

Enhancing Problem-Solving Skills in Secondary Mathematics Education Through Collaborative Learning

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Abstract. This study investigated how collaborative learning strategies enhance problem-solving skills among junior high students at Maimbung Technical Vocational High School. Using a descriptive-correlational design, 100 purposively selected students participated. Strategies examined included Think-Pair-Share, Jigsaw, Collaborative Problem-Solving, and Team-Based Learning, alongside demographic factors such as age, gender, grade level, learning style, and parental education. Most students were female, aged 13-14, preferred the Reading/Writing style, and had college-educated parents. Overall, collaborative strategies were viewed as effective in promoting problem-solving, teamwork, engagement, and critical thinking. No significant differences emerged across demographic groups, but strong positive correlations were found among Jigsaw, Collaborative Problem-Solving, and Team-Based Learning, underscoring their complementary roles. However, the study's scope—limited to one school and its descriptive design—restricts causal conclusions and broader applicability. It also did not explore long-term effects, qualitative aspects, or online learning contexts. The study recommends training and resources for teachers, parental support for home learning, and student participation in group activities. Future research should use experimental and longitudinal methods, explore group dynamics, and examine collaborative learning in varied educational settings to address current gaps and better understand its sustained impact on academic performance.

Keywords: Collaborative learning; Jigsaw strategy; Problem-solving strategy; Problem-solving skills; Team-based learning strategy; Think-pair-share strategy.

1.0 Introduction

Due to its numerous positive impacts on both teachers and learners, collaborative learning has garnered considerable attention from researchers as an effective learning strategy for many students. It also aims to improve a teacher's professional performance. It transforms the learner into a valuable participant in the educational process. It encourages students to engage in conversation and discussion, improve their academic performance and psychological well-being, and hone their problem-solving skills.

Collaborative learning not only benefits students but also has a positive impact on teachers' professional development. Teachers who implement collaborative methods evolve into facilitators of learning, fostering a student-centered environment that supports active engagement and learner autonomy (Mohamad & Zaharudin, 2025). This pedagogical shift contributes to enhanced job satisfaction as teachers observe improved classroom dynamics and more meaningful student interactions (Sánchez, 2025). Moreover, collaborative learning enables

teachers to better identify student strengths and areas for growth through peer collaboration, allowing for more targeted instructional support (Cao, 2025).

With the adoption of the K-12 curriculum, collaborative learning has gained importance due to its alignment with the curriculum's emphasis on critical thinking and problem-solving. This approach is particularly suitable for K-12 education as it encourages skills beyond academic performance, such as teamwork and resilience. The role of the teacher shifts to that of a facilitator, guiding students through group activities that emphasize independent learning and peer support (Zuo, 2024).

Though collaborative and cooperative learning are similar, they have distinct characteristics. Cooperative learning often involves specific roles assigned to each group member, ensuring accountability and clear tasks. Collaborative learning, in contrast, is more flexible, allowing students to explore roles as they work towards a shared objective. This flexibility is particularly beneficial for projects that require creativity and critical thinking, making collaborative learning a valuable strategy for subjects that benefit from open-ended exploration (Acharya, Sigdel, & Poudel, 2024).

Effective collaborative learning depends on positive group dynamics and open peer interaction. Research shows that collaborative settings encourage students to take responsibility for their learning while also supporting their peers' understanding. Group dynamics, such as trust, respect, and mutual support, are essential for fostering an environment where students feel comfortable sharing ideas. Collaborative learning helps develop critical interpersonal skills like empathy and conflict resolution, which are important for both academic and personal growth (Acharya et al., 2024).

Collaborative learning has been shown to enhance academic performance. Studies suggest that students in collaborative environments retain information longer and achieve higher test scores. This approach is efficient in challenging subjects, such as mathematics, where students benefit from working through problems collectively (Adejumo et al., 2015). Collaborative learning also accommodates various learning styles, allowing students to approach topics from multiple perspectives, which can make complex material more accessible (Lawrence, 2004).

Despite its advantages, collaborative learning can present challenges, such as managing group dynamics and ensuring equal participation. Some students may dominate discussions, while others may struggle to contribute (Summers & Volet, 2010). Teachers can address these issues by setting clear guidelines, defining roles, and encouraging balanced participation. Additionally, assessing group work can be complex, as teachers must balance individual accountability with overall group performance (Willis, 2007). Structured guidance can help mitigate these challenges, making collaborative learning more effective.

Numerous studies highlight the effectiveness of collaborative learning in enhancing both academic and social skills. For instance, collaborative learning encourages higher-level thinking and improves information retention. Similarly, students in collaborative settings develop critical thinking skills and take ownership of their learning. A recent study by Nerona (2017) supports these findings, demonstrating that collaborative learning boosts student engagement and performance across various subjects.

Collaborative learning can be applied to different subjects and educational levels. In STEM fields, for example, students can tackle complex problems collectively, sharing diverse approaches (Fasli & Kopoules, 2005). In the humanities, collaborative learning fosters discussion and critical analysis, as students explore multiple perspectives on complex issues (Barnes, 1998). The flexibility of collaborative learning allows teachers to adapt it for both theoretical and practical subjects, providing students with hands-on experience that enhances their understanding and retention (Srinivas, 2007).

As education evolves, collaborative learning is expected to play an even larger role in classroom settings. Its benefits—such as increased student engagement, improved academic performance, and strengthened social skills—make it an invaluable teaching strategy (Chiu, 2004). Effective implementation requires thoughtful planning, clear guidelines, and support for teachers. In the long term, collaborative learning has the potential to transform the educational experience, preparing students to be critical thinkers, collaborative workers, and engaged citizens (Dillenbourg, 1999; Briandley et al., 2009).

2.0 Methodology

2.1 Research Design

This study employed a descriptive, comparative, and correlational research design to investigate the use of collaborative learning strategies and their impact on students' problem-solving skills. The descriptive component was used to systematically present and summarize the current status and perceptions of junior high school students regarding various collaborative learning strategies implemented in the classroom. Through this approach, the study captured demographic information. It established a baseline understanding of how students perceive the effectiveness of strategies such as Think-Pair-Share, Jigsaw, Collaborative Problem-Solving, and Team-Based Learning.

2.1 Population and Sampling Design

The sampling technique and procedure employed in this study were purposive sampling, where the sample population of junior high school students from Maimbung Technical Vocational High School was purposefully selected. In this case, the selected students in each grade level, ranging from Grade 7 to 10 at the said school, were considered the respondents of this study. This method allowed the researcher to easily direct the participants how to answer every question in each category, prepared in the research instrument, ensuring the reliable responses. Additionally, it was assumed that the data collected followed a normal distribution, which is a common assumption in quantitative research.

2.2 Research Instruments

To answer the specific problems in the study, the researcher revised and adapted the instrument from the related study of Michaelson & Sweet (2008). The essential elements of team-based learning. New Directions for Teaching and Learning, 2008(116), 7-27, Lyman, F. (1981). The responsive classroom: Using group process to promote student learning. In Brody & Crippen (Eds.), Research on teaching: Concepts, findings, and implications (pp. 127-145). Longman, Wittrock's Generative Learning Theory, and Vygotsky's notion of the Zone of Proximal Development. The questionnaire is divided into two sections. Part I covers the respondent's demographic profile, gathering essential information about the learners' backgrounds, including their age, gender, grade level, learning style preferences, and parents' educational attainment.

Part II addresses the core themes of the study, specifically assessing the use of collaborative learning strategies employed by learners and is constructed into four categories. Each category is composed of 7 items, which are the think-pair-share strategy (7 items), the jigsaw strategy (7 items), the collaborative problem-solving strategy (7 items), and the team-based learning strategy (7 items). The students are required to give their agreement on each item based on a five-point Likert scale (5: Strongly Agree; 4: Agree; 3: Moderately Agree; 2: Disagree; and 1: Strongly Disagree). The researcher ensured that experts validated the questionnaire before it was launched for the study.

2.3 Data Gathering Procedure

Permission to launch the research instrument was sought from the Office of the Dean of Graduate Studies. Upon securing the letter of permission, the researcher immediately sought the letter of approval from the principal of Maimbung Technical Vocational High School. After approval, the researcher personally administered the instrument to the respondents, and afterwards, it was submitted to the statistician for tabulation and statistical analysis and interpretation.

2.4 Data Analysis Process

In analyzing the data collected for this study, the researcher employed various statistical methods in addressing the specific queries outlined in the statement of the problem. To answer the statement of the problem on "What is the demographic profile of junior high school students of Maimbung Technical Vocational High School in terms of: age, gender, grade level, learning style preferences, and parents' educational attainment?", the statistical tool utilized was frequency and percentage; to answer statement of the problem on "What is the extent of the use of collaborative learning strategies for junior high school students of Maimbung Technical Vocational High School in enhancing their problem-solving skills in terms of: think-pair-share strategy, jigsaw strategy, collaborative problem-solving strategy, and team-based learning strategy?", the statistical tools utilized were weighted mean and standard deviation; to answer statement of the problem on "Is there a significant difference in the extent of

the use of collaborative learning strategies for junior high school students of Maimbung Technical Vocational High School in enhancing their problem-solving skills in terms of: age, gender, grade level, learning style preferences, and parents' educational attainment?", the statistical tools utilized were t-test for gender and One-way Analysis of Variance for the rest of the demographic profile; to answer the statement of the problem on "Is there a significant correlation among the sub-categories subsumed under the extent of using collaborative learning strategies in enhancing problem-solving skills among junior high school students of Maimbung Technical Vocational High School?", the statistical tool utilized was Pearson Product-Moment Correlation.

Through these statistical methods, the study aimed to provide a comprehensive understanding of investigating the use of collaborative learning strategies in enhancing problem-solving skills in secondary mathematics education, as responded by the junior high school students of Maimbung Technical Vocational High School.

3.0 Results and Discussion

3.1 Demographic Profile of Junior High School Students of Maimbung Technical

By Age

Table 1 presents the demographic profile of junior high school students at Maimbung Technical Vocational High School based on age. The data show that out of 100 respondents, 17 (17.0%) are aged 12 years old and below, 44 (44.0%) are aged 13–14 years old, and 39 (39.0%) are aged 15 years old and above.

Table 1. *Demographic Profile of Junior High School Students by Age*

Age	Number of respondents	Percentage
12 years old and below	17	17.00
13-14 years old	44	44.00
15 years old and above	39	39.00
Total	100	100.00

These findings indicate that the majority of the student population falls within the 13–14-year age group, making up nearly half of the respondents, followed by those aged 15 years and above. Students aged 12 and below represent the smallest group. This age distribution reflects a predominantly adolescent student demographic at Maimbung Technical Vocational High School.

By Gender

Table 2 presents the demographic profile of junior high school students at Maimbung Technical Vocational High School, categorized by gender. The data show that out of 100 respondents, 39 (39.0%) are male, while 61 (61.0%) are female.

Table 2. *Demographic Profile of Junior High School Students by Gender*

Gender	Number of respondents	Percentage
Male	39	39.00
Female	61	61.00
Total	100	100.00

These findings indicate that the majority of the student population at Maimbung Technical Vocational High School consists of female students compared to male students in the school.

By Grade Level

Table 3 presents the demographic profile of junior high school students at Maimbung Technical Vocational High School, categorized by grade level. The data indicate an even distribution of students across all grade levels, with 25 (25.0%) respondents in each of Grades 7, 8, 9, and 10.

Table 3. *Demographic Profile of Junior High School Students by Grade Level*

Grade Level	Number of respondents	Percentage
Grade 7	25	25.00
Grade 8	25	25.00
Grade 9	25	25.00
Grade 10	25	25.00
Total	100	100.00

These findings indicate a balanced representation of students across all junior high school grade levels at

Maimbung Technical Vocational High School.

By Learning Style Preferences

Table 4 presents the demographic profile of junior high school students at Maimbung Technical Vocational High School based on their learning style preferences. The data show that out of 100 respondents, 68 (68.0%) prefer the Reading/Writing learning style, 14 (14.0%) favor the Kinesthetic learning style, 10 (10.0%) prefer the Auditory learning style, and 8 (8.0%) prefer the Visual learning style.

Table 4. *Demographic Profile of Junior High School Students by Learning Style Preferences*

Learning Style Preferences	Number of respondents	Percentage
Visual	8	8.00
Auditory	10	10.00
Reading/Writing	68	68.00
Kinesthetic	14	14.00
Total	100	100.00

These findings indicate that the majority of the student population prefers the Reading/Writing learning style, accounting for over two-thirds of the respondents.

By Parents' Educational Attainment

Table 5 presents the demographic profile of junior high school students at Maimbung Technical Vocational High School based on their parents' educational attainment. The data show that out of 100 respondents, 33 (33.0%) have parents who are college graduates, 27 (27.0%) have parents who are high school graduates, 25 (25.0%) have parents who completed elementary education, 12 (12.0%) have parents with no formal education, and 3 (3.0%) have parents with post-graduate degrees.

Table 5. *Demographic Profile of Junior High School Students by Parents' Educational Attainment*

Parent's Educational Attainment	Number of respondents	Percentage
No formal education	12	12.00
Elementary Graduate	25	25.00
High School Graduate	27	27.00
College Graduate	33	33.00
Post-Graduate	3	3.00
Total	100	100.00

These findings indicate that the majority of the students' parents have achieved higher levels of education, with college graduates making up the largest group.

3.2 Extent of the Use of Collaborative Learning Strategies in Enhancing their Problem-Solving Skills

In terms of the Think-Pair-Share Strategy

Table 6 presents the extent of the use of collaborative learning strategies for junior high school students of Maimbung Technical Vocational High School in enhancing their problem-solving skills in terms of the Think-Pair-Share strategy. The data show that the total weighted mean is 3.7200, with a standard deviation of 0.34032, corresponding to an overall rating of "Agree." This suggests that students generally perceive the Think-Pair-Share strategy as beneficial in enhancing their mathematical problem-solving skills.

Table 6. *Extent of the Use of Collaborative Learning Strategies in Terms of the Think-Pair-Share Strategy*

	Statements	Mean	Standard Deviation	Interpretation
1	Think-Pair-Share activities help me maintain my attention and interest in the topic during lectures.	4.17	.65	Agree
2	I just depend on my partner every time we are given a task to work on in pair.	3.05	.27	Moderately Agree
3	Discussing my solution with my partner during the "share" phase can help me build connection and open-mindedness.	3.94	.89	Agree
4	Listening to other student solutions and discussion during the "share" phase helps me learn to be considerate and passionate to solve the problem.	3.93	.97	Agree
5	I would have not gained as much knowledge from the lecture if there had been no Think-Pair-Share activities.	3.23	1.19	Moderately Agree
6	I am satisfied with the Think-Pair-Share approach.	3.79	.91	Agree
7	I learn efficiently when I received information from my peer.	3.93	.78	Agree
	Total Weighted Mean	3.72	.34	Agree

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

Among the statements, the highest-rated is "Think-Pair-Share activities help me maintain my attention and interest in the topic during lectures" (Mean = 4.17, S.D. = 0.652), suggesting that students strongly agree that this strategy fosters their engagement and interest in the topic. Conversely, the lowest-rated statement is "I just depend on my partner every time we are given a task to work on in pairs" (Mean = 3.05, S.D. = 1.266), rated as "Moderately Agree," indicating that while some students occasionally rely on their partner, this is not a predominant behavior.

These findings underscore the effectiveness of the Think-Pair-Share strategy in promoting collaboration, cultivating open-mindedness, and enhancing learning efficiency among students. However, it also points to areas where students may need to develop greater independence in collaborative settings. According to Slavin (2014), collaborative learning strategies like Think-Pair-Share are effective in engaging students actively, promoting peer-to-peer interaction, and enhancing critical thinking skills in mathematics.

In terms of the Jigsaw Strategy

Table 7 presents the extent to which junior high school students of Maimbung Technical Vocational High School utilize collaborative learning strategies to enhance their problem-solving skills through the Jigsaw strategy. The data show that the total weighted mean is 3.7786, with a standard deviation of 0.49336, corresponding to an overall rating of "Agree." This indicates that students generally perceive the Jigsaw strategy as a practical approach to enhance their problem-solving skills in mathematics.

Table 7. *Extent of the Use of Collaborative Learning Strategies in Terms of the Jigsaw Strategy*

	Statements	Mean	Standard Deviation	Interpretation
1	Working in a group enhance my communication skills.	4.23	.69	Agree
2	Doing any activities using jigsaw method, helps me in overcoming the shyness and hesitation in the class.	3.55	.98	Agree
3	I don't like to work with the group because most of the time my groupmates are dependent.	3.05	1.23	Moderately Agree
4	I believe working in a group boost my confidence to do the task.	4.15	.78	Agree
5	Group work promotes closeness despite of diverse learning preferences.	3.92	.84	Agree
6	Sharing knowledge in a group helps me discover new learning.	4.34	.78	Agree
7	Doing task in a group can discourage the deserving students especially when the members are doing off-task activities (e.g. playing mobile games in their phones and make disruptive noise).	3.21	1.55	Moderately Agree
Total Weighted Mean		3.79	.49	Agree

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

Among the statements, the highest-rated is "Sharing knowledge in a group helps me discover new learning" (Mean = 4.34, S.D. = 0.781), reflecting students' strong agreement that the Jigsaw strategy fosters new learning opportunities through collaborative knowledge sharing. Conversely, the lowest-rated statement is "I do not like to work with the group, because most of the time my groupmates are dependent" (Mean = 3.05, S.D. = 1.226), rated as "Moderately Agree," suggesting that some students occasionally experience frustration with group dependency but do not perceive it as a significant barrier to learning. Additionally, students agree that the Jigsaw strategy helps enhance communication skills, boost confidence, and promote closeness despite diverse learning preferences. However, some students moderately agree that group work can discourage deserving students when off-task behaviors occur, such as playing mobile games or creating disruptions (Mean = 3.21, S.D. = 1.552).

These findings underscore the effectiveness of the Jigsaw strategy in fostering collaboration, communication, and confidence among students. However, they also emphasize the need for strategies to address group dependency and off-task behaviors in order to maximize the benefits of this approach. According to Aronson and Patnoe (2011), the jigsaw strategy is highly effective in creating a cooperative learning environment, promoting active engagement, and building critical social and academic skills.

In terms of the Collaborative Problem-Solving Strategy

Table 8 presents the extent to which junior high school students of Maimbung Technical Vocational High School utilize collaborative learning strategies to enhance their problem-solving skills, as measured by the Collaborative Problem-Solving Strategy. The data show that the total weighted mean is 3.8500, with a standard deviation of 0.43425, corresponding to an overall rating of "Agree." This suggests that students generally view the Collaborative Problem-Solving Strategy as a practical approach to improve their mathematical problem-solving

skills.

Table 8. *Extent of the Use of Collaborative Learning Strategies in Terms of Collaborative Problem-Solving Strategy*

	Statements	Mean	Standard Deviation	Interpretation
1	When I work with other students, I develop my social skills such as effective communication skills, confidence, responsiveness and teamwork.	4.19	.80	Agree
2	Working together in a group helps every member learns the assigned task.	4.19	.79	Agree
3	I often discourage doing a task with my group especially when other members are not paying attention.	3.39	1.15	Moderately Agree
4	When we work together in a small group, I have to find out what everyone else knows if I am going to be able to do the assignment.	3.72	.89	Agree
5	In any topic discussion, I believe I learn more when I share with others.	4.20	.82	Agree
6	When we work in a small group, our grade depends on how much all members learn.	3.96	.84	Agree
7	I have a lot of questions to my groupmates but I hesitate to ask.	3.30	1.09	Moderately Agree
	Total Weighted Mean	3.85	.43	Agree

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

Among the statements, the highest-rated is "In any topic discussion, I believe I learn more when I share with others" (Mean = 4.20, S.D. = 0.816), reflecting students' strong agreement that sharing knowledge within the group significantly enhances their learning process. Conversely, the lowest-rated statement is "I have a lot of questions to my groupmates but I hesitate to ask" (Mean = 3.30, S.D. = 1.087), rated as "Moderately Agree," suggesting that while students occasionally hesitate to engage in group discussions fully, this does not significantly hinder their collaborative learning experience. Students also agree that working in groups fosters social skills, including communication, confidence, responsiveness, and teamwork. Furthermore, they recognize the value of group collaboration in distributing learning responsibilities and achieving group success. However, a moderate agreement was noted on challenges such as group members' inattentiveness ("I often discourage doing a task with my group, especially when other members are not paying attention," Mean = 3.39, S.D. = 1.154).

These findings suggest that while the Collaborative Problem-Solving Strategy is generally effective in promoting problem-solving and collaborative skills, occasional challenges related to group dynamics may need to be addressed to maximize its benefits. According to Johnson and Johnson (2017), collaborative learning environments encourage active participation, shared responsibility, and the development of higher-order thinking skills.

In terms of the Team-Based Learning Strategy

Table 9 presents the extent to which junior high school students of Maimbung Technical Vocational High School utilize collaborative learning strategies to enhance their problem-solving skills through the Team-Based Learning Strategy. The data show that the total weighted mean is 3.9671, with a standard deviation of 0.37211, corresponding to an overall rating of "Agree." This indicates that students generally perceive the Team-Based Learning Strategy as a practical approach to enhance their problem-solving skills in mathematics.

Table 9. *Extent of the Use of Collaborative Learning Strategies in Terms of Team-Based Learning Strategy*

	Statements	Mean	Standard Deviation	Interpretation
1	There must be a goal in every team.	4.23	.75	Agree
2	Teamwork promotes unity and consensus among members.	3.84	.87	Agree
3	Members regularly provide each other with feedback.	3.74	.73	Agree
4	I learn to contribute the sufficient amount of work and time.	3.92	.79	Agree
5	The team must be provided with sufficient resources to accomplish its task.	3.70	.86	Agree
6	I like this team-based learning most of the time because the disputes are resolved in a constructive manner.	4.03	.82	Agree
7	A task becomes easy when everyone shows cooperation and willingness to learn and complete his/her work on time.	4.31	.91	Agree
	Total Weighted Mean	3.97	.37	Agree

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

Among the statements, the highest-rated is "A task becomes easy when everyone shows cooperation and willingness to learn and complete his/her work on time" (Mean = 4.31, S.D. = 0.907), highlighting students' strong agreement that teamwork fosters efficiency and task completion. The lowest-rated statement is "The team must be provided with sufficient resources to accomplish its task" (Mean = 3.70, S.D. = 0.859), which still received an "Agree" rating, emphasizing the importance of adequate resources in team-based activities. Students also agree

that teamwork promotes unity, feedback, and learning contributions among members. They appreciate the constructive resolution of disputes ("I like this team-based learning most of the time because the disputes are resolved in a constructive manner," Mean = 4.03, SD = 0.82). They also recognize the value of setting clear goals and achieving consensus.

These findings suggest that Team-Based Learning is an effective collaborative strategy that enhances problem-solving skills by fostering cooperation, timely task completion, and constructive conflict resolution. According to Michaelsen et al. (2016), team-based learning strategies improve student engagement, accountability, and the development of practical problem-solving abilities within collaborative settings.

3.3 Difference in the Extent of the Use of Collaborative Learning Strategies in Enhancing their Problem-Solving Skills

In terms of Age

Table 10 presents the differences in the extent of collaborative learning strategy use among junior high school students of Maimbung Technical Vocational High School in enhancing their problem-solving skills, grouped by age. The table shows the F-values and significance values (Sig.) for the collaborative learning strategies: Think-Pair-Share Strategy, Jigsaw Strategy, Collaborative Problem-Solving Strategy, and Team-Based Learning Strategy. All these variables show no significant differences, as the Sig. Values are above the alpha level of 0.05.

Table 10. The difference in the Extent of the Use of Collaborative Learning Strategies in Terms of Age

Sources of Variation		Sum of squares	df	Mean Square	F	Sig.	Description
Think-Pair-Share Strategy	Between Groups	.056	2	.028	.239	.788	Not Significant
	Within Groups	11.410	97	.118			
	Total	11.466	99				
Jigsaw Strategy	Between Groups	.466	2	.233	.957	.388	Not Significant
	Within Groups	23.631	97	.244			
	Total	24.097	99				
Collaborative Problem-Solving Strategy	Between Groups	.179	2	.089	.469	.627	Not Significant
	Within Groups	18.489	97	.191			
	Total	18.668	99				
Team-Based Learning Strategy	Between Groups	.477	2	.239	1.749	.179	Not Significant
	Within Groups	13.231	97	.136			
	Total	13.708	99				

Note. * Significant at alpha 0.05

For the Think-Pair-Share Strategy, the sum of squares between groups is 0.056, with a mean square of 0.028, an F-value of 0.239, and a Sig—the value of 0.788, which is not significant. Similarly, for the Jigsaw Strategy, the sum of squares between groups is 0.466, with a mean square of 0.233, an F-value of 0.957, and a Significance Level of 0.33. value of 0.388, which is also not significant. For the Collaborative Problem-Solving Strategy, the sum of squares between groups is 0.179, with a mean square of 0.089, an F-value of 0.469, and a Sig—the value of 0.627, which is not significant. Finally, for the Team-Based Learning Strategy, the sum of squares between groups is 0.477, with a mean square of 0.239, an F-value of 1.749, and a Significance Level of 0.477. Value of 0.179, which is also not significant.

These findings suggest that age does not significantly influence the extent to which collaborative learning strategies are used to enhance students' problem-solving skills. Therefore, the hypothesis which states, "There is no significant difference in the extent of the use of collaborative learning strategies for junior high school students of Maimbung Technical Vocational High School in enhancing their problem-solving skills when data are grouped according to their age," is accepted.

In terms of Gender

Table 11 presents the differences in the extent of collaborative learning strategy use for junior high school students of Maimbung Technical Vocational High School in enhancing their problem-solving skills, grouped by their demographic profile in terms of gender. The table presents the mean, standard deviation (SD), mean difference, t-values, and significance values (Sig.) for the collaborative learning strategies: Think-Pair-Share Strategy, Jigsaw Strategy, Collaborative Problem-Solving Strategy, and Team-Based Learning Strategy. All variables show no significant differences, as the Sig. Values are above the alpha level of 0.05.

Table 11. *Difference in the Extent of the Use of Collaborative Learning Strategies in Terms of Gender*

Variables	Grouping	Mean	S.D	Mean Difference	t	Sig.	Description
Think-Pair-Share Strategy	Male	3.73	.31	.021	.295	.769	Not Significant
	Female	3.71	.36				
Jigsaw Strategy	Male	3.66	.44	-.195	-1.96	.053	Not Significant
	Female	3.86	.51				
Collaborative Problem-Solving Strategy	Male	3.76	.42	-.156	-1.78	.079	Not Significant
	Female	3.91	.44				
Team-Based Learning Strategy	Male	3.97	.38	.012	.154	.878	Not Significant
	Female	3.96	.37				

Note. * Significant at alpha 0.05

For the Think-Pair-Share Strategy, the mean for male students is 3.733 (S.D. = 0.31466), and for female students, it is 3.712 (S.D. = 0.35809), with a mean difference of 0.02066, a t-value of 0.295, and a Significance Level of 0.795. value of 0.769. For the Jigsaw Strategy, male students have a mean of 3.659 (S.D. = 0.44289), and female students have a mean of 3.855 (S.D. = 0.51209), with a mean difference of -0.19546, a t-value of -1.96, and a Significance Level of 0.05. value of 0.053. For the Collaborative Problem-Solving Strategy, male students have a mean of 3.755 (S.D. = 0.41579), and female students have a mean of 3.911 (S.D. = 0.43812), with a mean difference of -0.15643, a t-value of -1.78, and a Significance Level of 0.078. value of 0.079, indicating no significant difference. For the Team-Based Learning Strategy, male students have a mean of 3.974 (S.D. = 0.37920), and female students have a mean of 3.963 (S.D. = 0.37060), with a mean difference of 0.01183, a t-value of 0.154, and a Significance Level of 0.882. Value of 0.878, showing no significant difference.

These findings suggest that gender does not significantly influence the extent to which collaborative learning strategies are used to enhance students' problem-solving skills. Therefore, the hypothesis which states, "There is no significant difference in the extent of the use of collaborative learning strategies for junior high school students of Maimbung Technical Vocational High School in enhancing their problem-solving skills when data are grouped according to their gender," is accepted.

In terms of Grade Level

Table 12 presents the differences in the extent of collaborative learning strategy use for junior high school students of Maimbung Technical Vocational High School in enhancing their problem-solving skills, grouped by grade level. The table shows the F-values and significance values (Sig.) for the collaborative learning strategies: Think-Pair-Share Strategy, Jigsaw Strategy, Collaborative Problem-Solving Strategy, and Team-Based Learning Strategy. All these values are above the alpha level of 0.05, indicating that there are no significant differences among the groups based on grade level.

Table 12. *Difference in the Extent of the Use of Collaborative Learning Strategies in Terms of Grade Level*

Sources of Variation		Sum of squares	df	Mean Square	F	Sig.	Description
Think-Pair-Share Strategy	Between Groups	.306	3	.102	.877	.456	Not Significant
	Within Groups	11.160	96	.116			
	Total	11.466	99				
Jigsaw Strategy	Between Groups	.403	3	.134	.545	.653	Not Significant
	Within Groups	23.694	96	.247			
	Total	24.097	99				
Collaborative Problem-Solving Strategy	Between Groups	.210	3	.070	.363	.780	Not Significant
	Within Groups	18.459	96	.192			
	Total	18.668	99				
Team-Based Learning Strategy	Between Groups	.359	3	.120	.859	.465	Not Significant
	Within Groups	13.350	96	.139			
	Total	13.708	99				

Note. * Significant at alpha 0.05

For the Think-Pair-Share Strategy, the sum of squares between groups is 0.306, with a mean square of 0.102, an F-value of 0.877, and a Sig – value of 0.456, which is not significant. Similarly, for the Jigsaw Strategy, the sum of squares between groups is 0.403, with a mean square of 0.134, an F-value of 0.545, and a Sig – value of 0.653, which is also not significant. For the Collaborative Problem-Solving Strategy, the sum of squares between groups is 0.210, with a mean square of 0.070, an F-value of 0.363, and a Sig – value of 0.780, which is not significant. Lastly, for the Team-Based Learning Strategy, the sum of squares between groups is 0.359, with a mean square of 0.120, an F-value of 0.859, and a Significance Level of 0.359. value of 0.465, which is not significant.

These findings suggest that grade level does not significantly influence the extent of the use of collaborative learning strategies for junior high school students. Therefore, the hypothesis which states, "There is no significant difference in the extent of the use of collaborative learning strategies for junior high school students of Maimbung Technical Vocational High School in enhancing their problem-solving skills when data are grouped according to grade level," is accepted.

In terms of Learning Style Preferences

Table 13 presents the differences in the extent of collaborative learning strategy use for junior high school students of Maimbung Technical Vocational High School in enhancing their problem-solving skills, grouped by learning style preferences. The table shows the F-values and significance values (Sig.) for the collaborative learning strategies: Think-Pair-Share Strategy, Jigsaw Strategy, Collaborative Problem-Solving Strategy, and Team-Based Learning Strategy – all the Sig. Values are above the alpha level of 0.05, indicating that there are no significant differences among the groups based on learning style preferences.

Table 13. *Difference in the Extent of the Use of Collaborative Learning Strategies in Terms of Learning Style Preferences*

Sources of Variation		Sum of squares	df	Mean Square	F	Sig.	Description
Think-Pair-Share Strategy	Between Groups	.050	3	.017	.141	.935	Not Significant
	Within Groups	11.416	96	.119			
	Total	11.466	99				
Jigsaw Strategy	Between Groups	.516	3	.172	.701	.554	Not Significant
	Within Groups	23.581	96	.246			
	Total	24.097	99				
Collaborative Problem-Solving Strategy	Between Groups	.611	3	.204	1.082	.360	Not Significant
	Within Groups	18.058	96	.188			
	Total	18.668	99				
Team-Based Learning Strategy	Between Groups	.473	3	.158	1.144	.335	Not Significant
	Within Groups	13.235	96	.138			
	Total	13.708	99				

Note. * Significant at alpha 0.05

For the Think-Pair-Share Strategy, the sum of squares between groups is 0.050, with a mean square of 0.017, an F-value of 0.141, and a Sig – value of 0.935, which is not significant. Similarly, for the Jigsaw Strategy, the sum of squares between groups is 0.516, with a mean square of 0.172, an F-value of 0.701, and a Significance Level of 0.401. Value of 0.554, which is not significant. For the Collaborative Problem-Solving Strategy, the sum of squares between groups is 0.611, with a mean square of 0.204, an F-value of 1.082, and a Sig – value of 0.360, which is not significant. Lastly, for the Team-Based Learning Strategy, the sum of squares between groups is 0.473, with a mean square of 0.158, an F-value of 1.144, and a Significance Level of 0.473. value of 0.335, which is not significant.

These findings suggest that learning style preferences do not significantly influence the extent to which junior high school students use collaborative learning strategies. Therefore, the hypothesis which states, "There is no significant difference in the extent of the use of collaborative learning strategies for junior high school students of Maimbung Technical Vocational High School in enhancing their problem-solving skills when data are grouped according to learning style preferences," is accepted.

In terms of Parents' Educational Attainment

Table 14 presents the differences in the extent of collaborative learning strategy use for junior high school students of Maimbung Technical Vocational High School in enhancing their problem-solving skills, when data are grouped according to their parents' educational attainment. The table shows the F-values and significance values (Sig.) for the collaborative learning strategies: Think-Pair-Share Strategy, Jigsaw Strategy, Collaborative Problem-Solving Strategy, and Team-Based Learning Strategy – all the Sig. Values are above the alpha level of 0.05, indicating no significant differences among the groups based on parents' educational attainment.

For the Think-Pair-Share Strategy, the sum of squares between groups is 0.120, with a mean square of 0.030, an F-value of 0.251, and a Significance Level of 0.120. value of 0.909, which is not significant. Similarly, for the Jigsaw Strategy, the sum of squares between groups is 0.275, with a mean square of 0.069, an F-value of 0.274, and a Significance Level of 0.275. value of 0.894, which is not significant. For the Collaborative Problem-Solving Strategy, the sum of squares between groups is 0.046, with a mean square of 0.011, an F-value of 0.059, and a Sig – value of 0.994, which is not significant. Lastly, for the Team-Based Learning Strategy, the sum of squares between groups

is 1.086, with a mean square of 0.271, an F-value of 2.043, and a Significance Level of 0.146. value of 0.095, which is not significant.

Table 14. The difference in the Extent of the Use of Collaborative Learning Strategies in Terms of Parents' Educational Attainment

Sources of Variation		Sum of squares	df	Mean Square	F	Sig.	Description
Think-Pair-Share Strategy	Between Groups	.120	4	.030	.251	.909	Not Significant
	Within Groups	11.346	95	.119			
	Total	11.466	99				
Jigsaw Strategy	Between Groups	.275	4	.069	.274	.894	Not Significant
	Within Groups	23.822	95	.251			
	Total	24.097	99				
Collaborative Problem-Solving Strategy	Between Groups	.046	4	.011	.059	.994	Not Significant
	Within Groups	18.622	95	.196			
	Total	18.668	99				
Team-Based Learning Strategy	Between Groups	1.086	4	.271	2.043	.095	Not Significant
	Within Groups	12.623	95	.133			
	Total	13.708	99				

Note. * Significant at alpha 0.05

These findings suggest that parents' educational attainment does not significantly influence the extent to which junior high school students use collaborative learning strategies to enhance their problem-solving skills. Therefore, the hypothesis which states, "There is no significant difference in the extent of the use of collaborative learning strategies for junior high school students of Maimbung Technical Vocational High School in enhancing their problem-solving skills when data are grouped according to parents' educational attainment," is accepted.

3.4 Correlations among the Sub-categories Subsumed Under the Extent of Using Collaborative Learning Strategies in Enhancing Problem-Solving Skills

Table 15 presents the correlations among the subcategories encompassed under the extent of using collaborative learning strategies to enhance problem-solving skills among junior high school students of Maimbung Technical Vocational High School. The computed Pearson correlation coefficients (r) between these variables indicate statistically significant relationships at an alpha level of 0.01 for some subcategories.

Table 15. Correlations among the Sub-categories Subsumed Under the Extent of Using Collaborative Learning Strategies in Enhancing Problem-Solving Skills

Dependent Variables	Independent Variables	Pearson r	Sig.	N	Description
Think-Pair-Share Strategy	Jigsaw Strategy	.156	.121	100	Not Significant
	Collaborative Problem-Solving Strategy	.090	.376	100	Not Significant
	Team-Based Learning Strategy	.200**	.46	100	Low
Jigsaw Strategy	Collaborative Problem-Solving Strategy	.569**	.000	100	High
	Team-Based Learning Strategy	.443**	.000	100	Moderate
Collaborative Problem-Solving Strategy	Team-Based Learning Strategy	.476**	.000	100	Moderate

Note. **Correlation coefficient is significant at alpha .01; 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.

The degrees of correlation among the subcategories are as follows: (a) A low positive correlation ($r = 0.200$, $p = 0.046$) is observed between the Think-Pair-Share Strategy and the Team-Based Learning Strategy, suggesting a weak association between the use of these two strategies, (b) A high positive correlation ($r = 0.569$, $p < 0.001$) is observed between the Jigsaw Strategy and Collaborative Problem-Solving Strategy, indicating that the use of the Jigsaw Strategy is strongly associated with the use of the Collaborative Problem-Solving Strategy, (c) A moderate positive correlation ($r = 0.443$, $p < 0.001$) is observed between the Jigsaw Strategy and Team-Based Learning Strategy, suggesting that the use of the Jigsaw Strategy is moderately linked to the use of Team-Based Learning Strategy, (d) A moderate positive correlation ($r = 0.476$, $p = 0.000$) is observed between the Collaborative Problem-Solving Strategy and the Team-Based Learning Strategy, implying that the use of the Collaborative Problem-Solving Strategy is moderately associated with the use of the Team-Based Learning Strategy.

These findings suggest that while some strategies, such as Jigsaw, Collaborative Problem-Solving, and Team-

Based Learning, show significant interrelations, others, such as Think-Pair-Share, are not significant with the Jigsaw Strategy and Collaborative Problem-Solving Strategy. Therefore, the hypothesis, which states, "There is no significant correlation among the subcategories subsumed under the extent of using collaborative learning strategies in enhancing problem-solving skills among junior high school students at Maimbung Technical Vocational High School," is rejected.

4.0 Conclusion

The study's results revealed several key insights into the use of collaborative learning strategies at Maimbung Technical Vocational High School. The demographic profile of the student respondents showed a predominance of females, most of whom were in the adolescent age group of 13 to 14 years old, with a significant number coming from families where parents attained higher education, particularly at the college level. Additionally, students generally exhibited a preference for the Reading/Writing learning style. This suggests the importance of integrating instructional materials that emphasize text-based resources, reflective writing, and reading comprehension into collaborative learning activities to align with their learning preferences and enhance academic engagement.

In terms of the perceived effectiveness of collaborative learning strategies, students rated approaches such as Think-Pair-Share, Jigsaw, Collaborative Problem-Solving, and Team-Based Learning as generally effective. These methods were recognized for fostering engagement, communication, and teamwork within the classroom. However, some challenges were acknowledged, including group dependency and occasional off-task behaviors, which underscore the need for structured group management and active teacher facilitation to ensure balanced participation and accountability. Despite these minor issues, the students' positive reception of the collaborative environment supports its continued use in the curriculum.

Notably, the analysis revealed no significant differences in the perceived effectiveness of collaborative learning strategies across demographic factors, including age, gender, grade level, learning style preferences, and parental educational attainment. This finding highlights the inclusive nature of collaborative learning, suggesting that these strategies can be effectively implemented across a diverse student population without inherent bias or limitation.

Furthermore, significant positive correlations were observed among the Jigsaw Strategy, Collaborative Problem-Solving Strategy, and Team-Based Learning Strategy. This suggests that these approaches are not only practical independently but also work synergistically in promoting active engagement, deeper understanding, and enhanced problem-solving capabilities. Their interconnectedness suggests that a blended or rotational approach to these methods could maximize learning outcomes and better cater to diverse instructional goals.

Taken together, the findings suggest that Maimbung Technical Vocational High School can continue to leverage the benefits of collaborative learning strategies to enhance students' problem-solving skills. The school should consider maintaining and possibly expanding its teacher training programs, focusing on collaborative pedagogy and support systems to manage group dynamics effectively. The integration of learning style-based content—especially for reading/writing learners—and equitable access to structured collaboration tools could further strengthen inclusivity and learning efficacy across all student groups.

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The author does all the work.

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7.0 Conflict of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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9.0 References

- Acharya, B., Sigdel, S., & Poudel, O. (2024). Analysis of effectiveness of collaborative pedagogy practices. *NPRC Journal of Multidisciplinary Research*, 7(1). <https://doi.org/10.3126/nprcjmr.v7i1.70965>
- Adejumo, D. B., Oluwole, B. B., & Muraina, M. B. (2015). Effect of collaborative learning on students' academic performance in mathematics. *UNIZIK Journal of STEM Education*, 3(2), 104–112. <https://journals.unizik.edu.ng/jstme/article/download/2849/2296>
- Ahmad, R. K. (2016). The effect of (Think-Pair-Share) strategy on the achievement of third-grade students in sciences in the educational district of Irbid. *Journal of Education and Practice*, 8(9).
- Aronson, E., & Patnoe, S. (2011). *Cooperation in the classroom: The jigsaw method* (3rd ed.). Pinter & Martin Publishers.
- Cao, J. (2025). Application and practice of student-centered blended teaching in the international settlement course. *Journal of Educational Theory and Practice*, 25(1). <https://ojs.apspublisher.com/index.php/jetp/article/download/228/195>
- Gokhale, A. (1995). Collaborative learning enhances critical thinking. *Journal of Technology Education*, 7(1), 22–30.
- Halimah, L., & Sukmayadi, V. (2019). The role of “jigsaw” method in enhancing Indonesian prospective teachers' pedagogical knowledge and communication skills. *International Journal of Instruction*, 12(2), 289–304.
- Jainal, N. H., & Shahhill, M. (2021). Incorporating jigsaw strategy to support students' learning through action research. *International Journal on Social and Educational Sciences (IJonSES)*, 3(2), 252–266.
- Johnson, D., & Johnson, R. (2017). Collaborative learning environments: Encouraging active participation, shared responsibility, and higher-order thinking skills. (Publication info incomplete; consider updating with journal or publisher)
- Lawrence, W. K. (2004). The experience of contrasting learning styles, learning preferences, and personality types in the community college English classroom (Doctoral dissertation, Northeastern University).
- Lyman, F. (1981). The responsive classroom: Using group process to promote student learning. In C. B. Brody & J. G. Crippen (Eds.), *Research on teaching: Concepts, findings, and implications* (pp. 127–145). Longman.
- Michaelsen, L. K., & Sweet, M. (2008). The essential elements of team-based learning. *New Directions for Teaching and Learning*, 2008(116), 7–27. <https://doi.org/10.1002/tl.330>
- Mohamad, S. A., & Zaharudin, R. (2025). Shaping the future: Bibliometric insights on teaching strategies in vocational education. *Journal of Research in Vocational Education*.
- Nerona, D. L. (2017). The effectiveness of collaborative learning strategy on students' academic performance. *International Journal of Advanced Research in Education & Technology*, 4(3), 15–18. <https://core.ac.uk/download/pdf/234032804.pdf>
- Saadati, F., & Reyes, C. (2019). Collaborative learning to improve problem-solving skills: A relation affecting through attitude toward mathematics. In *Mathematics Education in the Digital Era* (pp. 187–202). (Publisher info needed)
- Sánchez, J. (2025). Empowering education: How technology transforms teaching into meaningful learning experiences. *INTED2025 Proceedings*.
- Slavin, R. E. (1990). *Cooperative learning: Theory, research, and practice*. Allyn and Bacon.
- Summers, M., & Volet, S. (2010). Group work does not necessarily equal collaborative learning: Evidence from observations and self-reports. *European Journal of Psychology of Education*, 25(4), 473–492. <https://doi.org/10.1007/s10212-010-0026-5>
- Willis, J. (2007). Cooperative learning is a brain turn-on. *Middle School Journal*, 38(4), 4–13.
- Wismath, S., & Orr, D. (2015). Collaborative learning in problem solving: A case study in metacognitive learning. *The Canadian Journal for the Scholarship of Teaching and Learning*, 6(3), 1–19. <https://doi.org/10.5206/cjsotl-rcacea.2015.3.9>