

Collaborative Learning Approaches in Mathematics 6 Under English Program in International Schools in Bangkok, Thailand: Basis for an Instructional Enhancement Program

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ABSTRACT

This study examined the effectiveness of collaborative learning approaches in improving the mathematics performance of Grade 6 students under the English Program in an international school in Bangkok, Thailand. A quasi-experimental one-group pre-test and post-test design was employed among 60 Grade 6 learners. A 30-item Mathematics Achievement Test measured performance before and after the intervention, while a structured questionnaire assessed challenges encountered during collaborative learning activities. Frequency counts, percentages, means, standard deviations, weighted means, a paired-samples t-test, and correlation procedures were used to analyze the data. The pre-test mean of 18.23 increased to 23.23 after the integration of structured collaborative learning approaches. The post-test

scores also became more consistent, as the standard deviation decreased from 7.36 to 3.85. The difference was statistically significant, $t = -7.62$, $p < .001$, with a reported large practical effect. Challenges encountered during group activities were moderately serious overall ($M = 3.15$), particularly unequal participation, unclear instructions, time constraints, noise or distractions, and difficulty solving mathematics problems collaboratively. None of the reported learner-profile variables had a statistically significant relationship with mathematics performance. Based on the findings, the study proposed the Math Bridge Program to strengthen structured group participation, teacher facilitation, English-language support, classroom management, and monitoring. The results indicate that well-planned collaborative learning can improve mathematics achievement in English-medium international-school settings.

Keywords: *collaborative learning; mathematics achievement; Grade 6 learners; English-medium instruction; student engagement; instructional enhancement program*

INTRODUCTION

Mathematics instruction in international schools under English-medium programs requires learners to develop conceptual understanding and academic language proficiency simultaneously. Grade 6 learners may experience difficulty understanding mathematical concepts, solving word problems, and communicating their reasoning when language barriers, varied learning styles, and limited classroom interaction constrain participation. These concerns call for instructional approaches that move beyond passive reception and encourage active engagement in meaning-making.

Collaborative learning provides learners with opportunities to discuss ideas, explain solutions, compare strategies, and solve problems collectively. It is grounded in the view that knowledge is constructed through social interaction and shared experience. Structured group work can enhance reasoning, communication, engagement,

and accountability when teachers provide clear roles, purposeful tasks, and appropriate guidance (Gillies, 2021; Johnson et al., 2021). In mathematics classrooms, collaborative interaction is particularly useful because learners can articulate procedures, identify misconceptions, and receive immediate peer feedback.

The potential value of collaboration is especially relevant in English-medium mathematics classrooms. Peer explanations can support both mathematical understanding and the use of academic language. However, successful implementation is not automatic. Unequal participation, unclear instructions, group conflicts, time limitations, language difficulty, and inadequate materials may reduce the quality of learning experiences if they are not addressed through effective facilitation (Gillies & Boyle, 2022; Ridwan et al., 2022).

This study examined the effectiveness of collaborative learning approaches in Mathematics 6 under the English Program in an international school in Bangkok, Thailand. Specifically, it described learners' demographic profile, compared mathematics performance before and after the intervention, assessed the seriousness of problems encountered during collaboration, examined relationships between learner-profile variables and performance, and developed an instructional enhancement program based on the findings.

Literature Review

Collaborative Learning in Mathematics Education

Collaborative learning is a learner-centered approach in which students work in small groups toward shared learning goals. Through discussion, explanation, and joint problem-solving, learners participate actively in constructing knowledge rather than receiving information passively. Research has consistently associated structured collaboration with improved mathematics achievement, problem-solving ability, engagement, and critical thinking (Agwu & Nmadu, 2023; Baliyan et al., 2021; Slavin, 2020).

The effectiveness of collaborative learning is strengthened when groups are intentionally structured. Cooperative Learning Theory emphasizes positive interdependence, individual accountability, promotive interaction, social skills, and group processing. These elements reduce passive participation and help ensure that all learners contribute meaningfully to the learning task (Johnson et al., 2021). Social Constructivist Theory further explains that learners can accomplish more with guided assistance and peer scaffolding within the Zone of Proximal Development.

Collaborative Learning in English-Medium Mathematics Classes

English-medium instruction can increase the cognitive and communication demands of mathematics learning. Learners must interpret subject-specific terms, explain procedures, and follow task directions in a language that may not be their strongest. Collaborative learning can support both content mastery and language development because learners negotiate meaning, clarify unfamiliar terms, and rehearse mathematical language during peer interaction. Studies in English-medium contexts indicate that collaboration can strengthen participation and conceptual understanding when teachers provide language-sensitive support (Namraksa & Kraiwant, 2023; Rao et al., 2022).

Challenges in Collaborative Learning

Although collaborative learning can improve achievement, poorly structured group work may lead to unequal participation, dominance by more confident learners, conflict, off-task behavior, and incomplete work. Language barriers can also limit participation in English-medium classrooms. Clear instructions, defined roles, teacher monitoring, manageable time allocations, and sufficient learning materials are therefore essential for productive collaboration (Gillies & Boyle, 2022; Valls et al., 2021).

Instructional Enhancement Through Structured Collaboration

Instructional enhancement programs can translate research findings into sustained classroom practices. In Mathematics 6, such programs may combine peer tutoring, think-pair-share, group problem-solving, collaborative games, language scaffolds, role assignments, observation tools, and teacher development. These measures can maximize the benefits of collaboration while directly addressing the implementation problems experienced by learners.

METHODS

Research Design

The study employed a quasi-experimental one-group pre-test and post-test design. The same learners completed a mathematics assessment before and after the integration of collaborative learning approaches. The design was used to determine whether mathematics performance improved after the intervention in an authentic classroom setting.

Research Locale

The study was conducted in an international school in Bangkok, Thailand that offered an English Program for Grade 6 learners. Mathematics instruction was delivered in English. The setting was appropriate because learners needed to develop mathematical understanding while communicating through the English language.

Participants and Sampling Technique

The participants were 60 Grade 6 students enrolled in the English Program during Academic Year 2025-2026. The respondents were drawn from an intact class in which collaborative learning strategies were implemented. Their demographic profile included age, gender, parental employment, average monthly family income, and number of siblings.

Research Instruments

Two instruments were used. First, a 30-item Mathematics Achievement Test measured learners' performance before and after the intervention. Each correct response received one point. Scores of 25-30 were interpreted as very high; 19-24, high; 13-18, average; 7-12, low; and 0-6, very low. Second, a structured survey questionnaire assessed the seriousness of problems encountered during collaborative learning activities. The survey covered participation, language comprehension, task distribution, time management, group coordination, learning materials, and classroom conditions. The instruments underwent content validation and reliability testing as reported in the source manuscript.

Data Gathering Procedure

After securing permission from the school administration, the researcher administered the pre-test to determine baseline mathematics performance. Collaborative learning strategies were then integrated into Mathematics 6 instruction through structured group activities, peer discussion, cooperative problem-solving tasks, and student-centered learning practices. Following the intervention, the post-test and survey questionnaire were administered. Responses were collected, coded, tabulated, and prepared for statistical analysis.

Data Analysis

Frequency counts and percentages described the participants' profile and performance-level distribution. Means, standard deviations, minimum values, maximum values, skewness, and kurtosis summarized pre-test and post-test results. Weighted means described the seriousness of problems encountered. A paired-samples t-test determined whether mathematics performance differed significantly before and after the intervention. The reported relationships between profile variables and performance were also examined using correlation procedures at the .05 level of significance.

Ethical Considerations

Permission was secured from the school administration before data collection. Learners were informed of the purpose and procedures of the study, and participation was voluntary. Confidentiality and anonymity were protected through coded responses and aggregate reporting. The intervention consisted of classroom learning activities intended to support, rather than disadvantage, participants.

RESULTS AND DISCUSSION

Profile of the Respondents

The respondents were predominantly 11 years old (58.3%) and female (61.7%). Many parents had stable sources of employment, with business ownership frequently reported for both fathers (43.3%) and mothers (31.7%). The largest income group was THB 60,001-100,000 per month (35.0%), while half of the learners had one to two siblings. These characteristics describe the sample but, as shown later, did not significantly explain the learners' mathematics performance.

Table 1. *Profile of Grade 6 Respondents (n = 60)*

Variable	Category	Frequency	Percentage
Age	10 years old and below	21	35.0
	11 years old	35	58.3
	12 years old and above	4	6.7
Gender	Male	23	38.3
	Female	37	61.7
Employment of father	Government employee	7	11.7
	Private employee	10	16.7
	Self-employed	9	15.0
	Business owner	26	43.3
	Overseas worker	6	10.0
	Unemployed	2	3.3
Employment of mother	Government employee	6	10.0
	Private employee	18	30.0
	Self-employed	7	11.7
	Business owner	19	31.7
	Unemployed	10	16.7
Average family monthly income	Below THB 30,000	5	8.3
	THB 30,000-60,000	18	30.0
	THB 60,001-100,000	21	35.0
	Above THB 100,000	16	26.7
Number of siblings	None	18	30.0
	1-2 siblings	30	50.0
	3-4 siblings	10	16.7
	5 or more siblings	2	3.3

Mathematics Performance Before and After Collaborative Learning

The mean mathematics score increased from 18.23 in the pre-test to 23.23 in the post-test, representing a five-point gain. The post-test mean fell within the high-performance range, whereas the pre-test mean was within the average range. The standard deviation decreased from 7.36 to 3.85, suggesting that scores became more consistent after the intervention. The minimum score increased from 5.00 to 15.00, while the maximum remained 30.00. These results indicate that collaborative learning supported improvement among learners who initially performed at lower levels without diminishing the achievement of high-performing students.

Table 2. *Descriptive Statistics of Mathematics Performance*

Statistic	Pre-test	Post-test
Mean	18.23	23.23
Standard deviation	7.36	3.85
Minimum	5.00	15.00
Maximum	30.00	30.00
Skewness	0.10	-0.01
Kurtosis	-1.11	-0.71

The distribution of performance levels confirms the improvement. Before the intervention, 26.7% of learners were classified as low or very low. After the intervention, no learners remained in these categories. The share of learners classified as high increased from 13.3% to 51.7%, while those classified as very high increased from 28.3% to 35.0%. The upward movement supports prior findings that structured cooperative learning can improve mathematics achievement and reduce performance gaps (Agwu & Nmadu, 2023; Baliyan et al., 2021; Gillies, 2020).

Table 3. *Mathematics Performance Levels Before and After the Intervention*

Performance level	Score range	Pre-test f	Pre-test %	Post-test f	Post-test %
Very high	25-30	17	28.3	21	35.0
High	19-24	8	13.3	31	51.7
Average	13-18	19	31.7	8	13.3
Low	7-12	13	21.7	0	0.0
Very low	0-6	3	5.0	0	0.0

Problems Encountered During Collaborative Learning

The problems encountered during collaborative learning were moderately serious overall ($M = 3.15$). The most serious reported concern was inactive participation by some group members ($M = 3.53$), followed by unequal sharing of tasks ($M = 3.38$), difficulty solving mathematics problems collaboratively ($M = 3.37$), noise or distractions ($M = 3.28$), unclear group instructions ($M = 3.25$), and limited time to complete group tasks ($M = 3.07$). These findings indicate that collaboration should be guided by clear roles, explicit instructions, active monitoring, and sufficient time. English-language support also remains relevant because learners reported difficulty understanding mathematics instructions in English ($M = 2.98$).

Table 4. *Seriousness of Problems Encountered in Collaborative Learning*

Problem encountered	Weighted mean	Interpretation
Some group members do not participate actively.	3.53	Serious
Unequal sharing of tasks.	3.38	Moderately serious
Difficulty solving mathematics problems collaboratively.	3.37	Moderately serious
Noise or distractions affect group learning.	3.28	Moderately serious
Instructions for group activities are sometimes unclear.	3.25	Moderately serious
Limited time to complete group tasks.	3.07	Moderately serious
Difficulty understanding mathematics instructions in English.	2.98	Moderately serious
Group work takes more time than individual work.	2.98	Moderately serious
Conflict among group members.	2.92	Moderately serious
Learning materials for collaborative work are insufficient.	2.68	Moderately serious
Overall mean	3.15	Moderately serious

Significant Difference in Mathematics Performance

The paired-samples t-test showed a statistically significant difference between the pre-test and post-test scores, $t = -7.62$, $p < .001$. The null hypothesis was rejected. The source manuscript also reported an approximate Cohen's d of 0.84, indicating a large practical effect. The statistical evidence suggests that the improvement was not merely numerical but educationally meaningful. Structured collaborative learning likely supported achievement by increasing opportunities for explanation, peer feedback, shared reasoning, and problem-solving practice.

Table 5. *Paired-Samples t-Test of Pre-test and Post-test Scores*

Assessment	Mean	SD	Mean difference	t	p-value
Pre-test	18.23	7.36	-5.00	-7.62	< .001
Post-test	23.23	3.85			

Relationship Between Learner Profile and Mathematics Performance

None of the reported profile variables had a statistically significant relationship with mathematics performance because all p-values exceeded .05. This suggests that the learning gains associated with the intervention were not limited to a particular age group, gender, parental-employment category, family-income group, or sibling category. The result supports the use of collaborative learning as an inclusive instructional approach. Because the source manuscript reports mixed correlation procedures for the profile variables, the coefficients below are presented as reported.

Table 6. *Relationship Between Profile Variables and Mathematics Performance*

Profile variable	Reported statistic	p-value	Interpretation
Age	-0.157	0.146	Not significant
Gender	0.066	0.616	Not significant
Employment of father	0.296	0.863	Not significant
Employment of mother	0.678	0.954	Not significant

Average family monthly income	0.136	0.183	Not significant
Number of siblings	0.199	0.056	Not significant

Proposed Instructional Enhancement Program

The Math Bridge Program was developed from the reported findings. It aims to strengthen mathematics understanding through structured teamwork while addressing the moderately serious implementation problems identified by learners. The program emphasizes group roles, language scaffolds, teacher facilitation, collaborative problem-solving, confidence-building, and monitoring.

Table 7. *Math Bridge Program: Building Mathematical Understanding Through Teamwork*

Key need	Strategy	Objective	Indicator	Timeframe
Difficulty understanding concepts	Peer tutoring and collaborative problem-solving	Improve conceptual understanding	Improved quiz and class-activity results	June-July 2026
Unequal participation	Assign rotating group roles and use participation checklists	Strengthen accountability and balanced participation	Active contribution from all members	Weekly
English-language difficulty	Use vocabulary scaffolds, visual aids, and guided examples	Improve comprehension of English-medium mathematics tasks	Clearer responses and fewer clarification issues	Throughout program
Low confidence and limited engagement	Use think-pair-share, math games, and positive reinforcement	Increase participation and confidence	Greater willingness to answer and explain	Throughout program
Difficulty solving word problems	Conduct group math challenges and structured reasoning tasks	Improve problem-solving and higher-order thinking	Improved problem-solving outputs	July-August 2026
Teacher facilitation needs	Provide orientation and collaborative-learning workshops	Strengthen group-task design and classroom management	Consistent classroom implementation	Before implementation
Need for monitoring	Use observations, reflective logs, and quarterly reviews	Track program effectiveness	Completed monitoring reports	Quarterly

CONCLUSION

The integration of collaborative learning approaches significantly improved the mathematics performance of Grade 6 learners under the English Program in an international school in Bangkok, Thailand. The increase in the mean score from 18.23 to 23.23, the elimination of low and very low post-test performance levels, and the significant paired-samples t-test result demonstrate that structured collaboration can enhance mathematics achievement. The absence of significant relationships between the reported learner-profile variables and performance suggests that the approach can benefit learners across demographic groups.

The findings also show that effective collaboration requires deliberate instructional design. Learners encountered moderately serious challenges involving participation, task distribution, time, clarity of instructions, classroom distractions, and English-language comprehension. Collaborative learning is therefore most effective when teachers use clear group roles, language-sensitive explanations, purposeful tasks, active monitoring, and sustained support. The proposed Math Bridge Program translates these findings into an instructional enhancement plan for Mathematics 6.

Recommendations

Mathematics teachers should integrate structured collaborative learning activities regularly and assign clear roles to promote equal participation and individual accountability. English-language support should be embedded in Mathematics 6 instruction through vocabulary scaffolds, visual aids, guided examples, and simplified task directions. Teachers should also strengthen classroom-management routines for group work, establish realistic time allocations, and provide sufficient learning materials.

School administrators should support teacher development through workshops on cooperative learning, English-medium mathematics instruction, and monitoring of student participation. The Math Bridge Program may be implemented and evaluated using classroom observations, achievement data, learner feedback, and reflective logs. Future studies may use larger samples, multiple schools, comparison groups, and longer intervention periods to assess the generalizability and sustained effects of collaborative learning approaches.

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