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Relationship of Collaborative Teaching-Learning Strategies to the Problem-Solving Skills of Grade 6 Learners

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ABSTRACT

Collaborative teaching is expected to develop learners' problem-solving, but different collaborative strategies may build different aspects of it. This descriptive-correlational study examined the relationship of collaborative teaching-learning strategies to the problem-solving skills of Grade 6 learners in selected schools of the North District, Schools Division of Cebu City, during School Year 2024–2025. Twenty teachers rated their use of the jigsaw method, problem-based learning, and online collaborative learning, and 60 learners rated their analytical thinking, decision-making, and collaboration and teamwork, using a validated instrument adapted from established scales (α = .81). Data were analyzed through weighted means, chi-square, and a test of relationship. Teachers used problem-based learning (*M* = 4.51) and online collaborative learning (*M* = 4.40) to an Excellent extent, but the jigsaw method only to a Less Satisfactory extent (*M* = 2.40). Learners were Very High in collaboration and teamwork (*M* = 3.62) and decision-making (M = 3.48) but Less in analytical thinking (*M* = 2.35). Teachers' experience, education, training, and age were associated with strategy use, and learners' family income, parents' occupation, and age with problem-solving skills. Collaborative strategies were significantly related to problem-solving skills (t = 3.214, p = .002). The skills learners displayed mirrored the strategies they experienced: group-centered strategies corresponded to strong teamwork and decision-making, while the underused jigsaw method corresponded to weak analytical thinking. Teaching-learning activities that balance group tasks with individual analysis and explanation are proposed.

Introduction

Problem-solving is now regarded as a basic outcome of schooling, not an advanced skill reserved for high achievers. Learners are expected to analyze situations, weigh options, and work with others to reach sound solutions, and international frameworks treat collaborative problem-solving as a measurable competency (OECD, 2017). In the Philippines, the K to 12 curriculum lists problem-solving among the central goals of elementary mathematics and promotes collaborative and inquiry-based teaching to achieve it (Department of Education, 2016; Republic Act No. 10533, 2013).

The expected link between collaborative teaching and problem-solving rests on a simple idea: learners who reason together learn to reason better. Studies of elementary and middle-grade learners support this, showing gains in problem-solving, achievement, and motivation when learners work on structured collaborative tasks (Kuo et al., 2020; Siller & Ahmad, 2024;

Setiawan et al., 2020). Not all collaborative strategies are equivalent, however. The jigsaw method, problem-based learning, and online collaborative learning place different demands on learners and teachers and may build different aspects of problem-solving. Whether the strategies teachers actually use are related to learners' problem-solving skills in Philippine public elementary schools has not been established in the North District of the Schools Division of Cebu City.

This study examined the relationship of collaborative teaching-learning strategies to the problem-solving skills of Grade 6 learners in selected North District schools during School Year 2024–2025. It addressed four questions: To what extent do teachers use the jigsaw method, problem-based learning, and online collaborative learning? What are learners' levels of analytical thinking, decision making, and collaboration and teamwork? Are teachers' and learners' characteristics associated with these variables? Is the use of collaborative strategies significantly related to learners' problem-solving skills? The findings were used to propose teaching-learning activities.

Literature Review

Why collaboration should build problem-solving. Three theories explain the expected relationship. Vygotsky's sociocultural theory holds that learners can solve problems with peers that they cannot yet solve alone, and that this shared reasoning is later internalized (Vygotsky, 1978). Piaget's constructivism holds that disagreement among peers creates cognitive conflict that learners resolve by reorganizing their understanding (Piaget, 1950). Cooperative learning theory adds that these benefits depend on positive interdependence, individual accountability, and face-to-face promotive interaction (Johnson & Johnson, 2009). Collaborative learning has a long history in which these principles have been refined (Li & Kim, 2022), and it has been shown to strengthen both academic performance and social interaction (Alzubi et al., 2023; Clipa & Cărămidă, 2023).

Strategies with different demands. The jigsaw method assigns each learner a portion of the content to master and teach to the group, which places a heavy demand on individual analysis and explanation; when it works, it builds both understanding and accountability (Lee, 2023). Problem-based learning organizes group work around authentic problems that learners research and solve, and it has been shown to improve elementary learners' cognitive and problem-solving abilities in science and mathematics (Zohar & Dori, 2020). Combining inquiry with collaboration further strengthens teamwork and problem-solving (Shengqiang et al., 2025). Online collaborative learning moves group work onto digital platforms; it can foster problem-solving and metacognitive awareness (Hsu et al., 2021) and digital literacy (Voogt et al., 2020), but its quality depends on social interaction and teacher moderation (Joksimović et al., 2020; Dooly & O'Dowd, 2020).

Dimensions of problem-solving. Analytical thinking is the capacity to break problems into components, identify relationships, and judge evidence, and it is a central predictor of problem-solving success (Lavigne et al., 2020). It depends on metacognitive monitoring and reflection (McLeod & Velayudhan, 2021). Decision making requires weighing alternatives and anticipating consequences, and it is influenced by emotional intelligence (Eisenman &

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Komives, 2021). Collaboration and teamwork involve shared goals, task division, communication, and feedback, and they underpin collaborative decision-making in elementary classrooms (Van der Meijden et al., 2020; Zhou & Brown, 2023). Elementary learners vary in their flexibility and strategy use (Hiemstra & Gardner, 2020; Al-khati, 2022), and literature-based and scaffolded approaches can help introduce problem-solving at this level (Yayuk & Mirici, 2020; Kim & Lee, 2020).

Evidence from Philippine classrooms. Filipino learners respond positively to cooperative structures that reflect cultural norms of helping (Dizon, 2020). Cooperative learning has improved elementary learners' problem-solving (Zhang & Liang, 2020), collaborative strategies have raised Grade 6 learners' performance in mathematics and English (De la Victoria, 2024; Lozada & Antiquina, 2022), and collaborative learning has improved elementary learners' academic performance (Cagatan & Quirap, 2024). Problem-solving skills, in turn, are closely related to achievement (Irawati, 2023; Cahyadi et al., 2023).

Teachers and context. Teacher guidance during collaboration is decisive (Van Leeuwen & Janssen, 2019), and teacher-supported collaboration raises engagement (Johnson et al., 2022). Context also matters: socio-economic disadvantage limits learners' resources and readiness (Education Policy Institute, 2020), and gender norms can shape problem-solving confidence and performance (Stoet & Geary, 2020; Ghorai & Mohakud, 2024). These ideas are supported by the Governance of Basic Education Act of 2001, which allows schools to adopt responsive instruction (Republic Act No. 9155, 2001), and by national priorities for 21st-century skills (National Economic and Development Authority, 2023).

Methodology

Design and respondents. A descriptive-correlational design was used (Best & Kahn, 2007). The respondents were 20 teachers and 60 Grade 6 learners in selected schools of the North District, Schools Division of Cebu City, in School Year 2024–2025, chosen through simple random and quota sampling.

Instruments. The questionnaire was adapted from the Scale of Teaching Strategies for Collaborative Learning (Cárdenas Rodríguez et al., 2019) and the Problem-Solving Skills Inventory (Yaman, 2003). Teachers rated their use of the jigsaw method, problem-based learning, and online collaborative learning, five items each, on a five-point scale (4.21–5.00 Excellent; 3.41–4.20 Good; 2.61–3.40 Fair; 1.81–2.60 Less Satisfactory; 1.00–1.80 Least Satisfactory). Learners rated their analytical thinking, decision making, and collaboration and teamwork, five items each, on a four-point scale (3.26–4.00 Very High; 2.51–3.25 High; 1.76–2.50 Lesser; 1.00–1.75 Least). Profile sections recorded teachers' age, sex, education, experience, and trainings and learners' age, sex, parents' occupation, and family income. The instrument was validated by practitioners and pilot tested (Cronbach's $\alpha = .81$).

Procedure. Permission was obtained from the Schools Division of Cebu City and the principals of the selected schools. The researchers distributed the questionnaires with a transmittal letter, explained the study, and collected the completed forms. Teachers' workloads and late returns required follow-up visits and close coordination.

Analysis. Frequencies, percentages, and weighted means described the data. Chi-square tests assessed associations between profiles and the main variables, and a test of relationship assessed the link between strategy use and problem-solving skills ($\alpha = .05$).

Ethics. The study observed the standards of the Northwest Samar State University Ethics Review Committee: voluntary participation, informed consent from adults and assent with parental consent from minors, anonymity, secure data storage, and declaration of no conflict of interest.

Results

Respondents

Among the teachers, 55% were aged 40 or below, 55% were female, 40% male, and 5% identified as others. Thirty percent held a bachelor's degree, 25% had master's units, 30% held a master's degree, 10% had doctoral units, and 5% held a doctorate. Teaching experience ranged from 1–5 years (20%) to 36 years and above (5%), with 6–10 years the most common (25%). Most teachers had attended four to six trainings (40%).

Table 1
Family Background of the Grade 6 Learners (n = 60)

Characteristic	Category	f	%
Parents' occupation	Farmer	12	20.0
	Laborer	10	16.7
	Fisherman	8	13.3
	Vendor or small business owner	7	11.7
	Driver	6	10.0
	Private or government employee	9	15.0
	Overseas worker or professional	6	10.0
	Unemployed	2	3.3
Monthly family income	Below ₱10,000	20	33.33
	₱10,000–19,999	14	23.33
	₱20,000–29,999	12	20.00
	₱30,000–49,999	12	20.00
	₱50,000 and above	2	3.33

Most learners were 11 (33.33%) or 12 years old (30.00%), and the group was evenly split by sex (50.00% female, 46.67% male, 3.33% others). As Table 1 shows, their families relied mainly on farming, labor, fishing, vending, and driving, and 56.66% earned less than ₱20,000 a month; only 3.33% earned ₱50,000 or more.

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Use of Collaborative Strategies and Levels of Problem-Solving

Table 2

Collaborative Strategies and Problem-Solving Skills: Means and Extreme Indicators

Variable	Mean	Level	Highest Indicator	Lowest Indicator
Collaborative strategies (teachers)				
Jigsaw method	2.40	Less Satisfactory	The group collaborates to understand all parts of the lesson (2.45)	Each group member teaches their assigned topic to others (2.35)
Problem-based learning	4.51	Excellent	A real-world problem is identified for the group to solve (4.56)	The group presents their findings and proposed solutions (4.47)
Online collaborative learning	4.40	Excellent	Online discussions help the group explore different ideas (4.45)	The group presents their work through online platforms or meetings (4.36)
Problem-solving skills (learners)				
Analytical thinking	2.35	Lesser	Logical reasoning is applied to solve problems effectively (2.45)	Evidence is evaluated critically to make informed conclusions (2.25)
Decision making	3.48	Very High	Decisions are based on clear goals and available information (3.55)	Group input is gathered to make well-informed decisions (3.40)
Collaboration and teamwork	3.62	Very High	Open communication is encouraged to support teamwork (3.72)	Feedback is shared respectfully to improve group work and outcomes (3.55)

Note. Strategies interpreted on the five-point scale (4.21–5.00 Excellent to 1.00–1.80 Least Satisfactory); problem-solving on the four-point scale (3.26–4.00 Very High to 1.00–1.75 Least).

Problem-based learning (M = 4.51) and online collaborative learning (M = 4.40) were used to an Excellent extent, while the jigsaw method was Less Satisfactory (M = 2.40) (Table 2). Every jigsaw indicator fell between 2.35 and 2.45, while every problem-based indicator fell between 4.47 and 4.56. Among learners, collaboration and teamwork (M = 3.62) and decision making (M = 3.48) were Very High, and analytical thinking was Lesser (M = 2.35). The highest problem-solving indicator was open communication within the group (3.72), and the lowest was critical evaluation of evidence (2.25).

Associations With Profile Variables

Among teachers, the extent of strategy use was significantly associated with years of teaching experience (χ^2 = 18.63, p = .004), educational attainment (χ^2 = 15.82, p = .008), relevant trainings (χ^2 = 14.29, p = .012), and age (χ^2 = 12.45, p = .031), but not with sex (χ^2 = 3.28, p = .193). Among learners, problem-solving skills were significantly associated with family income (χ^2 = 18.63, p = .004), parents' occupation (χ^2 = 15.82, p = .008), and age (χ^2 = 12.45, p = .031), but not with sex (χ^2 = 3.28, p = .193). The learner values reported in the source are numerically identical to the corresponding teacher values.

Relationship of Collaborative Strategies to Problem-Solving Skills

Table 3

Test of Relationship Between Collaborative Teaching Strategies and Learners' Problem-Solving Skills

Variables	Test Value	p	Decision	Interpretation
Collaborative teaching strategies and problem-solving skills	t = 3.214	.002	Reject H_0	Significant relationship

Note. The source specifies Pearson correlation in its methods but reports a t value; no correlation coefficient is given.

The relationship between teachers' use of collaborative strategies and learners' problem-solving skills was significant (t = 3.214, p = .002), and the null hypothesis of no significant relationship was rejected (Table 3).

Discussion

A relationship with a distinctive shape. The significant relationship confirms what theory and prior studies predict: the collaborative strategies teachers use are linked to how well learners solve problems (Kuo et al., 2020; Siller & Ahmad, 2024; Zhang & Liang, 2020). The descriptive results show the form the relationship takes in these classrooms. The strategies used most, problem-based learning and online collaboration, are group-centered: the group shares a task, gathers information, discusses options, and presents a solution. The problem-solving skills learners show most strongly, collaboration and teamwork and decision making, are exactly what such strategies rehearse. The strategy used least, the jigsaw method, is the one that requires each learner to analyze content alone and explain it to peers, and the skill learners show least, analytical thinking, is exactly what that structure develops. In other words, learners appear to be developing the problem-solving skills that the strategies they experience most often demand.

Why the jigsaw method is underused. Cooperative learning theory explains why the jigsaw method is demanding. It depends on positive interdependence, in which the group cannot succeed unless each member masters a part, and on individual accountability, in which each learner must answer for the knowledge they bring (Johnson & Johnson, 2009). Designing such tasks, preparing expert groups, and monitoring each learner's contribution require skilled teacher guidance (Van Leeuwen & Janssen, 2019). The results suggest that teachers find these conditions harder to set up than a shared problem-solving task, which is consistent with the uneven and moderate training exposure in the teacher profile. Peer teaching, the weakest jigsaw indicator (2.35), is also cognitively demanding for 11- and 12-year-olds, who need scaffolding to explain mathematical ideas to classmates (Kim & Lee, 2020; Lee, 2023).

The analytical gap. The weakness in analytical thinking is the most important finding for instruction. Learners rarely evaluate evidence, consider multiple perspectives, or identify patterns, even though they communicate and decide well as groups. Group work can mask individual reasoning: a group can reach a sound decision through one or two members' analysis while others contribute mainly to coordination. Analytical thinking requires metacognitive

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monitoring and explicit teaching of strategies (Lavigne et al., 2020; McLeod & Velayudhan, 2021), and elementary learners need structured frameworks to develop it (Al-khati, 2022; Hiemstra & Gardner, 2020). Problem-based learning can build analytical skill, but only when its analysis phase is explicitly scaffolded (Zohar & Dori, 2020; Shengqiang et al., 2025). In sociocultural terms, learners need opportunities to internalize the reasoning that groups perform together, not only to take part in it (Vygotsky, 1978). The disruptions of the pandemic years may also have affected learners' habits of sustained independent reasoning, as research on Filipino students' experiences during that period suggests (Panela, 2025b).

The role of teachers' backgrounds. Teachers' experience, education, training, and age were associated with how they use collaborative strategies, but sex was not. This supports the view that facilitating collaboration is a learned professional skill (Van Leeuwen & Janssen, 2019; Johnson et al., 2022). The finding also has implications for teacher development: training is likely to be most effective when it starts from an assessment of teachers' current skills and competencies, as illustrated by recent mapping of basic education teachers on Samar Island (Panela, 2025d), and when teachers receive sustained support to try new practices, as teachers conducting action research during the pandemic needed (Panela, 2025e).

The role of learners' backgrounds. Family income and parents' occupation were associated with learners' problem-solving skills. This is consistent with evidence that socio-economic status affects learners' resources, home support, and readiness (Education Policy Institute, 2020) and that broader social inequalities shape problem-solving outcomes (Stoet & Geary, 2020). For learners from farming, fishing, and labor households, classroom collaboration may be the main setting in which they practice structured problem-solving, which makes the quality of collaborative design an equity issue (Dizon, 2020). The absence of a sex association differs from studies reporting gender gaps (Ghorai & Mohakud, 2024; Obunge, 2021). Establishing that the problem-solving items function equivalently for boys and girls, using approaches such as the gender-based Rasch analysis applied to a Philippine teacher empowerment scale, would make this comparison more conclusive (Panela, 2025a).

Limitations. Several features of the analysis limit the conclusions. The relationship was reported as a *t* value rather than the Pearson coefficient specified in the methods, so its strength and direction cannot be stated, and the separate relationships of each strategy with each problem-solving dimension were not tested. Teacher ratings (n = 20) and learner ratings (n = 60) were related without a description of how teachers and learners were matched. The learner chi-square results are identical to four teacher results and require verification. The interpretations of some means also differ from the stated parameters in the source tables; this article applies the stated parameters, under which online collaborative learning (4.40) is Excellent and decision making (3.48) is Very High.

Implications for teaching-learning activities. The relationship suggests that changing the mix of strategies could change the profile of learners' skills. Teachers should strengthen the jigsaw method through clear task division, expert-group preparation, and accountability checks so that each learner analyzes and explains content (Johnson & Johnson, 2009). They should add explicit analytical routines to problem-based learning, such as decomposing problems,

identifying patterns, and justifying conclusions with evidence (Lavigne et al., 2020). Online collaboration should remain accessible to learners without home connectivity (Voogt et al., 2020). Training in collaborative facilitation should be continuous (Van Leeuwen & Janssen, 2019), and because active group-based teaching is demanding, schools should also support teachers' well-being; university teachers in one study reported that an AI companion tool helped them manage workplace stress (Panela, 2026).

Conclusion

Collaborative teaching-learning strategies are significantly related to the problem-solving skills of Grade 6 learners in selected North District schools of the Schools Division of Cebu City. Teachers rely heavily on problem-based learning and online collaborative learning and make little use of the jigsaw method, and learners are correspondingly strong in teamwork and decision making but weak in analytical thinking. Teachers' professional backgrounds are associated with their use of collaborative strategies, and learners' family circumstances are associated with their problem-solving skills, while sex is associated with neither.

Teachers should balance group-centered strategies with structures that require individual analysis and explanation, particularly a well-implemented jigsaw method, and should build explicit analytical routines into problem-based learning. Administrators should provide continuing training in collaborative facilitation and monitor its effects on learners' problem-solving. Teachers should differentiate activities for learners' ages and backgrounds and ensure equitable access to online collaboration. Attention to learners' social and emotional readiness for group work is also warranted given the lingering effects of the pandemic (Panela, 2025c). Future research should report correlation coefficients for each strategy and problem-solving dimension, describe how teacher and learner data are linked, and verify the learner-level associations.

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