent of the collaborative learning strategy's impact on learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School, grouped by parents' educational

attainment. The table shows the computed F-values and corresponding significance (Sig.) values for the three domains, namely cognitive, problem-solving skills, and confidence and self-efficacy.

For cognitive, the computed F-value is 1.672 with a significance value of 0.161, which is greater than the 0.05 level of significance. This indicates that there is no significant difference in the extent of cognitive impact from the collaborative learning strategy across groups defined by parents' educational attainment.

In terms of problem-solving skills, the computed F-value is 1.086 with a significance value of 0.367, which is also higher than the 0.05 level of significance. This result shows that there is no significant difference in the extent of the collaborative learning strategy's impact on students' problem-solving skills across groups defined by parents' educational attainment.

For confidence and self-efficacy, the computed F-value is 2.067 with a significance value of 0.090, which is greater than the 0.05 level of significance. This indicates that there is no significant difference in the extent of the collaborative learning strategy's impact on students' confidence and self-efficacy across groups defined by parents' educational attainment.

The findings reveal that parents' educational attainment does not significantly influence the extent of the impact of collaborative learning strategy on learning mathematics concepts across the domains of cognitive understanding, problem-solving skills, and confidence and self-efficacy. Therefore, the null hypothesis stating that "There is no significant difference in the extent of impact of collaborative learning strategy toward learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School when the data are grouped according to parents' educational attainment" is accepted.

Sources of Variation		Sum of squares	df	Mean Square	F	Sig.	Description
Cognitive	Between Groups	2.659	4	.665	1.672	.161	Not Significant
	Within Groups	45.72	115	.398			
	Total	48.38	119				
Problem-Solving Skills	Between Groups	1.383	4	.346	1.086	.367	Not Significant
	Within Groups	36.610	115	.318			
	Total	37.993	119				
Confidence and Self-Efficacy	Between Groups	4.304	4	1.076	2.067	.090	Not Significant
	Within Groups	59.872	115	.521			
	Total	64.176	119				

*Note. * Significant at alpha 0.05*

Table 14. Difference in the Extent of the Impact of Collaborative Learning Strategy Toward Learning Mathematics Concepts When the Data are Grouped According to Parents' Educational Attainment

3.5 According to Parents' Average Monthly Income

Table 15 presents differences in the extent of the collaborative learning strategy's impact on learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School, grouped by parents' average monthly income. The table shows the computed F-values and corresponding significance (Sig.) values for the three domains, namely cognitive, problem-solving skills, and confidence and self-efficacy.

For cognitive, the computed F-value is 0.118 with a significance value of 0.888, which is greater than the 0.05 level of significance. This indicates that there is no significant difference in the extent of cognitive impact from the collaborative learning strategy across groups defined by parents' average monthly income.

In terms of problem-solving skills, the computed F-value is 0.251, with a p-value of 0.779, which is also higher than the 0.05 level of significance. This result shows that there is no significant difference in the extent of the collaborative learning strategy's impact on students' problem-solving skills across groups defined by parents' average monthly income.

For confidence and self-efficacy, the computed F-value is 0.511 with a significance value of 0.601, which is greater than the 0.05 level of significance. This indicates that there is no significant difference in the extent of the collaborative learning strategy's impact on students' confidence and self-efficacy across groups defined by parents' average monthly income.

The findings reveal that parents' average monthly income does not significantly influence the extent of the collaborative learning strategy's impact on learning mathematics concepts across the domains of cognitive understanding, problem-solving skills, and confidence and self-efficacy. Therefore, the null hypothesis stating that "There is no significant difference

in the extent of impact of collaborative learning strategy toward learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School when the data are grouped according to parents' average monthly income" is accepted.

Sources of Variation		Sum of squares	df	Mean Square	F	Sig.	Description
Cognitive	Between Groups	.098	2	.049	.118	.888	Not Significant
	Within Groups	48.28	117	.413			
	Total	48.38	119				
Problem-Solving Skills	Between Groups	.162	2	.081	.251	.779	Not Significant
	Within Groups	37.831	117	.323			
	Total	37.993	119				
Confidence and Self-Efficacy	Between Groups	.556	2	.278	.511	.601	Not Significant
	Within Groups	63.620	117	.544			
	Total	64.176	119				

*Note. * Significant at alpha 0.05*

Table 15. Difference in the Extent of the Impact of Collaborative Learning Strategy Toward Learning Mathematics Concepts When the Data are Grouped According to Parents' Average Monthly Income

4. Is there a significant correlation among the sub-categories subsumed under the extent of the impact of collaborative learning strategy toward learning mathematics concepts at Sulu State University *Laboratory High School?*

Table 16 presents the correlations among the subcategories that comprise the extent of the collaborative learning strategy's impact on learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School. The computed Pearson correlation coefficients (r) indicate statistically significant relationships at the 0.01 level among the variables, based on a sample of 120 respondents.

The degrees of correlation among the subcategories are as follows:

1. A highly significant positive correlation is observed between cognitive and problem-solving skills (r = 0.614, Sig. = 0.000), suggesting that students who demonstrate higher cognitive understanding of mathematical concepts also tend to exhibit stronger problem-solving skills.
2. A moderate, positive, significant correlation is found between cognitive ability and confidence and self-efficacy (r = 0.402, Sig. = 0.000), indicating that students with stronger cognitive understanding in mathematics are more likely to develop greater confidence and belief in their mathematical abilities.
3. A highly significant positive correlation is observed between problem-solving skills and confidence and self-efficacy (r = 0.585, Sig. = 0.000), suggesting that students with stronger problem-solving skills tend to demonstrate higher confidence and self-efficacy in learning mathematics.

These findings indicate that the subcategories of the impact of collaborative learning strategy on learning mathematics concepts are significantly related to one another. As students improve their cognitive understanding through collaborative learning, their problem-solving abilities and confidence in mathematics are also strengthened. Therefore, the hypothesis, which states, "There is no significant correlation among the sub-categories subsumed under the extent of the impact of collaborative learning strategy toward learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School," is rejected.

Variables		Pearson *r*	Sig.	N	Description
Dependent	**Independent**				
Cognitive	Problem-Solving Skills	.614**	.000	120	High
	Confidence and Self-Efficacy	.402**	.000	120	Moderate
Problem-Solving Skills	Confidence and Self-Efficacy	.585**	.000	120	High

*Note. **Correlation coefficient is significant at alpha .01, *Correlation coefficient is significant at alpha .05*
Correlation Coefficient Scales Adopted from Hopkins, Will (2002):
0.0-0.1 = Nearly Zero; 0.1-0.3 = Low; 0.3-0.5 = Moderate; 0.5-0.7 = High; 0.7-0.9 = Very High; 0.9-1 = Nearly Perfect

Table 16. Correlation Among the Sub-Categories Subsumed Under the Extent of the Impact of Collaborative Learning Strategy Toward Learning Mathematics Concepts

Summary of Findings

The following are findings of this study:

1) For Research Question Number 1: On the demographic profile of student-respondents:
The majority of the Junior High School learner respondents at Sulu State University Laboratory High School are aged 14–15. In terms of gender, the majority of the respondents are female. In terms of grade level, respondents are evenly distributed across Grade 7, Grade 8, Grade 9, and Grade 10, with each grade level having the same number of participants. Regarding parents' educational attainment, the majority of respondents reported that their parents are college graduates. Regarding parents' average monthly income, most respondents come from families earning between 10,001 and 15,000 pesos per month.

2) For Research Question Number 2: On the extent of the impact of collaborative learning strategy on learning mathematics concepts among junior high school learners:
The extent of the impact of the collaborative learning strategy on learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School is interpreted as Agree regarding cognitive understanding, problem-solving skills, and confidence and self-efficacy.

3) For Research Question Number 3: On the difference in the extent of the impact of collaborative learning strategy toward learning mathematics concepts at Sulu State University Laboratory High School based on their demographic profile:
The findings reveal that there is no significant difference in the extent of the collaborative learning strategy's impact on learning mathematics concepts across age, gender, grade level, parents' educational attainment, and parents' average monthly income. Thus, the null hypothesis stating that "There is no significant difference in the extent of impact of collaborative learning strategy toward learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School when the data are grouped according to age, gender, grade level, parents' educational attainment, and parents' average monthly income" is accepted.

4) For Research Question Number 4: On correlation among the subcategories subsumed under the extent of the impact of collaborative learning strategy toward learning mathematics concepts at Sulu State University Laboratory High School:
The findings reveal that there is a significant correlation among the subcategories subsumed under the extent of the impact of collaborative learning strategy toward learning mathematics concepts, particularly between cognitive and problem-solving skills which show a high degree of correlation, cognitive and confidence and self-efficacy which show a moderate degree of correlation, and problem-solving skills and confidence and self-efficacy which also show a high degree of correlation. Thus, the null hypothesis stating that "There is no significant correlation among the sub-categories subsumed under the extent of the impact of collaborative learning strategy toward learning mathematics concepts among junior high school learners at Sulu State University Laboratory High School" is rejected.

Conclusion and Recommendations

Conclusions

The study concludes that:

1. The findings indicate that the respondents are predominantly aged 14–15, with female students comprising the majority of participants. The respondents are evenly distributed across Grades 7-10, while most of their parents are college graduates and belong to the income bracket of 10,001–15,000 pesos per month. These demographic characteristics suggest that the respondents generally come from families with moderate educational and economic backgrounds.

2. The results indicate that a collaborative learning strategy has a positive impact on students' learning of mathematics concepts, including cognitive understanding, problem-solving skills, and confidence and self-efficacy. Students generally perceive that working with peers allows them to understand mathematical ideas better, discuss different strategies, and build confidence in solving mathematical problems. These findings support Johnson and Johnson's (2018) assertion that cooperative learning enhances academic achievement by encouraging interaction, shared responsibility, and active engagement among learners. Similarly, Gillies (2016) emphasized that collaborative discussion enables students to deepen their conceptual understanding and develop critical thinking skills in mathematics.

3. The findings reveal that there is no significant difference in the extent of the collaborative learning strategy's impact on learning mathematics concepts across socio-demographic groups. This indicates that collaborative learning strategies can benefit students regardless of their demographic characteristics. The effectiveness of collaborative learning is consistent across different groups of learners. This conclusion is supported by the study by Webb and Palincsar (2022), which emphasized that group collaboration enhances learning experiences among students with diverse backgrounds by allowing them to exchange ideas and support one another in solving mathematical problems.

4. The findings indicate significant relationships among the subcategories of collaborative learning impact, particularly between cognitive understanding and problem-solving skills, between cognitive understanding and confidence and self-efficacy, and between problem-solving skills and confidence and self-efficacy. The correlations demonstrate that improvements in students' understanding of mathematical concepts are associated with stronger problem-solving abilities and increased confidence in learning mathematics. These results support the argument of Mazana et al. (2018) that collaborative learning enhances students' attitudes toward mathematics and strengthens their self-efficacy. In addition, Subia et al. (2020) explained that effective problem-solving requires cognitive processes such as analyzing, evaluating, and applying mathematical knowledge. Therefore, strengthening students' conceptual understanding through collaborative learning can also improve problem-solving skills and increase confidence in mathematics.

Recommendations

This study recommends the following:

1. School administrators of Sulu State University Laboratory High School may consider strengthening the implementation of collaborative learning strategies in mathematics classes by developing structured group activities, classroom policies, and instructional support that encourage active student participation and cooperative problem-solving.

2. Mathematics teachers may integrate collaborative learning techniques, such as group problem-solving, peer discussion, think–pair–share, and cooperative tasks, into their daily instruction to enhance students' cognitive understanding of mathematical concepts and improve their engagement in mathematics learning.

3. Parents may be encouraged to support their children's mathematics learning at home by promoting positive attitudes toward collaboration, encouraging peer study groups, and motivating students to engage in discussions and shared problem-solving with classmates.

4. Students may actively participate in collaborative learning activities by sharing ideas, asking questions, and supporting their peers during group discussions to strengthen their understanding of mathematical concepts and build confidence in solving mathematical problems.

5. Future researchers may explore additional factors that influence students' mathematical achievement and engagement, such as mathematics anxiety, motivation to learn mathematics, prior mathematical knowledge, classroom learning environment, and access to instructional materials and educational technology.

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Data Availability Statement

No new data were generated or examined in this study. All information utilized was drawn from previously published sources, which are duly acknowledged in the reference list; hence, data sharing is not applicable.

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Appendices

No appendices are attached to this study.