

Original Article

Group Rotation Frequency as Predictor of Effectiveness and Functionality of Collaborative Learning in Elementary Science

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Article History:

Date received: April 25, 2026

Date revised: June 5, 2026

Date accepted: June 17, 2026

Recommended citation:

Niduaza, T. (2026). Group rotation frequency as predictor of effectiveness and functionality of collaborative learning in elementary science. *Journal of Interdisciplinary Perspectives*, 4(7), 246-261.
<https://doi.org/10.69569/jip.2026.091>

Abstract. Collaborative learning is widely endorsed as an effective instructional strategy in science education, yet the assumption that how teachers implement it, specifically, how often they rotate student groups, meaningfully affects outcomes, remains largely untested. Most existing research treats collaboration as a binary condition (present or absent) rather than examining specific design features that may shape teacher perceptions of success. This predictive correlational study examined whether group rotation frequency predicts two distinct teacher-perceived outcomes: effectiveness and functionality, among 100 public elementary science teachers in Tubao District, La Union, Philippines. Results showed that teachers practiced moderate rotation frequency, with 45% rotating every 3-4 weeks. Perceived effectiveness was high ($M = 3.84$), while perceived functionality was only moderate ($M = 2.98$), revealing a critical gap of 0.86. Classroom space was the lowest-rated item ($M = 2.65$). Group rotation frequency correlated significantly with effectiveness ($r = 0.38, p < 0.01$) but not with functionality ($r = 0.12, p > 0.05$). Simple linear regression confirmed that rotation frequency significantly predicted effectiveness ($\beta = 0.38, p < 0.001, R^2 = 0.14$) but not functionality ($\beta = 0.12, p = 0.214, R^2 = 0.01$). This study provides evidence that effectiveness and functionality are distinct constructs with different antecedents: rotation frequency enhances perceptions of effectiveness but not necessarily of functionality. Functionality is constrained by resource feasibility and equitable participation, which are problems that rotating groups cannot solve. The findings challenge the assumption that implementation design features, such as rotation frequency, affect all outcomes uniformly and reveal that improving collaborative learning requires a two-pronged approach: encouraging an appropriate rotation frequency while separately addressing resource and training gaps.

Keywords: Collaborative learning; Effectiveness; Elementary science; Functionality; Group rotation frequency.

Collaborative learning has long been celebrated as an effective pedagogical practice. In science education, its promise is particularly compelling as group work mirrors the collaborative nature of scientific inquiry, encourages peer-to-peer explanation, and creates spaces where students who struggle with abstract concepts can find support from classmates. However, for all its benefits, collaborative learning is not a self-executing strategy. Its success depends not on the idea of collaboration alone, but on the decisions that teachers

make about how to organize groups, and crucially, when to change them.

Globally, collaborative learning has become a central feature of science education. The Programme for International Student Assessment (PISA) 2022 collected extensive data on instructional practices across OECD countries, with subsequent analyses highlighting collaborative learning as a key pedagogical approach in high-performing education systems (OECD, 2023; David, 2025). A recent mixed-meta analysis by Yaşar et al. (2024), synthesizing 77 studies spanning two decades, confirmed that cooperative learning produces a large positive effect on academic achievement in science education ($g = 1.070$). However, beneath these promising averages lies considerable heterogeneity. Research on the implementation of collaborative learning has demonstrated that the way teachers structure and maintain groups significantly shapes student outcomes. A systematic review by van Leeuwen and Janssen (2019), for instance, found that teacher guidance behaviors, such as providing feedback, prompting questioning, and transferring control to students, were positively associated with collaboration outcomes, while excessive teacher presence or absence was detrimental. Group stability or the frequency with which student teams are rotated is one of the most consequential yet least studied design features.

In the Philippines, collaborative learning is essentially mandated. The Enhanced Basic Education Act of 2013 (Republic Act No. 10533) explicitly requires the use of "learner-centered, constructivist, and inquiry-based" pedagogical approaches, including collaborative and cooperative learning strategies (Section 5, Article IV). Despite this policy commitment, Philippine basic education faces persistent challenges. The country ranked 77th out of 81 countries in PISA 2022 in science literacy, with only 23% of Filipino 15-year-olds reaching the minimum proficiency level (OECD, 2023). While many factors explain this performance, ranging from learning poverty exacerbated by the COVID-19 pandemic to persistent resource gaps, classroom-level implementation of mandated pedagogies remains critically underexamined. Teachers are told to use collaborative learning, but they are rarely given evidence-based guidance on its design, particularly, how often groups should change.

It is in this sense that group rotation as a practice in collaborative learning needs to be unpacked. The researcher draws on the core logic of David W. Johnson and Roger T. Johnson's Cooperative Learning Theory (1994, as cited in Choirunnisa & Rodliyah, 2025), influential work to construct two broader, more practical constructs: perceived effectiveness and perceived functionality. Perceived effectiveness in this paper is understood as the teacher's judgment of the degree to which collaborative learning achieves intended learning outcomes in science, covering four dimensions aligned with the conceptualization of Liu et al. (2024): conceptual understanding, problem-solving skills, scientific reasoning, and retention of learning. Meanwhile, perceived functionality refers to the teacher's judgment of the degree to which collaborative learning operates smoothly and practically in the classroom, covering four dimensions: ease of implementation (setting up and managing collaborative learning without excessive preparation as cited in Ellebæk et al., 2025), classroom management (maintaining focus and order during group work as cited in Ellebæk et al., 2025), equitable student participation (all students, including quieter ones, contributing meaningfully as cited in Loi, 2024), and resource feasibility (having enough space and materials to support collaborative learning as cited in Frelin et al., 2025).

As an elementary Science teacher in the Tubao District of La Union, the researcher confronts the everyday problem of having to deal with classrooms that often exceed 40 students, limited textbooks, laboratory materials, and classroom space. Under these conditions, the researcher observes that collaborative learning can easily become performative, with students seated together but not truly collaborating. Some groups are kept static for convenience rather than pedagogical intent. On one hand, stable groups build relational trust and reduce management overhead; on the other, they risk entrenched participation patterns in which the same students speak and the same students withdraw. Rotating groups promises fairness and fresh perspectives but demands constant reorganization and norm-setting. Without empirical evidence on how rotation frequency relates to teachers' own perceptions of effectiveness and functionality, this dilemma remains unresolved.

In particular, this study addresses the following questions: (1) What is the extent of group rotation frequency practiced by teachers in implementing collaborative learning as an instructional strategy in elementary science? (2) What is the level of perceived effectiveness of collaborative learning as an instructional strategy in elementary science in terms of: a) conceptual understanding, b) problem-solving skills, c) scientific reasoning, and d) retention of learning? (3) What is the level of perceived functionality of collaborative learning as an instructional strategy in elementary science in terms of: a) ease of implementation, b) classroom management, c) equitable student participation, and d) resource feasibility? (4) Is there a significant relationship between group rotation

frequency and the perceived effectiveness of collaborative learning as an instructional strategy in elementary science? (5) Is there a significant relationship between group rotation frequency and the perceived functionality of collaborative learning as an instructional strategy in elementary science? (6) Does group rotation frequency significantly predict the perceived effectiveness of collaborative learning as an instructional strategy in elementary science? (7) Does group rotation frequency significantly predict the perceived functionality of collaborative learning as an instructional strategy in elementary science?

Methodology

Research Design

This study employed a predictive correlational design. According to Creswell & Guetterman (2019), a predictive correlational design is used when the researcher seeks to determine whether one variable can predict the value of another variable without manipulating either variable. This design was selected to directly examine whether group rotation frequency predicts teachers' perceptions of the effectiveness and functionality of collaborative learning as an instructional strategy in elementary science. In this sense, group rotation frequency served as the predictor variable, while the perceived effectiveness and functionality served as the outcome variable.

To address the specific research questions, the study employed a combination of descriptive, correlational, and regression analyses. Descriptive statistics (mean, standard deviation, frequency, and percentage) were used to answer questions on the extent of group rotation frequency and the levels of perceived effectiveness and functionality, including their subdimensions. In this case, Pearson product-moment correlation was used to determine whether significant relationships exist between group rotation frequency and the two outcome variables. Simple linear regression was then used to test whether group rotation frequency significantly predicts perceived effectiveness and perceived functionality. This two-step approach (first establishing correlation, then testing prediction) is consistent with standard procedures in predictive correlational studies (Crano et al., 2023).

Participants and Sampling Technique

The population of this study is public elementary school science teachers in the Tubao District, Division of La Union, during the School Year 2025–2026. These teachers served as respondents for all research questions, as the study aimed to measure their existing practices regarding group rotation frequency and their perceptions of the effectiveness and functionality of collaborative learning as an instructional strategy in elementary science.

The researcher utilized complete enumeration as all 100 public elementary school science teachers (N = 100) in the Tubao District during the School Year 2025–2026 were included as respondents. According to Creswell and Guetterman (2019), complete enumeration is appropriate when the population size is manageable, and the researcher aims to obtain data from every eligible individual rather than a subset. This approach was selected because the total number of science teachers in the district was within feasible limits for data collection, and including all teachers eliminates sampling error and increases the representativeness of the findings. This approach ensured maximum statistical power by including the entire population and eliminated concerns about sampling bias or the generalizability of findings from a smaller subset (Huang et al., 2025).

To be included in the study, teachers had to meet the following criteria: (1) officially designated as a science teacher in any public elementary school within the Tubao District during the School Year 2025–2026; (2) had been teaching science for at least one full grading period prior to the conduct of the survey to ensure adequate familiarity with implementing collaborative learning in their classrooms; (3) currently using or having used collaborative learning as an instructional strategy in their science classes within the current school year; and (4) provided informed consent to participate. Exclusion criteria for teachers included: (1) newly hired teachers who had not yet completed one full grading period of teaching science; (2) teachers on extended leave (e.g., maternity leave, medical leave) during the data collection period; and (3) teachers who declined to provide informed consent.

Research Instrument

The researcher utilized a researcher-made survey questionnaire titled Collaborative Learning Perception Scale for Elementary Science Teachers (CLPS-EST), whose conceptualization was drawn from the theoretical framework of Johnson and Johnson on the five essential elements of cooperative learning, as well as from subsequent empirical studies on collaborative learning, including studies from Liu et al. (2024), Ellebæk et al. (2025), Loi (2024), and Frelin et al. (2025), and refined through the researcher's reflexive engagement with the local educational context. CLPS-EST measured three key constructs: group rotation frequency (predictor variable), perceived effectiveness

of collaborative learning (outcome variable with four subdimensions), and perceived functionality of collaborative learning (outcome variable with four subdimensions).

The survey questionnaire was structured into three main parts. Part 1 measured group rotation frequency using a single item asking teachers how often they typically change student groups in their science class, with response options ranging from weekly to never. Part 2 measured perceived effectiveness of collaborative learning across four dimensions: conceptual understanding (Items 2–4), problem-solving skills (Items 5–7), scientific reasoning (Items 8–10), and retention of learning (Items 11–13), for a total of 12 items. Meanwhile, Part 3 measured perceived functionality of collaborative learning across four dimensions: ease of implementation (Items 14–16), classroom management (Items 17–19), equitable student participation (Items 20–22), and resource feasibility (Items 23–25), for a total of 12 items. The entire instrument comprises 25 items.

All items in Parts 2 and 3 employed a five-point Likert scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. Part 1 used a frequency scale with five response options: Weekly, Every 2 weeks, Every 3–4 weeks, Once per quarter, and Never. These response options have been converted to numerical scores for analysis, with weekly receiving the highest score of 5 and never receiving the lowest score of 1, such that higher scores indicated higher group rotation frequency (more fluid groups) and lower scores indicated lower group rotation frequency (more stable or fixed groups).

Validation. The validation of the instrument followed a three-phase process consistent with established guidelines for developing researcher-made questionnaires in educational research (DeVellis & Thorpe, 2021), including expert validation to establish content and face validity, item refinement based on expert feedback, and a pilot test with a non-participating sample to estimate internal consistency reliability and identify any administration issues.

For the expert validation phase, the researcher invited three experts to evaluate the instrument's initial draft. The panel consisted of the researcher's own research adviser, a faculty member from the Graduate School, and a master teacher with experience in collaborative learning and science education. Feedback from experts led to specific refinements of the instrument. Following expert validation and item refinement, the researcher conducted a pilot test with a non-participating sample to estimate internal consistency reliability. The pilot test involved 30 elementary science teachers from two public elementary schools in Buang North District, also within the Division of La Union. These teachers completed the entire CLPS-EST during a faculty meeting, requiring approximately 10 to 12 minutes on average. No teacher refused to answer any item, and all 30 teachers completed the full instrument.

Reliability analysis of the pilot test data yielded strong internal consistency estimates. For Part 2 (Perceived Effectiveness), Cronbach's alpha was 0.87 for conceptual understanding (Items 2–4), 0.85 for problem-solving skills (Items 5–7), 0.88 for scientific reasoning (Items 8–10), 0.84 for retention of learning (Items 11–13), and 0.92 for the total effectiveness scale (Items 2–13), with 95% confidence intervals ranging from 0.74 to 0.96. These values indicate good to excellent internal consistency. Corrected item-total correlations for the effectiveness items ranged from 0.48 to 0.74, with all 12 items exceeding the minimum threshold of 0.30.

For Part 3 (Perceived Functionality), Cronbach's alpha was 0.86 for ease of implementation (Items 14–16), 0.88 for classroom management (Items 17–19), 0.83 for equitable student participation (Items 20–22), 0.85 for resource feasibility (Items 23–25), and 0.91 for the total functionality scale (Items 14–25), with 95% confidence intervals ranging from 0.72 to 0.95. Corrected item-total correlations for the functionality items ranged from 0.45 to 0.76. For Part 1 (Group Rotation Frequency), which consisted of a single item, Cronbach's alpha was not applicable; instead, test-retest reliability was assessed by administering the same item to the same 30 teachers two weeks apart, yielding a correlation coefficient of $r = 0.89$, indicating good temporal stability.

Data Gathering Procedure

The preliminary activities, including ethics clearance and permission seeking, were conducted during the first quarter of the School Year 2025–2026. Ethics clearance was secured from the university as recommended by the research adviser, followed by permission from the school principal of each participating public elementary school in the district. An information sheet explaining the purpose of the study, the voluntary nature of participation, and the confidentiality of responses was distributed to all prospective teacher-respondents during a regularly scheduled district-wide faculty meeting. Consent was entirely voluntary, and no teacher was penalized for

declining to participate. Teachers who agreed to participate signed an informed consent form, which the researcher collected before any data were gathered.

Following the pilot test and subsequent refinements to the Collaborative Learning Perception Scale for Elementary Science Teachers (CLPS-EST), actual data collection was carried out during the second quarter of the school year. The researcher coordinated with the school principals to schedule the administration of the survey on a date when all elementary science teachers of each school were convened for a professional development session or meeting. This approach ensured maximum participation while minimizing disruption to instructional time. The survey was administered in a designated room or venue where teachers could complete the questionnaire without interruptions. Before distribution, the researcher explained the purpose of the study, provided clear instructions for each part of the questionnaire, and reminded respondents that their answers would remain anonymous and confidential. Teachers were informed that they could skip any item they were uncomfortable answering and could withdraw from the study at any time without consequence.

The CLPS-EST was then distributed to all eligible science teachers who had provided informed consent. The researcher remained present during the entire administration period to answer any clarifying questions. Teachers were instructed to answer each item based on their actual current practice and honest perceptions, rather than on what they believed to be the ideal or expected response. To reduce social desirability bias, teachers were assured that no school administrator would have access to their individual responses and that only aggregated data would be reported in the study. The questionnaire required approximately 10 to 12 minutes to complete. Upon completion, teachers placed their answered questionnaires in a sealed envelope or a designated collection box to further ensure confidentiality.

To establish the reliability of the single-item measure of group rotation frequency (Part 1 of the CLPS-EST), a test-retest procedure was conducted. Two weeks after the initial administration, the same group rotation frequency item was readministered to a randomly selected subset of 30 teachers from the original sample. Finally, all data from the completed questionnaires were encoded into a spreadsheet by the researcher. The encoded data were then stored in a password-protected computer accessible only to the researcher, and the original paper questionnaires were kept in a locked filing cabinet.

Data Analysis Procedure

The data were analyzed using descriptive and inferential statistical techniques aligned with the research questions. Prior to analysis, all data were screened for missing values, outliers, and the assumptions of normality, linearity, and homoscedasticity appropriate for parametric tests. Descriptive statistics were computed to address the first three research questions.

For the extent of group rotation frequency practiced by teachers in implementing collaborative learning as an instructional strategy in elementary science (Research Question 1), descriptive statistics were employed. Specifically, frequencies and percentages were computed to determine how many teachers fell into each category of group rotation frequency (Weekly, Every 2 weeks, Every 3-4 weeks, Once per quarter, Never). The mean and standard deviation were also calculated for the group rotation frequency score, which was converted to numerical values as presented in Table 1. This dual approach was necessary because while the mean provides a central tendency estimate suitable for subsequent correlational and regression analyses, frequencies reveal the distribution of teachers across rotation frequency levels, which the mean alone cannot capture.

Table 1. *Scoring and Interpretation for Group Rotation Frequency*

Response	Score	Interpretation
Weekly	5	Very High Rotation Frequency
Every 2 weeks	4	High Rotation Frequency
Every 3-4 weeks	3	Moderate Rotation Frequency
Once per quarter	2	Low Rotation Frequency
Never	1	Very Low Rotation Frequency

For the level of perceived effectiveness of collaborative learning as an instructional strategy in elementary science (Research Question 2), two complementary descriptive approaches were employed. First, means and standard deviations were calculated for the overall Perceived Effectiveness scale (Items 2-13) and for each of its four dimensions: conceptual understanding (Items 2-4), problem-solving skills (Items 5-7), scientific reasoning (Items

8–10), and retention of learning (Items 11–13). Second, frequencies and percentages were computed to determine how many teachers fell into each interpretive category (Very Low, Low, Moderate, High, Very High) based on the scoring system presented in Table 2.

Table 2. *Scoring and Interpretation for Perceived Effectiveness*

Mean Range	Interpretation
1.00 – 1.79	Very Low
1.80 – 2.59	Low
2.60 – 3.39	Moderate
3.40 – 4.19	High
4.20 – 5.00	Very High

For the level of perceived functionality of collaborative learning as an instructional strategy in elementary science (Research Question 3), the same descriptive approach was employed. Means and standard deviations were calculated for the overall Perceived Functionality scale (Items 14–25) and for each of its four dimensions: ease of implementation (Items 14–16), classroom management (Items 17–19), equitable student participation (Items 20–22), and resource feasibility (Items 23–25). Additionally, frequencies and percentages were computed to determine how many teachers fell into each interpretive category (Very Low, Low, Moderate, High, Very High) based on the scoring system presented in Table 3.

Table 3. *Scoring and Interpretation for Perceived Functionality*

Mean Range	Interpretation
1.00 – 1.79	Very Low
1.80 – 2.59	Low
2.60 – 3.39	Moderate
3.40 – 4.19	High
4.20 – 5.00	Very High

To address the fourth and fifth research questions on the significant relationship between group rotation frequency and perceived effectiveness (Research Question 4) and between group rotation frequency and perceived functionality (Research Question 5), Pearson product-moment correlation coefficients were computed. Specifically, correlations were calculated between the group rotation frequency score (Part 1) and the overall Perceived Effectiveness score (Part 2), as well as between the group rotation frequency score (Part 1) and the overall Perceived Functionality score (Part 3). Prior to computing the correlations, the researcher confirmed that all requisite assumptions were met, including normality (assessed using Shapiro-Wilk tests), linearity (assessed through visual inspection of scatterplots), and the absence of outliers (assessed using boxplots and z-scores). Correlation coefficients were interpreted as small ($r = 0.10$), medium ($r = 0.30$), or large ($r = 0.50$).

To address the sixth and seventh research questions on whether group rotation frequency significantly predicts perceived effectiveness (Research Question 6) and perceived functionality (Research Question 7), simple linear regression analyses were conducted. For Research Question 6, group rotation frequency served as the predictor variable, and overall Perceived Effectiveness served as the outcome variable. For Research Question 7, group rotation frequency served as the predictor variable, and overall Perceived Functionality served as the outcome variable. For each regression model, the following statistics were reported: the unstandardized regression coefficient (B), the standardized regression coefficient (β), the coefficient of determination (R^2), the F-statistic for model fit, and the p-value. The R^2 value indicated the proportion of variance in the outcome variable explained by group rotation frequency. Prior to conducting the regression analyses, the researcher confirmed that all requisite assumptions were met, including linearity (assessed through scatterplots), independence of residuals (assessed using the Durbin-Watson statistic), homoscedasticity (assessed through visual inspection of residual plots), and normality of residuals (assessed using Shapiro-Wilk tests and Q-Q plots).

Ethical Considerations

The researcher ensured that ethical protocols were observed throughout the study, especially given that teachers, though adults, required protections regarding professional reputation, confidentiality, and freedom from coercion in workplace settings. Informed consent was obtained from all teacher-respondents after a clear explanation that participation was voluntary, that declining would not affect their employment evaluation or standing with the district, and that they could withdraw at any time without consequence. The information sheet was distributed in coordination with school principals during their respective faculty meetings. Teachers were given at least one

week to consider their participation before being asked to sign the consent form. No teacher was pressured or incentivized to participate. All teacher data were reported in aggregate; no individual teacher or school was identifiable in any published report.

The study involved no experimental manipulation, deprivation, or deception. The only risk for teachers was the minor inconvenience of completing a 10- to 12-minute questionnaire during an existing district meeting, which did not require additional travel or time outside regular work hours. The primary risk was the potential discomfort of having their classroom practices regarding group rotation frequency and their perceptions of collaborative learning scrutinized. To minimize this, the researcher emphasized that the survey focused on teachers' existing practices and honest perceptions, not on evaluating their competence or performance. Teachers were assured that no school administrator would have access to their individual responses and that only aggregated data would be reported in the study. To further reduce anxiety, the researcher explicitly stated that there were no right or wrong answers and that the goal was to understand current practices, not to judge or rank teachers. Teachers who expressed concerns about the survey were given opportunities to ask questions before consenting.

All data were anonymized. Each teacher received a unique code (e.g., T001, T002, T003) that was used on all data collection forms. The master list linking codes to names was stored separately from the data files in a locked filing cabinet accessible only to the researcher. Data files stored on the researcher's computer were password-protected, and no identifying information was included in any spreadsheet or statistical output. The researcher also ensured that during the test-retest procedure for Part 1, the subset of 30 teachers was identified by code only, and no record linking these codes to teacher names was retained beyond the duration of the retest analysis. Upon completion of the study, the master list will be destroyed, and only anonymized data will be retained for potential future analysis or archival purposes.

For the pilot test conducted in a neighboring district, the same ethical protocols were observed. Teachers in the pilot sample were informed of the purpose of the pilot test, provided written informed consent, and were assured that their responses would be used solely to refine the instrument and estimate reliability, not for any evaluative purpose.

Results and Discussion

Group Rotation Frequency

By and large, elementary teachers in the Tubao District have a moderate level of group rotation as evidenced in Table 4 below. The majority of teachers (45.0%) reported changing student groups every 3-4 weeks, which falls under the moderate rotation frequency category. This was followed by 22.0% who change groups every 2 weeks (high rotation frequency), 18.0% who change groups once per quarter (low rotation frequency), 8.0% who change groups weekly (very high rotation frequency), and 7.0% who never change groups (very low rotation frequency).

Table 4. *Extent of Group Rotation Frequency*

Response	Frequency (n)	Percentage (%)	Interpretation
Weekly	8	8.0	Very High Rotation Frequency
Every 2 weeks	22	22.0	High Rotation Frequency
Every 3-4 weeks	45	45.0	Moderate Rotation Frequency
Once per quarter	18	18.0	Low Rotation Frequency
Never	7	7.0	Very Low Rotation Frequency
Total	100	100.0	Moderate Rotation Frequency

This finding suggests that teachers recognize the value of periodically changing group composition but are not rotating so frequently that it becomes disruptive. The modal practice of rotating every 3-4 weeks may reflect a practical compromise: teachers likely want to expose students to different peers while also allowing enough time for groups to develop functional working relationships. This is consistent with the observation of Saqr et al. (2024) that effective collaborative learning requires both stability for building trust and fluidity for ensuring equitable participation. Teachers in the Tubao District appear to have arrived at a middle ground, rotating approximately once per month. The 7.0% who never rotate groups is concerning, as completely fixed groups risk entrenched participation hierarchies where the same students always lead and the same students always withdraw (van Leeuwen & Janssen, 2019).

Level of Perceived Effectiveness of Collaborative Learning

The second research question aimed to determine the level of perceived effectiveness of collaborative learning as an instructional strategy in elementary science across four dimensions: conceptual understanding, problem-solving skills, scientific reasoning, and retention of learning.

Table 5. *Perceived Effectiveness of Collaborative Learning in Terms of Conceptual Understanding*

Item	Mean	SD	Interpretation
Collaborative learning helps my students understand science concepts better.	4.02	0.71	High
Collaborative learning clarifies my students' misconceptions in science.	3.85	0.74	High
My students are able to explain science ideas more clearly after working in groups.	3.89	0.69	High
Dimension Mean	3.92	0.68	High

In terms of conceptual understanding, it can be gleaned from Table 5 above that teachers perceived the effectiveness of collaborative learning at a high overall mean score of 3.92 ($SD = 0.68$). The researcher notes that the particularly high rating for the first item (collaborative learning helps understand science better) indicates that teachers see group work as a means for improved understanding. It should be understood, however, that the slightly lower rating for the second item (misconception clarification) may reflect the reality that while group work exposes misconceptions through peer discussion, it does not automatically correct them; teachers likely still need to intervene and guide conceptual change. As Chia et al. (2025) noted, promotive interaction, where students explain, elaborate, and justify, is essential for conceptual development, but this requires structured tasks and teacher facilitation.

Table 6. *Perceived Effectiveness of Collaborative Learning in Terms of Problem-Solving Skills*

Item	Mean	SD	Interpretation
Collaborative learning improves my students' ability to solve science problems.	3.92	0.73	High
My students generate better solutions when working collaboratively than when working alone.	3.78	0.78	High
Group work helps my students approach unfamiliar science problems with confidence.	3.85	0.70	High
Dimension Mean	3.85	0.72	High

Teachers also rated with an overall high ($M = 3.85$, $SD = 0.72$) their perception of the effectiveness of collaborative learning in terms of problem-solving skills. As shown in Table 6, the indicator that "collaborative learning improves my students' ability to solve science problems" received the highest rating within this dimension ($M = 3.92$, $SD = 0.73$). The lower rating for the second indicator nonetheless suggests that teachers may be more cautious about claiming that group work produces better solutions than individual work. This is reasonable, as the quality of group solutions also depends heavily on group composition, task design, and the presence of individual accountability mechanisms. As Tian & Zheng (2024) found in their meta-analysis, collaborative learning's advantage over individual learning for problem-solving outcomes is moderate rather than large, moderated by task design and implementation. Teachers may be observing that while group work helps students engage with problems, the solutions produced are not necessarily always superior to what high-achieving students would produce alone.

Table 7. *Perceived Effectiveness of Collaborative Learning in Terms of Scientific Reasoning*

Item	Mean	SD	Interpretation
Collaborative learning encourages my students to justify their scientific claims with evidence.	3.80	0.76	High
My students ask better scientific questions when learning collaboratively.	3.75	0.79	High
Through group work, my students learn to evaluate different scientific explanations.	3.79	0.74	High
Dimension Mean	3.78	0.75	High

In terms of scientific reasoning, the overall mean score is also high ($M = 3.78$, $SD = 0.75$). As presented in Table 7 above, the first indicator (encourages my students to justify their scientific claims with evidence) received the highest rating within this dimension ($M = 3.80$, $SD = 0.76$), while the item on asking better questions received the lowest ($M = 3.75$, $SD = 0.79$). It can be inferred that the slightly lower rating for this item may indicate that teachers find it more challenging to develop students' questioning skills through group work compared to having them justify claims or evaluate explanations. This aligns with the developmental nature of scientific inquiry, where questioning often precedes and scaffolds deeper reasoning (Kirk et al., 2025). This could also be explained by the observation of Kreps et al. (2025) that collaborative learning's effects on reasoning skills depend heavily on the quality of teacher guidance. Without explicit instruction on how to justify claims or evaluate explanations, students may simply agree on an answer without engaging in substantive reasoning. The teachers in this study

may be recognizing that while group work creates opportunities for reasoning, those opportunities are not always realized without additional scaffolding.

Table 8. *Perceived Effectiveness of Collaborative Learning in Terms of Retention of Learning*

Item	Mean	SD	Interpretation
My students remember science content longer when they learn it through group work.	3.82	0.72	High
Collaborative learning leads to durable learning that my students can apply in later lessons.	3.84	0.71	High
Students who learn science collaboratively perform better on cumulative assessments.	3.77	0.73	High
Dimension Mean	3.81	0.70	High

Meanwhile, teachers perceived collaborative learning as effective for retention of learning, as indicated by the overall mean score of 3.81 ($SD = 0.70$). As evident in Table 8 above, the second indicator (leads to durable learning applicable in later lessons) received the highest rating ($M = 3.84$, $SD = 0.71$), while performing better in cumulative assessments received the lowest ($M = 3.77$, $SD = 0.73$). The slightly lower rating for cumulative assessment performance could be explained by the reality that many assessments are still designed for individual completion, and the benefits of collaborative learning may not always translate to individual test performance, especially if assessments do not measure the collaborative processes or deeper understanding that group work develops. As Bozeman et al. (2024) demonstrated, collaborative testing produces stronger performance benefits for integrative (application-based) items than for factual recall items, yet traditional individual assessments often emphasize factual recall over application. This mismatch may explain why teachers perceive collaborative learning as less effective for cumulative assessment performance, in that the assessments themselves may not be designed to capture the deeper, application-oriented learning that collaboration fosters.

Table 9. *Summary of Perceived Effectiveness Dimensions*

Dimension	Mean	SD	Interpretation
Conceptual understanding	3.92	0.68	High
Problem-solving skills	3.85	0.72	High
Scientific reasoning	3.78	0.75	High
Retention of learning	3.81	0.70	High
Overall Effectiveness	3.84	0.65	High

Taken together, all four dimensions of perceived effectiveness were rated high, with conceptual understanding receiving the highest overall rating ($M = 3.92$) and scientific reasoning receiving the lowest ($M = 3.78$). The overall effectiveness mean of 3.84 ($SD = 0.65$) indicates that teachers in the Tubao District generally believe collaborative learning is effective in achieving desired learning outcomes in science. However, the pattern across dimensions suggests that teachers are most confident in collaborative learning's ability to build conceptual understanding and least confident in its ability to develop scientific reasoning. This distinction between perceived effectiveness for conceptual understanding versus scientific reasoning has important implications for professional development planning, suggesting that targeted support for scaffolding higher-order thinking during group work may be needed rather than general training on collaborative learning implementation.

Level of Perceived Functionality of Collaborative Learning

The third research question aimed to determine the level of perceived functionality of collaborative learning as an instructional strategy in elementary science across four dimensions: ease of implementation, classroom management, equitable student participation, and resource feasibility.

Table 10. *Perceived Functionality of Collaborative Learning in Terms of Ease of Implementation*

Item	Mean	SD	Interpretation
I can set up collaborative learning activities in my science class without excessive preparation time.	3.08	0.85	Moderate
The routines for collaborative learning are easy to establish in my classroom.	3.22	0.80	Moderate
Transitioning between individual work and group work in my science class is smooth.	3.15	0.82	Moderate
Dimension Mean	3.15	0.82	Moderate

With respect to ease of implementation, the teacher-respondents have generally rated as moderate ($M = 3.15$, $SD = 0.82$) the perceived functionality of collaborative learning. This means that even though collaborative learning is deemed effective, the implementation process is not necessarily effortless. The highest rating for establishing routines ($M = 3.22$, $SD = 0.82$) suggests that once collaborative learning is integrated into regular classroom practice, the procedural aspects become manageable. However, the lower rating for preparation time ($M = 3.08$, $SD = 0.85$) reflects a common teacher concern that collaborative learning activities often require more advance

planning than traditional instruction, as this would entail designing interdependent tasks, preparing group materials, and anticipating potential management issues. As Penthisarn & Limhan (2025) emphasized, effective cooperative learning is not simply putting students in groups; it requires structured lesson design. Insofar as the survey results are concerned, teachers in the Tubao District appear to acknowledge this preparation burden.

Table 11. *Perceived Functionality of Collaborative Learning in Terms of Classroom Management*

Item	Mean	SD	Interpretation
During collaborative learning, my students remain focused and on-task.	3.05	0.87	Moderate
Managing student behavior during collaborative learning is manageable in my science class.	3.12	0.84	Moderate
I am able to monitor all groups effectively during collaborative learning activities.	3.07	0.86	Moderate
Dimension Mean	3.08	0.85	Moderate

In relation to classroom management, teachers have also rated as moderate ($M = 3.08$, $SD = 0.85$) the perceived functionality of collaborative learning. This is consistent with the earlier report on ease of implementation, where functionality was also at moderate levels. The researcher would also like to raise the concerning lower rating for student focus ($M = 3.05$, $SD = 0.87$). While this is understandable in the context of Philippine public schools, where class sizes often exceed 40 students, monitoring multiple groups simultaneously is genuinely difficult. The fact that behavior management itself is rated slightly higher ($M = 3.12$, $SD = 0.84$) than student focus suggests that teachers feel they can manage behavior when problems arise, but preventing off-task behavior in the first place is more challenging. This is consistent with Barnes-Story et al. (2025) finding that classroom management during collaborative learning is one of the most commonly cited implementation barriers, particularly in large classes.

Table 12. *Perceived Functionality of Collaborative Learning in Terms of Equitable Student Participation*

Item	Mean	SD	Interpretation
All students in a group, including quieter ones, contribute meaningfully to the task.	2.88	0.90	Moderate
No single student dominates the group work in my science class.	2.95	0.89	Moderate
My students share responsibilities equally when working in groups.	3.02	0.86	Moderate
Dimension Mean	2.95	0.88	Moderate

As presented in Table 12, the dimension of equitable student participation received a moderate overall mean score of 2.95 ($SD = 0.88$), which is notably lower than the previous functionality dimensions. The indicator "My students share responsibilities equally when working in groups" received the highest rating within this dimension ($M = 3.02$, $SD = 0.86$), while Item 20, "All students in a group, including quieter ones, contribute meaningfully" received the lowest ($M = 2.88$, $SD = 0.90$).

These findings reveal that equitable participation is a significant challenge for teachers. The low rating for the indicator, making all students, including quieter ones, contribute to the task, is consistent with extensive research on status effects in collaborative learning, where students with higher perceived academic ability or social status tend to dominate group interactions while lower-status students withdraw. In the words of Paavilainen et al. (2026), issues on uneven participation and "free-riding" could be explained by the heterogeneous nature of primary pupils' ability to regulate their learning. Nonetheless, the slightly higher rating for equal responsibility sharing suggests that teachers may assign roles or structure tasks to distribute work, but this does not guarantee that quieter students contribute substantively to discussion or decision-making. As Michaelsen (2023) noted, individual accountability is an essential element of any collaborative work, but it must be intentionally structured; it does not happen automatically simply because students are in groups.

Table 13. *Perceived Functionality of Collaborative Learning in Terms of Resource Feasibility*

Item	Mean	SD	Interpretation
Our classroom has enough space to support collaborative learning activities.	2.65	0.94	Moderate
The available materials (e.g., textbooks, manipulatives, laboratory equipment) support collaborative learning in science.	2.71	0.92	Moderate
Our school's schedule allows sufficient time for collaborative learning in science.	2.80	0.89	Moderate
Dimension Mean	2.72	0.91	Moderate

Similar to earlier ratings on functionality, the dimension of resource feasibility also received a moderate level ($M = 2.72$, $SD = 0.91$). The researcher would like to emphasize that this is the lowest among all four functionality dimensions and the lowest of any dimension in the entire study. While this may not be necessarily surprising given the physical reality of many Philippine public elementary classrooms when it comes to resources, this is still a concerning figure that could be interpreted that most teachers disagree or are neutral about having adequate

space for group work. The similarly low rating for materials availability ($M = 2.71$) indicates that teachers lack the textbooks, manipulatives, and laboratory equipment needed to support collaborative science activities. The slightly higher rating for schedule constraints ($M = 2.80$) suggests that time is also a barrier, though less severe than space and materials. As van Leeuwen and Janssen (2019) concluded, the functionality of collaborative learning depends on classroom conditions. Without adequate space, students cannot arrange their desks for effective group work. Without materials, group tasks cannot be designed to require interdependence. Without time, collaborative learning becomes rushed and superficial.

Table 14. *Summary of Perceived Functionality Dimensions*

Dimension	Mean	SD	Interpretation
Ease of implementation	3.15	0.82	Moderate
Classroom management	3.08	0.85	Moderate
Equitable student participation	2.95	0.88	Moderate
Resource feasibility	2.72	0.91	Moderate
Overall Functionality	2.98	0.78	Moderate

As summarized in Table 14, all four dimensions of perceived functionality were rated moderate, with ease of implementation receiving the highest rating ($M = 3.15$) and resource feasibility receiving the lowest ($M = 2.72$). The overall functionality mean of 2.98 ($SD = 0.78$) indicates that teachers find collaborative learning only moderately functional in their actual classrooms. This reveals a notable gap between perceived effectiveness (high, $M = 3.84$) and perceived functionality (moderate, $M = 2.98$). Teachers believe collaborative learning works, but they find it only moderately practical to implement. This gap is critical, as teachers who find a strategy difficult to implement may use it less frequently or less faithfully over time, regardless of their beliefs about its effectiveness.

Relationship Between Group Rotation Frequency and Perceived Effectiveness

The fourth research question aimed to determine whether there is a significant relationship between group rotation frequency and the perceived effectiveness of collaborative learning. Table 15 presents the results of the Pearson correlation analysis.

Table 15. *Correlation Between Group Rotation Frequency and Perceived Effectiveness*

Variable	Mean	SD	1	2
1. Group rotation frequency	3.06	1.02	—	
2. Perceived effectiveness	3.84	0.65	0.38**	—

** $p < 0.01$ (two-tailed)

As presented in Table 15, the Pearson correlation coefficient between group rotation frequency and perceived effectiveness was $r = 0.38$, which is significant at the 0.01 level. This indicates a moderate, positive, and statistically significant relationship between how often teachers rotate student groups and how effective they perceive collaborative learning to be.

More so, the positive direction of the relationship means that teachers who rotate groups more frequently tend to rate collaborative learning as more effective. Conversely, teachers who keep groups stable for longer periods or never rotate groups tend to rate effectiveness lower. This finding is plausible, as teachers who rotate groups more often may observe that students receive diverse perspectives, develop broader social skills, and avoid the stagnation that can occur in fixed groups. As Leon-Garcia et al. (2026) found, rotating groups reduces social loafing and increases individual accountability, which likely contributes to greater perceived effectiveness.

However, the correlation ($r = 0.38$) is moderate rather than strong, indicating that group rotation frequency explains only about 14% of the variance in perceived effectiveness ($r^2 = 0.14$). The researcher notes that other factors not measured in this study, such as teachers' prior training, class size, student characteristics, or school support, likely play larger roles in shaping effectiveness perceptions.

Relationship Between Group Rotation Frequency and Perceived Functionality

The fifth research question aimed to determine whether there is a significant relationship between group rotation frequency and the perceived functionality of collaborative learning. Table 16 presents the results of the Pearson correlation analysis.

Table 16. *Correlation Between Group Rotation Frequency and Perceived Functionality*

Variable	Mean	SD	1	2
1. Group rotation frequency	3.06	1.02	—	
2. Perceived functionality	2.98	0.78	0.12	—

$p > 0.05$ (not significant)

The Pearson correlation coefficient between group rotation frequency and perceived functionality was $r = 0.12$, which is not statistically significant ($p > 0.05$). This indicates that there is no significant relationship between how often teachers rotate student groups and how functional they perceive collaborative learning to be.

This non-significant finding is instructive. While higher rotation frequency is associated with greater perceived effectiveness, it does not translate into greater perceived functionality. Teachers who rotate groups more often do not find collaborative learning easier to implement, better managed, more equitable in participation, or more feasible given resource constraints. In fact, the near-zero correlation suggests that rotation frequency is simply irrelevant to functionality perceptions.

This finding makes practical sense. Rotating groups more frequently may actually impose additional logistical burdens, such as reorganizing seating, re-establishing group norms, and reteaching cooperative procedures, which could offset any functional benefits. As Johnson and Johnson (1994, as cited in Choirunnisa & Rodliyah, 2025) noted, the functionality of collaborative learning depends primarily on the presence of the five essential elements (positive interdependence, individual accountability, etc.), not on how often groups are changed. A teacher who rotates groups weekly but fails to establish clear individual accountability will still experience functionality problems. Conversely, a teacher who keeps groups stable but has well-established routines and strong classroom management may rate functionality highly despite low rotation frequency.

Group Rotation Frequency as a Predictor of Perceived Effectiveness

The sixth research question aimed to determine whether group rotation frequency significantly predicts the perceived effectiveness of collaborative learning. Simple linear regression was conducted with group rotation frequency as the predictor variable and overall perceived effectiveness as the outcome variable. Table 17 presents the regression results.

Table 17. *Simple Linear Regression Summary for Group Rotation Frequency Predicting Perceived Effectiveness*

Predictor	B	SE	β	t	p	95% CI
(Constant)	3.12	0.11		28.36	< 0.001	[2.90, 3.34]
Group rotation frequency	0.24	0.06	0.38	4.00	< 0.001	[0.12, 0.36]

Model Summary: $R = 0.38$, $R^2 = 0.14$, Adjusted $R^2 = 0.14$, $F(1, 98) = 16.00$, $p < 0.001$

Based on the simple linear regression undertaken, group rotation frequency was a statistically significant predictor of perceived effectiveness ($\beta = 0.38$, $t = 4.00$, $p < 0.001$). The regression equation indicates that for every one-unit increase in group rotation frequency (moving from, for example, "once per quarter" to "every 3-4 weeks"), perceived effectiveness is predicted to increase by 0.24 points. The model explained 14% of the variance in perceived effectiveness ($R^2 = 0.14$), and the overall regression model was significant, $F(1, 98) = 16.00$, $p < 0.001$.

This finding confirms that group rotation frequency is a modest but statistically significant predictor of how effective teachers perceive collaborative learning to be. Teachers who rotate groups more frequently tend to believe that collaborative learning achieves better learning outcomes. This aligns with the theoretical expectation that rotating groups exposes students to diverse cognitive perspectives, prevents the formation of unproductive hierarchies, and maintains individual accountability (Zhou & Ye, 2024).

However, the modest R^2 value of 0.14 indicates that 86% of the variance in perceived effectiveness is explained by factors other than rotation frequency. These may include teachers' prior professional development, years of experience, class size, student motivation, school leadership support, and the specific science topics being taught. Future research should examine these additional predictors.

Group Rotation Frequency as a Predictor of Perceived Functionality

Simple linear regression was conducted with group rotation frequency as the predictor variable and overall perceived functionality as the outcome variable. Regression results are presented in Table 18 below.

Table 18. Simple Linear Regression Summary for Group Rotation Frequency Predicting Perceived Functionality

Predictor	B	SE	β	t	p	95% CI
(Constant)	2.82	0.14		20.14	< 0.001	[2.54, 3.10]
Group rotation frequency	0.05	0.04	0.12	1.25	0.214	[-0.03, 0.13]

Model Summary: $R = 0.12$, $R^2 = 0.01$, Adjusted $R^2 = 0.00$, $F(1, 98) = 1.56$, $p = 0.214$

As shown in Table 18, group rotation frequency was not a statistically significant predictor of perceived functionality ($\beta = 0.12$, $t = 1.25$, $p = 0.214$). The regression model was not significant ($F(1, 98) = 1.56$, $p = 0.214$) and explained effectively zero variance in perceived functionality ($R^2 = 0.01$).

This non-significant finding indicates that how often teachers rotate groups has no bearing on how functional they perceive collaborative learning to be. Teachers who rotate groups weekly are no more likely to find collaborative learning easy to implement, manageable, equitable, or feasible than teachers who never rotate groups. This suggests that functionality is determined entirely by other factors.

What might these factors be? Based on the item-level results presented in earlier sections, resource feasibility items (space, materials, schedule) received the lowest ratings, with classroom space the lowest at $M = 2.65$. Equitable student participation also scored low, with quieter students contributing at $M = 2.88$. These are unlikely to be solved by simply rotating groups more often. Instead, they require systemic interventions: smaller class sizes, more classroom space, adequate learning materials, and professional development on structuring group work to ensure equitable participation.

Summary of Findings

In summary, here are the key findings of the study:

1. In terms of group rotation frequency, teachers practiced a moderate level of rotation frequency overall, with the majority (45.0%) changing groups every 3-4 weeks, while 7.0% never rotate groups. This finding implies that while most teachers have arrived at a practical compromise between stability and fluidity, the 7.0% who never rotate groups risk entrenched participation hierarchies where the same students always lead and the same students always withdraw.
2. In terms of perceived effectiveness, teachers rated collaborative learning as highly effective overall ($M = 3.84$, $SD = 0.65$). Among the four dimensions, conceptual understanding received the highest rating ($M = 3.92$), followed by problem-solving skills ($M = 3.85$), retention of learning ($M = 3.81$), and scientific reasoning ($M = 3.78$). By implication, this means that teachers are most confident in collaborative learning's ability to build conceptual understanding and least confident in its ability to develop scientific reasoning, suggesting that professional development should target higher-order thinking skills in collaborative science tasks.
3. As to perceived functionality, teachers rated collaborative learning as only moderately functional overall ($M = 2.98$, $SD = 0.78$). Among the four dimensions, ease of implementation received the highest rating ($M = 3.15$), followed by classroom management ($M = 3.08$), equitable student participation ($M = 2.95$), and resource feasibility ($M = 2.72$). The lowest-rated individual item was classroom space ($M = 2.65$). This finding reveals a critical gap between perceived effectiveness (high) and perceived functionality (moderate), implying that teachers believe collaborative learning works but find it difficult to implement, with resource constraints, particularly classroom space, being the most severe barrier.
4. With respect to the relationship between group rotation frequency and perceived effectiveness, a statistically significant moderate positive correlation was found ($r = 0.38$, $p < 0.01$). What this suggests is that teachers who rotate groups more frequently tend to rate collaborative learning as more effective, and teachers who currently rotate less frequently (once per quarter or never) may benefit from increasing rotation frequency to at least every 3-4 weeks.
5. Regarding the relationship between group rotation frequency and perceived functionality, no statistically significant relationship was found ($r = 0.12$, $p > 0.05$). This finding implies that how often teachers rotate groups has no bearing on how functional they perceive collaborative learning to be, and that functionality

problems, particularly resource feasibility and equitable participation, require different solutions than simply rotating groups more often.

6. In terms of prediction, group rotation frequency was a statistically significant predictor of perceived effectiveness ($\beta = 0.38, p < 0.001, R^2 = 0.14$) but not of perceived functionality ($\beta = 0.12, p = 0.214, R^2 = 0.01$). This finding implies that while rotation frequency has a modest but real effect on effectiveness perceptions, it has no effect on functionality perceptions, confirming that schools and districts should adopt a two-pronged approach: encourage appropriate rotation frequency to enhance effectiveness while separately addressing resource and training gaps to improve functionality.

Conclusion

This study affirms that group rotation frequency meaningfully predicts how effective teachers perceive collaborative learning to be, but it does not predict how functional they perceive it to be. The findings demonstrate a statistically significant positive relationship between rotation frequency and perceived effectiveness, whereas no significant relationship exists with perceived functionality. This provides empirical support for the proposition advanced in this study that effectiveness and functionality are distinct constructs that should be measured separately, as treating them as a single global measure of “success” would obscure the differential effects observed here.

More than testing the statistical relationships between group rotation frequency and teacher perceptions, this study reopens a conversation about how collaborative learning is implemented in Philippine elementary science classrooms. At a time when the Enhanced Basic Education Act of 2013 (RA 10533) mandates learner-centered and collaborative pedagogies, the findings suggest that teachers are being asked to implement a strategy they believe works but find only moderately practical to execute. The gap between effectiveness and functionality perceptions is not merely a statistical figure; it represents the daily reality of teachers who believe in collaborative learning but struggle with overcrowded classrooms, insufficient materials, packed schedules, and the persistent challenge of ensuring quieter students participate equitably. The lowest-rated item across the entire instrument was classroom space, followed by materials availability. This is not to say that group rotation frequency is unimportant, but rather that a teacher can rotate groups optimally yet still find collaborative learning dysfunctional if the classroom has no space for group work. The question for educators and policymakers is not merely how often teachers should rotate groups, but how to create the conditions (i.e., physical, material, and pedagogical) that make collaborative learning functional enough for teachers to sustain it over time.

This study contributes to existing literature by addressing three critical gaps. First, it extends the measurement of collaborative learning outcomes beyond the traditional focus on student achievement to include teacher perceptions of both effectiveness (academic outcomes) and functionality (procedural conditions), following the theoretical framework of Johnson and Johnson (1994) but adapting it for practical, survey-based research in Philippine public schools. Second, it treats group rotation frequency as a variable in its own right, which is an underexplored design feature in the collaborative learning literature, rather than controlling for it or ignoring it entirely. Third, it provides empirical evidence from the Philippine context, where collaborative learning is mandated by national policy, but implementation research remains scarce. In doing so, this study demonstrates that the relationship between implementation decisions (how often to rotate groups) and teacher perceptions is not uniform across outcomes: rotation frequency predicts effectiveness perceptions but not functionality perceptions.

Implications for Classroom Practice. The findings suggest that teachers who currently rotate groups less frequently (once per quarter or never) may benefit from increasing rotation frequency to at least every 3–4 weeks, which was the modal practice among teachers in this study and was associated with higher effectiveness perceptions. However, teachers should not expect that rotating groups more often will solve functionality problems. A teacher who rotates groups weekly but has no space for group work, insufficient materials, and no strategies for ensuring equitable participation will still find collaborative learning dysfunctional. Teachers who wish to improve functionality may need to focus on the lowest-rated dimensions identified in this study: resource feasibility (particularly classroom space) and equitable student participation. Practical strategies include arranging desks in permanent clusters, using hallway or outdoor space when possible, assigning specific roles to ensure quieter students contribute, and using techniques such as numbered heads together or round-robin to elicit participation from all group members.

Implications for Policy. The results support a reexamination of resource allocation priorities in the Tubao District. The finding that classroom space and materials availability were the lowest-rated items suggests that policy interventions should prioritize physical infrastructure and learning materials. School administrators may conduct space audits to identify schools where overcrowding most severely constrains collaborative learning and prioritize these schools for classroom construction or partitioning of existing large rooms. District officials may allocate specific budget lines for science manipulatives, consumables, and flexible furniture (movable desks, stackable chairs) that enable quick reconfiguration for group work. Additionally, the district may consider establishing a materials-borrowing system in which schools share specialized equipment. The finding that 7.0% of teachers never rotate groups also suggests a need for district guidance on rotation frequency, recommending the modal practice of rotating every 3-4 weeks.

Implications for Teacher Training. The study lays emphasis on the need to equip pre-service and in-service teachers with strategies that address the specific functionality dimensions rated lowest by teachers. Professional development programs may include modules on structuring individual accountability (ensuring every student contributes), managing status effects (preventing high-achieving students from dominating), and using specific techniques for eliciting quiet student participation. Additionally, teacher training may address the developmental reality that scientific reasoning, considered as the lowest-rated effectiveness dimension in this study, does not automatically emerge from group work; it must be explicitly taught through tasks that require justification, evidence evaluation, and scientific questioning. Teachers may benefit from training on designing collaborative tasks that promote higher-order thinking, such as predict-observe-explain activities, structured academic controversies, and evidence-based argumentation.

Implications for Future Research. Future studies may explore the differential effects of specific dimensions of collaborative learning implementation on student outcomes, rather than using teacher perceptions as the primary outcome. While this study focused on teacher perceptions of effectiveness and functionality, future research could examine whether group rotation frequency actually predicts student achievement gains, engagement, or science identity development. Longitudinal designs are needed to establish causal direction, as the predictive correlational design of this study cannot determine whether higher rotation frequency causes higher effectiveness perceptions or whether teachers who already believe collaborative learning is effective are simply more likely to rotate groups frequently. Future research may also examine the interaction between rotation frequency and other implementation variables, such as group size, role assignment, and task structure, to identify optimal combinations for different grade levels and science content areas. Finally, replication studies in different districts, regions, and school types (private, rural, urban) are needed to assess the generalizability of these findings beyond the Tubao District.

Contributions of Authors

N/A

Funding

The researcher received no funding, financial support, grant, sponsorship, or other form of monetary assistance for the conduct, preparation, or publication of this study.

Conflict of Interests

The researcher is a teacher in Tubao District, La Union. This affiliation was disclosed in the study as part of the researcher's positionality and reflexivity. Appropriate measures were undertaken to minimize potential bias during the conduct and reporting of the research.

Acknowledgment

The researcher gratefully acknowledges Dr. Artemio L. Florendo, Jr. of the Polytechnic College of La Union, for his guidance and assistance as adviser in the completion of this study.

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