

Parents' assessments of learners' collaboration and social interaction in Mathematics learning

Majesty P. Ortiz

Western Colleges, Inc., Naic, Cavite, Philippines

Corresponding Author e-mail: mortizwcus@gmail.com

Received: 04 June 2026

Revised: 05 July 2026; 12 July 2026; 13 July 2026

Accepted: 14 July 2026

Available Online: 15 July 2026

Volume 1 (2026), Issue 3, P-ISSN – 3116-3769; E-ISSN - 3116-3777

<https://doi.org/10.63498/injelps94>

Abstract

Aim: This study determined the parents' assessment of learners' collaboration and social interaction in mathematics learning. Specifically, it examined the relationship between collaboration and social interaction and determined whether parents' assessments differed according to age, sex, and role in the family.

Methodology: The study employed a quantitative descriptive-correlational research design. Forty (40) parents of learners were selected through simple random sampling. A researcher-made questionnaire with a Cronbach's alpha coefficient of 0.86 was used to collect the data. Descriptive statistics, Kendall's tau-b correlation coefficient, Mann-Whitney U test, and Kruskal-Wallis H test were utilized to analyze the data.

Results: The findings revealed that learners demonstrated a high level of collaboration and positive social interaction in mathematics learning as assessed by their parents. No significant relationship was found between collaboration and social interaction. Likewise, parents' assessments did not significantly differ according to age and role in the family. However, a significant difference was observed in the assessment of collaboration when respondents were grouped according to sex.

Conclusion: The study determined that learners generally exhibited collaborative behaviors and positive social interaction during mathematics learning. Although these competencies were consistently demonstrated, they were not significantly associated based on parents' assessments. The findings highlight the importance of sustaining collaborative, learner-centered mathematics instruction and strengthening home-school partnerships to enhance learners' interpersonal skills, collaborative competence, and mathematics learning outcomes.

Keywords: *collaboration, social interaction, mathematics learning, parent assessment, learner-centered instruction*

INTRODUCTION

Learners develop mathematical understanding not only through individual cognitive processes but also through cooperative learning, shared problem-solving, and interactions with teachers and peers. Contemporary educational approaches emphasize learner-centered instruction that promotes active participation, teamwork, and collaborative problem-solving, enabling learners to construct knowledge and develop higher-order thinking skills.

Recent studies have shown that effective collaboration and positive social interaction enhance learners' conceptual understanding, confidence, engagement, and achievement in mathematics. Collaborative learning environments encourage students to work together, exchange ideas, consider multiple perspectives, and develop problem-solving skills while reducing mathematics anxiety (Siller & Ahmad, 2024). These findings highlight the importance of fostering collaboration and social interaction as integral components of mathematics instruction.

Modern mathematics curricula are designed not only to develop computational competence but also to cultivate higher-order thinking, communication, and collaborative problem-solving skills through learner-centered pedagogies. Achieving these curriculum goals requires effective school leadership and instructional supervision to ensure that teachers implement collaborative instructional strategies consistently and in accordance with national educational standards. School leaders play a critical role in providing instructional guidance, monitoring classroom



practices, and facilitating professional development that enables teachers to translate curriculum expectations into meaningful learning experiences. Through supportive educational policies and strong instructional leadership, schools can create environments where collaborative learning becomes an integral part of mathematics instruction, thereby improving learner engagement and academic outcomes.

In the Philippine educational context, improving learners' mathematics performance remains a major concern, as evidenced by national and international assessment results (Rosalejos, 2026). Consequently, the Department of Education has strengthened learner-centered and collaborative teaching approaches that encourage active participation both inside and outside the classroom. Parents, as primary learning partners, regularly observe how learners cooperate with others, participate in group learning activities, and interact with family members during mathematics-related tasks at home, making their assessments valuable in understanding learners' collaboration and social interaction (Civil & Quintos, 2022).

Despite extensive research on mathematics learning, most studies have focused on teacher or classroom assessments, with limited attention given to parents' perspectives (Vanbecelaere et al., 2021; Zambak et al., 2025). Furthermore, few studies have examined the relationship between learners' collaboration and social interaction in mathematics using parent-based assessments, particularly in the Philippine setting. Addressing this gap is essential for gaining a more comprehensive understanding of the interpersonal competencies that support mathematics learning.

Thus, this study investigated parents' assessments of learners' collaboration and social interaction in mathematics learning. Specifically, it examined the relationship between these constructs and determined whether parents' assessments differed according to selected profile variables. The findings are expected to provide valuable insights for teachers, parents, and school leaders in developing instructional and family engagement strategies that strengthen collaboration, promote positive social interaction, and enhance mathematics learning outcomes. Furthermore, the findings may inform teacher preparation and professional development programs by identifying areas where educators can be better equipped to design collaborative learning experiences, strengthen home-school partnerships, and implement instructional practices that foster meaningful social interaction and improved mathematics achievement.

Review of Related Literature and Studies

Collaboration and Social Interaction in Mathematics Learning

Collaboration has become a fundamental component of contemporary mathematics education, enabling learners to develop mathematical understanding through shared inquiry, cooperative problem-solving, and the exchange of ideas. Learner-centered instructional approaches emphasize collaborative learning as a means of promoting active participation, critical thinking, and conceptual understanding (Safitri et al., 2024). Social interaction plays a vital role in promoting meaningful mathematics learning by encouraging learners to participate actively in discussions, build interpersonal relationships, and engage in shared learning experiences (Dorimana et al., 2022). Educational research has consistently shown that positive social interaction enhances learner engagement, motivation, and mathematical understanding (Alakoski et al., 2025).

Parents' Role in Mathematics Learning

Parents are essential partners in children's educational development and significantly influence learners' academic success (Zambak et al., 2025). Their involvement extends beyond monitoring academic performance to observing learners' participation in collaborative activities, interactions with family members, and attitudes toward learning mathematics. Recent research has demonstrated that active parental involvement contributes to improved learner motivation, self-confidence, and academic achievement (Ibrilla et al., 2025). Parents' observations provide valuable information regarding how learners cooperate with others, share ideas, and participate in mathematics-related learning activities at home (Padilla et al., 2023).

Relationship between Collaboration and Social Interaction

Collaboration and social interaction are closely related constructs that mutually support effective mathematics learning (Thabologo & Kesianye, 2024). Collaborative learning requires learners to interact with others, share responsibilities, exchange ideas, and work collectively toward common learning goals (Lee & Paul, 2023). Likewise, positive social interaction creates an environment where collaboration can flourish by fostering trust, mutual respect, and active participation. Recent educational studies have consistently reported a positive relationship between collaboration and social interaction, indicating that learners who demonstrate stronger collaborative skills also tend to

exhibit more positive interpersonal relationships, greater classroom participation, and enhanced mathematical learning experiences (Lee & Paul, 2023).

Synthesis and Research Gap

The reviewed literature establishes that collaboration and social interaction are essential elements of effective mathematics learning and that parental involvement positively supports learners' academic development. While numerous studies have investigated collaborative learning and social interaction from the perspectives of teachers, learners, or classroom observations, relatively few have examined these constructs through parents' assessments. Furthermore, limited empirical evidence has explored the relationship between collaboration and social interaction in mathematics learning using parent-based assessments within the Philippine educational context. This gap highlights the need for the present study, which seeks to provide empirical evidence on parents' assessments of learners' collaboration and social interaction in mathematics learning. The findings are expected to contribute to the development of instructional practices and home-school partnerships that foster collaborative learning, positive social interaction, and improved mathematics learning outcomes.

Theoretical Framework

This study was anchored on Social Constructivist Theory developed by Lev Vygotsky (1978), which posits that learning is fundamentally a social process that occurs through interaction and collaboration with others. According to Vygotsky, learners construct knowledge by engaging in meaningful activities with more knowledgeable individuals, such as teachers, parents, and peers. Through dialogue, cooperative learning, and shared problem-solving experiences, learners gradually develop higher-order thinking skills and deepen their understanding of concepts.

Learners who actively participate in collaborative activities are provided with opportunities to develop communication, teamwork, and interpersonal skills while enhancing their understanding of mathematical concepts. Social Constructivist Theory guided the present study by providing the theoretical basis for examining the relationship between learners' collaboration and social interaction in mathematics learning. It also informed the development of the research instrument and the interpretation of the findings by emphasizing that meaningful learning occurs through collaborative experiences and positive social engagement. Accordingly, the study assumes that learners who demonstrate higher levels of collaboration are more likely to exhibit positive social interaction, thereby supporting more effective mathematics learning experiences.

Figure 1. Research paradigm

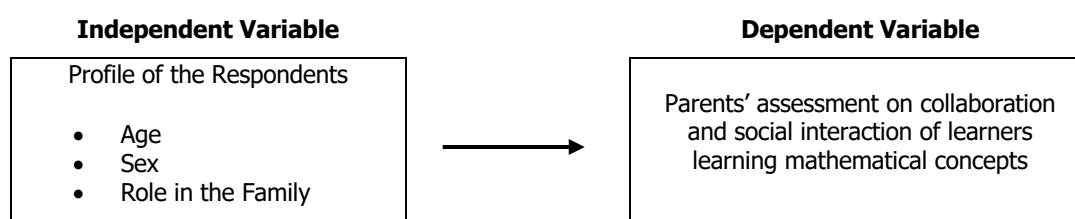


Figure 1 presents the research paradigm of the study. It illustrates the relationship between the independent and dependent variables investigated. The independent variable consists of the profile of the parent-respondents, specifically their age, sex, and role in the family. These variables were examined to determine whether differences existed in parents' assessments of learners' collaboration and social interaction in mathematics learning.

The dependent variable of the study is the parents' assessment of learners' collaboration and social interaction while learning mathematical concepts. Collaboration refers to learners' ability to work cooperatively, participate in shared learning activities, and contribute to group tasks, while social interaction pertains to learners' ability to establish positive relationships and interact effectively with others during mathematics learning. Guided by Social Constructivist Theory, the paradigm assumes that parents' demographic characteristics may influence their perceptions of learners' collaborative and social behaviors.

The conceptual framework served as the basis for the development of the research instrument, the formulation of the research questions, and the analysis of the relationship among the study variables. It likewise guided the interpretation of the findings in determining whether parents' assessments differed according to their profile characteristics.

Statement of the Problem

Collaboration and social interaction are essential competencies that support meaningful mathematics learning by promoting active participation, cooperative problem-solving, and positive learner engagement. These competencies enable learners to construct mathematical understanding, develop critical thinking skills, and interact effectively with others during learning activities. Consequently, fostering collaboration and social interaction has become an important objective of learner-centered mathematics instruction.

Despite the growing emphasis on collaborative learning, learners demonstrate varying levels of collaboration and social interaction that may influence their mathematics learning experiences. Although previous studies have primarily examined these competencies from the perspectives of teachers and learners, relatively limited attention has been given to parents' assessments despite their important role as educational partners in supporting learners at home and in school. Furthermore, few studies have investigated the relationship between collaboration and social interaction using parent-based assessments, particularly within the Philippine educational context.

Given these research gaps, the present study investigated parents' assessments of learners' collaboration and social interaction in mathematics learning. Specifically, it examined the relationship between these constructs and determined whether parents' assessments differed according to respondents' age, sex, and role in the family. The findings are expected to contribute to mathematics instruction, strengthen home-school partnerships, and provide empirical evidence to support collaborative and learner-centered educational practices.

Research Objectives

General Objective

To determine parents' assessments of learners' collaboration and social interaction in mathematics learning, examine the relationship between these constructs, and determine whether parents' assessments differ according to selected profile variables.

Specific Objectives

1. To describe the profile of the parent-respondents in terms of:
 - 1.1 age;
 - 1.2 sex; and
 - 1.3 role in the family.
2. To assess learners' collaboration and social interaction in mathematics learning based on the assessments of the parent-respondents.
3. To determine whether a significant relationship exists between learners' collaboration and social interaction.
4. To determine whether significant differences exist in parents' assessments when grouped according to age, sex, and role in the family.

Research Questions

1. What is the profile of the parent-respondents in terms of:
 - 1.1 age;
 - 1.2 sex; and
 - 1.3 role in the family?
2. How do the parent-respondents assess learners' collaboration and social interaction in mathematics learning?
3. Is there a significant relationship between collaboration and social interaction of learners in mathematics learning?
4. Is there a significant difference in the parents' assessments of learners' collaboration and social interaction when grouped according to age, sex, and role in the family?

Hypotheses

H₀₁: There is no significant relationship between collaboration and social interaction of learners in mathematics learning.

H₀₂: There is no significant difference in the parents' assessments of learners' collaboration and social interaction when grouped according to age, sex, and role in the family.



METHODOLOGY

Research Design

The study employed a descriptive-correlational research design to examine parents' assessments of learners' collaboration and social interaction in mathematics learning. The descriptive component was used to determine the profile of the parent-respondents and assess learners' collaboration and social interaction as perceived by their parents. The correlational component was utilized to examine the relationship between collaboration and social interaction, while inferential comparative analyses were conducted to determine whether parents' assessments differed according to age, sex, and role in the family.

The descriptive-correlational design was appropriate for the study because it enabled the researchers to describe the characteristics of the respondents, measure the variables of interest, determine the degree of relationship between collaboration and social interaction, and compare parents' assessments across selected profile variables without manipulating any conditions. This design provided an objective basis for understanding parents' perceptions of learners' collaborative and social behaviors in mathematics learning.

Population and Sampling

The respondents of the study consisted of 40 parents of learners who served as the primary source of data regarding learners' collaboration and social interaction in mathematics learning. Parents whose children were enrolled in selected public elementary schools within the Schools Division of Cavite were selected as respondents because they regularly observe their children's learning behaviors, participation in mathematics-related activities, and interactions with others in home-based learning environments.

A simple random sampling technique was employed to select the respondents, ensuring that each parent had an equal opportunity to participate in the study. This sampling technique minimized selection bias and enhanced the representativeness of the sample, thereby providing reliable data for examining parents' assessments of learners' collaboration and social interaction in mathematics learning.

Research Instrument

The study utilized a researcher-made questionnaire as the primary data-gathering instrument. The questionnaire consisted of two parts: Part I gathered the profile of the parent-respondents in terms of age, sex, and role in the family, while Part II assessed learners' collaboration and social interaction in mathematics learning based on parents' observations. Responses were measured using a four-point Likert scale ranging from 1 (Least True) to 4 (Very True).

The instrument was developed based on the objectives of the study and relevant literature on collaboration, social interaction, and mathematics learning. It underwent content validation by three experts in education to ensure the relevance, clarity, and adequacy of the items. A pilot test was subsequently conducted, and the instrument obtained a Cronbach's alpha coefficient of 0.86, indicating good internal consistency and confirming its reliability for data collection.

Data Collection

Data collection was conducted during the scheduled data-gathering period after the research instrument had undergone validation and reliability testing. The researcher personally administered the questionnaires to the selected parent-respondents in the identified public elementary schools within the Schools Division of Cavite. The respondents were given sufficient time to accomplish the questionnaire, after which the completed instruments were collected, checked for completeness, and prepared for data analysis. The data were gathered during the second semester of School Year 2025–2026.

Treatment of Data

Descriptive and inferential statistics were employed to analyze the data. Frequency counts and percentages were used to describe the profile of the parent-respondents, while the mean was used to determine parents' assessments of learners' collaboration and social interaction in mathematics learning.

To determine the relationship between collaboration and social interaction, Kendall's tau-b correlation coefficient was employed. To determine whether significant differences existed in parents' assessments when grouped

according to age and role in the family, the Kruskal–Wallis H test was used, while the Mann–Whitney U test was utilized to compare assessments according to sex. All inferential analyses were conducted at the 0.05 level of significance.

Ethics in Research

Ethical standards were observed throughout the conduct of the study. Permission to conduct the research was obtained from the school authorities prior to data collection. Informed consent was secured from all parent-respondents after they were informed of the purpose of the study, the voluntary nature of their participation, and their right to withdraw at any time without penalty. The confidentiality and anonymity of the respondents were maintained by ensuring that no personal identifiers were disclosed. All information collected was treated with utmost confidentiality and was used solely for academic and research purposes. All completed questionnaires were securely stored and were accessible only to the researcher.

RESULTS AND DISCUSSION

Table 1.

Frequency distribution of parents' profile in terms of age, sex and role in the family

Parents' Profile	f	%
Age		
35-39	13	33
40-44	10	25
45-49	14	35
50-54	3	8
Total	40	100
Sex		
Male	7	18
Female	33	83
Total	40	100
Role in the Family		
Parent	19	48
Grandparent	18	45
Guardian	3	8
Total	40	100

Table 1 presents the profile of the parent-respondents. Most respondents were aged 45–49 years (35%), followed by those aged 35–39 years (33%) and 40–44 years (25%). The majority were female (83%), while 18% were male. In terms of role in the family, 48% were parents, 45% were grandparents, and 8% were guardians. The findings indicate that the respondents were predominantly middle-aged female parents and grandparents who were actively involved in supporting learners' mathematics learning and were therefore well positioned to assess learners' collaboration and social interaction. Such involvement strengthens the credibility of parental assessments as complementary sources of information regarding learners' collaborative and social competencies beyond the classroom setting. From an educational perspective, the findings underscore the value of recognizing parents and grandparents as important stakeholders in the teaching and learning process.

Table 2.

Assessment of the parent-respondents on collaboration and social interaction of learners

VARIABLE	MEAN	SD	INTERPRETATION
Collaboration	3.33	0.46	Very True
Social Interaction	3.25	0.43	Very True
OVERALL MEAN	3.28	0.44	Very True

Legend: 3.25–4.00 = Very True; 2.50–3.24 = Often True; 1.75–2.49 = Somewhat True; 1.00–1.74 = Least True.

Table 2 presents the parents' assessment of learners' collaboration and social interaction in mathematics learning. The results revealed that learners were assessed as Very True in terms of both collaboration ($M = 3.33$, $SD = 0.46$) and social interaction ($M = 3.25$, $SD = 0.43$), resulting in an overall mean of 3.28 ($SD = 0.44$), which is likewise interpreted as Very True. These findings indicate that learners generally demonstrate collaborative behaviors and positive social interactions during mathematics learning as observed by their parents.

The findings suggest that learners actively participate in collaborative activities, cooperate with others, and establish positive interpersonal relationships while engaging in mathematics-related tasks. This may indicate that learners possess the social and collaborative skills necessary to support meaningful learning experiences both in school and at home. Similar findings have been reported in recent studies, which showed that collaborative learning enhances learner engagement, promotes active participation, and improves mathematical understanding by allowing learners to exchange ideas, solve problems collectively, and learn from one another (Junaid, 2025). Likewise, positive social interaction has been associated with increased learner confidence, motivation, and academic achievement in mathematics (Klang et al., 2021).

The findings support Vygotsky's Social Constructivist Theory (1978), which posits that learning is constructed through social interaction and collaboration with others. According to the theory, learners develop deeper understanding when they actively engage in cooperative learning experiences and interact with peers, teachers, and family members. The high assessments of collaboration and social interaction observed in this study suggest that learners are provided with opportunities to participate in meaningful interactions that facilitate both cognitive and social development. These findings also have practical implications for curriculum developers in strengthening collaborative and learner-centered mathematics activities, for mathematics coordinators in promoting instructional support and collaborative teaching practices, and for teacher education programs in preparing both pre-service and in-service teachers to effectively facilitate collaborative learning and foster meaningful home-school partnerships.

These findings highlight the importance of promoting collaborative learning experiences in mathematics instruction. Teachers should continue to implement learner-centered strategies that encourage teamwork, discussion, and cooperative problem-solving, while parents should be actively involved in supporting collaborative learning activities at home. Strengthening home-school partnerships may further enhance learners' collaboration and social interaction, ultimately contributing to improved mathematics learning outcomes.

Table 3.*Significant relationship between collaboration and social interaction of learners*

Variables	N	Kendall's τ_b	p-value	Decision	Interpretation
Collaboration and Social Interaction	40	0.057	0.602	Fail to Reject H_0	Not Significant

Table 3 presents the test of the relationship between learners' collaboration and social interaction as assessed by the parent-respondents. The results revealed no significant relationship between the two variables, as indicated by Kendall's τ_b value of 0.057 and a p-value of 0.602, which is greater than the 0.05 level of significance. Hence, the study failed to reject the null hypothesis.

The findings indicate that parents' assessments of learners' collaboration were not significantly associated with their assessments of learners' social interaction in mathematics learning. Although both variables were independently assessed as highly evident, the results suggest that higher levels of collaboration did not necessarily correspond to higher levels of social interaction among the learners. This implies that the two constructs may develop independently and may be influenced by different learning experiences and environmental factors.

The findings differ from studies reporting a positive association between collaborative learning and learners' social development, which suggest that cooperative activities enhance interpersonal relationships and engagement in mathematics learning (Akendita et al., 2026; Alakoski et al., 2025). However, the absence of a significant relationship in the present study indicates that, based on parents' observations, collaborative behaviors and social interactions may not always occur simultaneously in mathematics learning contexts.

These findings suggest that educators should implement instructional strategies that intentionally develop both collaboration and social interaction rather than assuming that improvement in one competency will automatically enhance the other. Likewise, parents and teachers should provide varied learning opportunities that foster cooperative learning and positive interpersonal engagement to support learners' holistic development. The findings highlight the need for instructional leaders and mathematics coordinators to support teachers through professional development and instructional supervision that emphasize collaborative learning practices. The results also provide curriculum developers with evidence to strengthen learner-centered mathematics activities and encourage teacher education programs to equip future teachers with the competencies needed to effectively facilitate collaboration and positive social interaction in diverse learning environments.

Table 4.*Significant difference in the assessment of the parent-respondents on collaboration and social interaction of learners*

ASSESSMENT	N	DF	TEST	TEST STATISTIC	P-VALUE	REMARKS
Collaboration						
Age	40	3	Kruskal Wallis	0.742	0.863	Fail to Reject Ho
Sex	40	---	Mann - Whitney	102.50	0.000	Reject Ho
Role in the Family	40	2	Kruskal Wallis	1.95	0.377	Fail to Reject Ho
Social Interaction						
Age	40	3	Kruskal Wallis	5.061	0.167	Fail to Reject Ho
Sex	40	---	Mann - Whitney	186.50	0.633	Fail to Reject Ho
Role in the Family	40	2	Kruskal Wallis	1.23	0.541	Fail to Reject Ho

Table 4 presents the results of the significant difference in parents' assessments of learners' collaboration and social interaction when grouped according to age, sex, and role in the family. The results revealed no significant differences in the assessment of collaboration when grouped according to age ($H = 0.742$, $p = 0.863$) and role in the family ($H = 1.950$, $p = 0.377$). Likewise, no significant differences were found in the assessment of social interaction based on age ($H = 5.061$, $p = 0.167$), sex ($U = 186.50$, $p = 0.633$), and role in the family ($H = 1.230$, $p = 0.541$). However, a significant difference was observed in the assessment of collaboration when respondents were grouped according to sex ($U = 102.50$, $p < 0.001$), leading to the rejection of the null hypothesis for this variable.

The findings suggest that parents generally shared similar perceptions of learners' collaboration and social interaction regardless of their age and role in the family. The significant difference observed according to sex indicates that male and female respondents differed in their assessment of learners' collaborative behaviors. Previous studies have reported that parents' perceptions of children's learning behaviors may vary according to parental characteristics, particularly in terms of their level of involvement and interaction with learners during educational activities (Clegg et al., 2020; Zha et al., 2025).

The findings may be explained by Vygotsky's Social Constructivist Theory, which emphasizes that collaboration and social interaction are developed through shared learning experiences. Although parents may differ in their perspectives based on sex, the generally consistent assessments across most profile variables suggest a common understanding of learners' collaborative and social behaviors. These findings imply that educators and parents should continue fostering collaborative learning opportunities while encouraging the active involvement of both mothers and fathers in supporting learners' mathematics learning. The findings also underscore the importance of strengthening home-school partnerships through parent engagement initiatives, while guiding curriculum developers and teacher education programs to integrate strategies that promote collaborative learning and meaningful family participation in mathematics education.

Conclusion

Based on the analysis and interpretation of the findings, learners demonstrated high levels of collaboration and positive social interaction in mathematics learning as reflected in their parents' assessments. Although both competencies were highly evident, no significant relationship was found between collaboration and social interaction, suggesting that these competencies may develop independently within mathematics learning contexts. Parents' assessments were generally consistent regardless of age and role in the family, although differences according to respondents' sex indicate varying perceptions of learners' collaborative behaviors.

The findings contribute to educational practice by reinforcing the value of collaborative, learner-centered mathematics instruction and highlighting the importance of strong home-school partnerships. They likewise provide useful information for teachers, school leaders, curriculum developers, and teacher education institutions in designing instructional practices and family engagement initiatives that promote learners' collaborative competence and positive social interaction.

Recommendations

Mathematics teachers may continue implementing collaborative learning strategies and interactive classroom activities that promote learners' participation and positive social interaction during mathematics instruction.

Parents may be encouraged to sustain their involvement in learners' mathematics learning by providing opportunities for collaborative learning and positive social engagement at home.

School administrators may strengthen home-school partnership programs that encourage the active participation of mothers, fathers, grandparents, and guardians in supporting learners' collaborative and social development.

Curriculum developers may integrate collaborative learning and social interaction competencies more explicitly into mathematics learning competencies and instructional materials.

Teacher education institutions may strengthen preservice and in-service teacher preparation by incorporating collaborative learning strategies and effective family engagement practices into teacher professional development programs.

Education policymakers may consider supporting initiatives that promote meaningful home-school collaboration to enhance learners' collaborative skills and mathematics learning experiences.

Future researchers may conduct similar studies using larger samples, different educational settings, additional variables, or mixed-method research designs to further validate and extend the findings of the present study.

REFERENCES

- Akendita, P. A., Arhin, A. K., & Arthur, Y. D. (2026). Modeling the impact of collaborative learning and motivation on senior high school mathematics achievement. *Journal of Pedagogical Sociology and Psychology*, 8(2), 1-18. <https://doi.org/10.33902/jpsp.202634699>
- Alakoski, R., Laine, A., & Hannula, M. S. (2025). Interaction and collective emotional climate in innovative learning environments in mathematics lessons: a third- and fourth-grade students' perspective. *Learning Environments Research*, 28(1), 81-102. <https://doi.org/10.1007/s10984-025-09530-7>
- Civil, M., & Quintos, B. (2022). Mothers and children doing mathematics together: implications for teacher learning. *Teachers College Record: The Voice of Scholarship in Education*, 124(5), 13-29. <https://doi.org/10.1177/01614681221105008>
- Clegg, J. M., Wen, N. J., DeBaylo, P. H., Alcott, A., Keltner, E. C., & Legare, C. H. (2020). Teaching through collaboration: flexibility and diversity in caregiver-child interaction across cultures. *Child Development*, 92(1), 56-75. <https://doi.org/10.1111/cdev.13443>
- Dorimana, A., Uworwabayeho, A., & Nizeyimana, G. (2022). Teacher-student interactions for enhanced learning in upper secondary mathematics classroom. *International Journal of Evaluation and Research in Education*, 11(2), 507-507. <https://doi.org/10.11591/ijere.v11i2.22152>
- Ibrilla, O., Zulkarnain, S., & Wahyunengsih, W. (2025). Understanding the role of parental involvement in students' attitudes toward mathematics for elementary school learner. *Tuhenori Jurnal Ilmiah Multidisiplin*, 3(2), 95-102. <https://doi.org/10.62138/tuhenori.v3i2.160>
- Junaid, A. (2025). Enhancing problem-solving skills in secondary mathematics education through collaborative learning. *Journal of Interdisciplinary Perspectives*, 3(9), 95-107. <https://doi.org/10.69569/jip.2025.230>



International Journal of Education, Learning, and Pedagogical Sciences (INJELPS)

P - ISSN 3116-3769; E - ISSN 3116-3777

National Book Development Board (NBDB)
Registration as Book Publisher
(Print & Digital): 6312

PRC-CPD Accredited Provider:
PTR-2025-749

- Klang, N., Karlsson, N., Kilborn, W., Eriksson, P., & Karlberg, M. (2021). Mathematical problem-solving through cooperative learning—the importance of peer acceptance and friendships. *Frontiers in Education*, 6(1), 1-10. <https://doi.org/10.3389/educ.2021.710296>
- Lee, J., & Paul, N. (2023). A review of pedagogical approaches for improved engagement and learning outcomes in mathematics. *Journal of Student Research*, 12(3), 1-9. <https://doi.org/10.47611/jsrhs.v12i3.5021>
- Padilla, E. H., Bazán-Ramírez, A., Bazán-Ramírez, W., & Gutiérrez, J. S. (2023). Parental participation and parents' support: effects on mathematics achievement, 2018 national assessment of learning, Mexico. *Frontiers in Psychology*, 14(1), 1-15. <https://doi.org/10.3389/fpsyg.2023.1154470>
- Rosalejos, C. (2026). Instructional practices to improve the mathematics performance of Grade 6 learners: Basis for a proposed intervention program. *Pantao, International Journal of the Humanities and Social Sciences*, 5(1), 1-15. <https://doi.org/10.69651/pjihss0501768>
- Safitri, M., Suryani, N., Asrowi, A., & Sukarmin, S. (2024). Collaborative digital learning as a virtual learning environment on mathematics. *International Journal of Interactive Mobile Technologies (IJIM)*, 18(5), 4-17. <https://doi.org/10.3991/ijim.v18i05.47925>
- Siller, H.-S., & Ahmad, S. (2024). Analyzing the impact of collaborative learning approach on grade six students' mathematics achievement and attitude towards mathematics. *Eurasia Journal of Mathematics, Science and Technology Education*, 20(2), 1-21. <https://doi.org/10.29333/ejmste/14153>
- Thabologo, F., & Kesianye, S. (2024). Workshop training to facilitate parental involvement in their children's mathematics education: parents' perceptions. *Journal of Education and Learning (EduLearn)*, 18(4), 1279-1291. <https://doi.org/10.11591/edulearn.v18i4.21743>
- Vanbecelaere, S., Matsuyama, K., Reynvoet, B., & Depaepe, F. (2021). The role of the home learning environment on early cognitive and non-cognitive outcomes in math and reading. *Frontiers in Education*, 6(1), 1-14. <https://doi.org/10.3389/educ.2021.746296>
- Zambak, V. S., Steiner, L., & Carley-Rizzuto, K. (2025). A parental involvement program: facilitating parental scaffolding with literacy strategies to support students' mathematical skills. *Discover Education*, 4(1), 1-25. <https://doi.org/10.1007/s44217-025-00686-1>
- Zha, S., Tang, Y., Gong, J., & Xu, Y. (2025). COLP: Scaffolding children's online long-term collaborative learning. *International Journal of Human-Computer Interaction*, 41(24), 15453-15475. <https://doi.org/10.1080/10447318.2025.2498492>