Mathematical Identity, Parental Involvement, Engagement and Academic Performance of Students: Basis for Collaborative Leadership Among Teachers, Parents, and Administrators

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ABSTRACT

This study examined the relationship among mathematical identity, parental involvement, student engagement, and academic performance among Grade 11 students in four large public secondary schools in one of the Schools Divisions in the Negros Island Region during school year 2026–2027. Using a quantitative descriptive-correlational research design, the study assessed students' mathematical identity, parental involvement, engagement, and mathematics achievement. Findings revealed that students occasionally demonstrated confidence, persistence, positive mathematical beliefs, and active involvement in mathematics, suggesting that their mathematical identity was still developing. Parents provided support and encouragement from time to time, particularly in fostering positive attitudes toward mathematics, while participation in school activities and collaboration with teachers was less evident. Students frequently participated in learning activities and demonstrated active engagement. Most achieved expected learning competencies and maintained excellent academic performance. However, mathematical identity, parental involvement, and student engagement were not significantly associated with mathematics achievement. The findings provide a basis for strengthening collaborative leadership among teachers, parents, and administrators.

Keywords: Mathematical identity; parental involvement; student engagement; academic performance; mathematics achievement; collaborative leadership; teacher-parent-administrator collaboration; mathematics education; Grade 11 students; public secondary schools; descriptive-correlational research; quantitative research; learner engagement; parental support; student achievement; Negros Island Region

INTRODUCTION

Mathematics plays an important role in developing the knowledge and skills that learners need to address real-life problems, participate effectively in modern society, and pursue further education and employment in an increasingly technology-driven world. The OECD (2023) emphasizes that mathematical literacy involves applying mathematical reasoning and knowledge to real-world situations, while the updated PISA 2022 framework recognizes the importance of mathematics in preparing learners to function in a rapidly changing society shaped by technological developments. In the Philippines, mathematics education remains a significant concern because national and international assessments continue to show substantial challenges in learners' mathematics proficiency. These existing concerns highlight the continuing need to strengthen mathematics education in the country. The Philippine Department of Education has likewise identified mathematics performance as a key indicator in its Quality Basic Education Development Plan 2025–2035, with specific targets for improving learners' proficiency in mathematics across grade levels. Beyond academic knowledge alone, mathematics performance may also be understood within the broader learning environment, as PISA findings show associations between mathematics performance and factors such as socioeconomic background, teacher support, classroom conditions, and students' learning experiences.

Among these factors, mathematical identity has emerged as a significant predictor of students' success in mathematics. It reflects how learners perceive themselves as mathematics learners, including their confidence, beliefs, sense of competence, and willingness to engage in mathematical tasks (Heyd-Metzuyanim et al., 2021; Cribbs et al., 2021). Learners with a positive mathematical identity are more likely to persist in solving difficult problems, actively participate in classroom activities, and demonstrate greater confidence in learning mathematics, whereas those with a weaker mathematical identity often experience anxiety, low self-efficacy, and poor academic outcomes (Kurniawati et al., 2022). Equally important is parental involvement, which extends beyond monitoring schoolwork to providing emotional support, encouraging positive attitudes toward learning, and maintaining active communication with teachers (Ahlin, 2023). Likewise, student engagement, characterized by behavioral participation, emotional commitment, and cognitive investment in learning, has consistently been associated with improved understanding, motivation, and academic achievement (Nevid et al., 2022).

Recent studies have established that mathematical identity, parental involvement, and student engagement each contribute significantly to mathematics achievement (Ma & Xiao, 2021; Hachey, 2022). However, these variables have generally been investigated independently, with limited attention given to how they collectively influence students' academic performance. In the Philippine context, most research has focused on mathematics anxiety, teacher competence, learning strategies, or parental involvement as separate determinants of achievement (Tarigan et al., 2022; Yanthi et al., 2022). Consequently, there remains limited empirical evidence explaining the combined influence of mathematical identity, parental involvement, and student engagement on the academic performance of Grade 11 Senior High School students.

More importantly, existing studies rarely extend their findings to educational leadership and school improvement. Although improving mathematics achievement requires shared responsibility among teachers, parents, and school administrators, few studies have used these learner-related factors as a basis for developing collaborative leadership initiatives that strengthen home-school partnerships and coordinated instructional support. This gap highlights the need for research that integrates psychological, family, and school dimensions into a single framework capable of informing collaborative educational practices.

Hence, this study sought to determine the relationships among mathematical identity, parental involvement, student engagement, and academic performance of Grade 11 Senior High School students. Specifically, it aimed to provide empirical evidence that will serve as the basis for a Collaborative Leadership Framework designed to strengthen partnerships among teachers, parents, and school administrators. By addressing the existing research gap, the study is expected to contribute to the body of knowledge in mathematics education while offering practical strategies for improving students' academic performance through shared leadership and collaborative educational support.

METHODOLOGY

This study employed a quantitative descriptive-correlational research design to examine the relationships among mathematical identity, parental involvement, learner engagement, and academic performance of Grade 11 students. The descriptive component was used to determine the levels of mathematical identity, parental involvement, learner engagement, and academic performance, while the correlational component examined the relationships between mathematical identity, parental involvement, learner engagement, and students' academic performance. This design was appropriate because the study investigated naturally occurring variables without manipulating the research environment and used quantitative data to determine the degree and direction of their relationships (Creswell & Creswell, 2023; Fraenkel et al., 2023).

The respondents were 338 Grade 11 students enrolled in four large public secondary schools from two Schools Divisions in the Negros Island Region during school year 2026–2027. The total population consisted of 2,158 Grade 11 students. The required sample size was determined using Yamane's formula with a 5% margin of error. To ensure adequate representation from each participating school, proportionate stratified random sampling was employed. Each school served as a stratum, and the number of respondents selected from each school was determined proportionally according to its Grade 11 enrollment. The respondents within each stratum were then selected through random sampling.

Data were collected using a structured survey questionnaire consisting of three parts. The first part measured mathematical identity using a 20-item instrument based on the Mathematical Identity Scale developed by Kaspersen and Ytterhaug (2020) and informed by the adaptation of Fatqurhohman and Firdaus (2024). The instrument assessed students' mathematical confidence, beliefs, persistence, reflective thinking, problem-solving orientation, curiosity, and overall disposition toward mathematics. Responses were rated using a four-point frequency scale ranging from 1 (Never/Almost Never) to 4 (Always/Almost Always). The second part measured parental involvement in mathematics learning using a 20-item questionnaire adapted from Lachica (2024). The instrument covered four dimensions: home support, attitudes and beliefs, communication, and collaboration, with five items representing each dimension. Responses were rated on a five-point scale ranging from 1 (Never) to 5 (Always).

The third part measured learner engagement in mathematics learning using a 20-item instrument based on the multidimensional framework of student engagement and aligned with the work of Fong et al. (2021). The instrument assessed behavioral, emotional, cognitive, and agentic engagement, with five items representing each dimension. Responses were measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The respondents' academic performance was determined using their official final Mathematics grades from School Year 2025–2026. Although the respondents were enrolled in Grade 11 during School Year 2026–2027 when the data were collected, their Mathematics grades from the preceding school year were used as an objective measure of their most recent completed academic achievement. Access to these records was obtained with the approval of the appropriate school authorities and in accordance with confidentiality and data privacy requirements.

Prior to data collection, the researcher secured the necessary approvals from the concerned educational authorities and school administrators. The selected respondents were informed about the purpose of the study, the voluntary nature of their participation, and the confidentiality of their responses. Informed consent was obtained from the respondents and, when applicable, from their parents or legal guardians. The questionnaires were administered according to the agreed schedule of the participating schools. After retrieval, the responses were checked for completeness, coded, organized, and encoded for statistical analysis.

Descriptive statistics, particularly the mean and standard deviation, were used to determine the levels of mathematical identity, parental involvement, learner engagement, and academic performance. The academic performance of the respondents was interpreted based on the grading categories prescribed under DepEd Order No. 8, s. 2015. To determine the relationships between mathematical identity and academic performance, parental involvement and academic performance, and learner engagement and academic performance, the Spearman Rank-Order Correlation Coefficient (Spearman's rho) was employed. This statistical procedure was used to determine the strength, direction, and statistical significance of the relationships among the variables. The results provided empirical evidence that served as a basis for drawing conclusions and developing recommendations for strengthening collaborative efforts among teachers, parents, and school administrators in supporting students' mathematics learning and academic development.

RESULTS AND DISCUSSIONS

Level of Mathematical Identity of Students

Table 2. Level of Mathematical Identity of Grade 11 Students.

Statements	Mean	SD	Interpretation
1. I take the initiative to learn more about math than what is required at school.	2.15	0.71	Low

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2. When I learn a new method, I take time to find out if I can find a better method.	2.17	0.75	Low
3. When I learn a new method, I try to think of situations when it wouldn't work.	2.28	0.65	Low
4. I struggle with putting math problems aside.	2.20	0.79	Low
5. If I forget a formula or method, I try to derive it myself.	2.47	0.69	Low
6. I get engaged when someone starts a mathematical discussion.	2.18	0.56	Low
7. When I learn something new, I make my own problems.	2.33	0.58	Low
8. Math ideas that I hear or learn about help me inspire new trains of thoughts.	2.20	0.45	Low
9. When I learn a new method, I like to be told exactly what to do.	2.14	0.50	Low
10. When I try to use a method that doesn't work, I spend time to find out why it didn't work.	2.13	0.56	Low
11. When I learn a new formula/algorithm, I try to understand why it works.	2.29	0.66	Low
12. When I face a proof, I study it until it becomes meaningful.	2.25	0.66	Low
13. When I face a math problem, I consider different possible ways I can solve it.	2.20	0.55	Low
14. When I work with a math problem, I move back and forth between various strategies.	2.18	0.60	Low
15. When I learn something new, it makes me want to learn more things.	2.41	0.60	Low
16. When I work with a problem, I pause along the way to reflect on what I am doing.	2.24	0.49	Low
17. If I get stuck on a problem, I try to visualize it.	2.16	0.45	Low
18. I can explain why my solutions are correct.	2.20	0.47	Low
19. I try to connect new things I learn to what I already know.	2.26	0.53	Low

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20. If I immediately do not understand what to do, I keep trying.	2.30	0.61	Low
Mathematical Identity Overall Mean	**2.24**	**0.19**	**Low**

Legend: (3.26 – 4.00) Very High; (2.51 – 3.25) High; (1.76 – 2.50) Low; (1.00 – 1.75) Very Low

Among the indicators, the highest mean was obtained for the statement, "If I forget a formula or method, I try to derive it myself" (M = 2.47, SD = 0.69), interpreted as Low. This suggests that, compared with the other behaviors measured, students were relatively more likely to reconstruct a formula or method when they could not remember it. Such behavior reflects an emerging willingness to work independently rather than rely solely on memorized procedures and may indicate an initial form of persistence when dealing with mathematical tasks. This finding may be viewed in relation to mathematical identity, which encompasses how learners perceive and position themselves in relation to mathematics. Crossley et al. (2020), for example, examined mathematics identity in terms of students' self-concept, interest, and value of mathematics and its relationship with mathematics success. Joseph (2021) likewise emphasized the importance of developing robust mathematics identities through learning environments that recognize and affirm students' mathematical experiences. However, because the indicator remained within the Low category, this tendency toward independent mathematical thinking may not yet be sufficiently established among the respondents.

The result may also be understood in relation to the multidimensional nature of mathematical identity. Kurniawati et al. (2022) examined mathematics identity as a multidimensional construct in developing an instrument for pre-service mathematics teachers. The students' tendency to derive a formula when they forget it may therefore be interpreted as a cognitive and behavioral response to a mathematical challenge. Nevertheless, the relatively low mean suggests that such responses occur only occasionally. This finding is also consistent with Hima et al. (2021), who demonstrated that students' mathematical identity can be strengthened through learning experiences designed to increase students' involvement in mathematics.

On the other hand, the lowest mean was obtained for the statement, "When I try to use a method that doesn't work, I spend time to find out why it didn't work" (M = 2.13, SD = 0.56), also interpreted as Low. This indicates that students were least likely to examine the reasons behind an unsuccessful mathematical approach. The result may suggest limited reflection on errors and unsuccessful strategies, which are important in developing a deeper relationship with mathematics. Rather than consistently analyzing why a solution failed, students may sometimes depend on prescribed procedures or move on when they encounter difficulty.

This finding is noteworthy in light of Barba's (2022) discussion of mathematical identity and the role of educators in creating learning environments that shape students' relationships with mathematics. Similarly, Pedersen and Haavold (2023) found relationships between students' mathematical beliefs and motivation, including their enjoyment of and perceived usefulness of mathematics. The low result for examining why a method did not work may therefore indicate an area where students' persistence and reflective engagement with mathematics could be further strengthened.

The two extreme results provide an important picture of the respondents' mathematical identity. Students were relatively more inclined to reconstruct a formula or method when they forgot it but were less inclined to investigate why an unsuccessful method did not work. This difference suggests that their mathematical identity may be more evident in attempting to recover mathematical procedures than in engaging in sustained reflection and analysis when difficulties arise. Latterell and Wilson (2017) described mathematical identity in terms of how individuals understand who they are mathematically, including their perceptions of mathematical ability, comfort with mathematics, and the value they attach to mathematics. Kambara (2022) likewise examined mathematical identity in relation to learners' experiences and relationships with mathematics.

Overall, the low level of mathematical identity found among the Grade 11 students suggests that their sense of themselves as confident, persistent, reflective, and engaged mathematics learners is still developing. The findings reinforce the view that mathematical identity is multidimensional and shaped through students' experiences, perceptions, beliefs, and participation in mathematics learning (Barba, 2022; Hima et al., 2021; Kurniawati et al., 2022). Thus, providing students with opportunities to explore mathematical ideas, learn from unsuccessful strategies, explain their reasoning, and persist through challenging problems may help foster a stronger and more positive mathematical identity.

Level of Parental Involvement

Table 3. Level of Parental Involvement of Grade 11 Students.

Statements	Mean	SD	Interpretation
Home Support	**3.16**	**0.68**	**Moderate**
1. My parents provide tools like rulers, calculators, or math references	3.46	0.82	High
2. My parents ensure I have a quiet, well-lit space to study math.	3.38	1.19	Moderate
3. My parents help me review lessons before quizzes or exams	2.52	1.12	Low
4. My parents help me find extra practice or examples when I am stuck.	3.44	1.28	High
5. My parents connect math to daily tasks like budgeting or measuring	3.00	1.22	Moderate
Attitude and Beliefs	**4.17**	**0.71**	**High**
6. My parents believe mathematics is important for my future.	4.23	1.03	Very High
7. My parents think I have the ability to do well in mathematics.	4.25	0.99	Very High
8. My parents see mistakes in math as opportunities to learn, not failures.	4.19	1.05	High
9. My parents encourage me not to give up when math feels hard.	4.38	0.97	Very High
10. My parents value mathematics as much as other school subjects.	3.78	0.85	High
Communication	**3.91**	**0.41**	**High**
11. My parents ask what I learned in math class each day.	3.07	1.19	Moderate
12. My parents listen when I explain what I find easy or hard in math.	3.40	1.23	High
13. My parents ask me to show how I solved a problem, not just give the answer.	4.19	0.88	High
14. My parents share how they use math in their own work or daily life.	4.51	0.59	Very High
15. My parents talk with me about my goals and how math can help achieve them.	4.36	0.84	Very High
Collaboration	**1.03**	**0.13**	**Very Low**

16. My parents attend meetings or conferences about my math progress.	1.00	0.00	Very Low
17. My parents message or meet my math teacher when I need extra help.	1.09	0.34	Very Low
18. My parents work with my teacher to set clear goals for my math learning.	1.01	0.09	Very Low
19. My parents follow suggestions from my teacher to support me at home.	1.07	0.32	Very Low
20. My parents join school activities that promote mathematics learning.	1.00	0.00	Very Low
Parental Involvement as a Whole	**3.07**	**0.30**	**Moderate**

Legend: (4.21 – 5.00) Very High; (3.41 – 4.20) High; (2.61 – 3.40) Moderate; (1.81 – 2.60) Low; (1.00 – 1.80) Very Low

Table 3 presents the perceived level of parental involvement in the mathematics learning of students. Overall, parental involvement was interpreted as moderate, with a mean of 3.07 (SD = 0.30). This indicates that parents sometimes provide support and participate in mathematics-related learning activities. The relatively small standard deviation suggests that the respondents' perceptions were generally consistent. However, the findings also show that parental involvement is not equally evident in all forms of participation. Parents appeared to be more involved through their attitudes and beliefs, communication, and home support, while their direct involvement with teachers and school activities was considerably limited.

The highest level was observed in the parents' attitudes and beliefs toward mathematics, which was interpreted as high (M = 4.17, SD = 0.71). In particular, students strongly perceived that their parents encouraged them not to give up when mathematics became difficult (M = 4.38, SD = 0.97), believed that they had the ability to do well in mathematics (M = 4.25, SD = 0.99), and considered mathematics important for their future (M = 4.23, SD = 1.03). These results indicate that parents generally communicate positive expectations and confidence in their children's mathematical capabilities. Such encouragement can provide students with emotional and motivational support, particularly when they encounter challenging mathematical tasks.

This finding can be related to Nicoletti, Sevilla, and Tonei (2024), who examined parental beliefs regarding children's academic abilities and emphasized that parents' perceptions of children's mathematics ability can influence the learning environment surrounding students. Their work also showed that parental beliefs are not always based solely on children's actual performance and may be affected by expectations and available information. In the present study, the high level of parental confidence in students' mathematical abilities represents a generally supportive environment. However, the findings of Nicoletti et al. (2024) also suggest the importance of ensuring that parental expectations are informed by accurate knowledge of students' actual learning progress. Positive encouragement may therefore become more meaningful when it is accompanied by appropriate awareness of students' strengths and areas for improvement.

Communication was also relatively evident, with a high interpretation (M = 3.91, SD = 0.41). Parents were most frequently perceived to share how they use mathematics in their own work or daily life (M = 4.51, SD = 0.59) and to discuss students' goals and how mathematics could help them achieve these goals (M = 4.36, SD = 0.84). These results suggest that parents often help students recognize the practical value of mathematics and its connection to everyday experiences and future aspirations. However, parents were only moderately likely to ask what their children learned in mathematics class each day (M = 3.07, SD = 1.19). Thus, communication appears to be stronger in discussing the relevance and usefulness of mathematics than in regularly monitoring specific classroom learning.

This pattern is consistent with Garcia et al. (2025), who highlighted that parental educational involvement can be influenced by parents' aspirations, available resources, confidence in supporting their children, time, and social support. Their findings suggest that parents may value their children's education and wish to support them while still experiencing circumstances that affect how actively they participate. In the present study, the high level of communication and positive parental beliefs may reflect parents' recognition of the importance of mathematics, while the more moderate forms of day-to-day academic monitoring may indicate limitations in the extent to which this support is translated into regular learning supervision.

Home support was interpreted as moderate (M = 3.16, SD = 0.68). Parents were most likely to provide learning materials such as rulers, calculators, and mathematics references (M = 3.46, SD = 0.82) and to help students find additional practice or examples when they encountered difficulty (M = 3.44, SD = 1.28). In contrast, helping students review lessons before quizzes or examinations obtained a Low interpretation (M = 2.52, SD = 1.12). This suggests that parents are more likely to provide resources and general assistance than to become directly involved in structured mathematics review.

This result supports the perspective of Wang and Wei (2024) that parental involvement should not be viewed simply in terms of whether parents are involved or not. Their meta-analysis demonstrated that the relationship between parental involvement and mathematics performance varies according to the type and quality of parental involvement. The present findings similarly show that parents participate in some supportive ways but are less involved in direct academic assistance. Thus, the availability of learning resources does not necessarily mean that parents regularly engage in students' mathematics study or assessment preparation.

The most pronounced finding was the very low level of collaboration, with M = 1.03 (SD = 0.13). Students rarely reported that their parents attended meetings or conferences concerning mathematics progress (M = 1.00, SD = 0.00), joined school activities promoting mathematics learning (M = 1.00, SD = 0.00), worked with teachers to establish mathematics learning goals (M = 1.01, SD = 0.09), or followed teachers' suggestions for supporting mathematics learning at home (M = 1.07, SD = 0.32). Even communicating with or meeting the mathematics teacher when additional help was needed was rated very low (M = 1.09, SD = 0.34). These results indicate that the major limitation in parental involvement is the lack of active school-home partnership.

The very low level of collaboration is important because parental involvement extends beyond what parents do at home. Li and Rahman (2025) emphasized the multidimensional nature of parental involvement and identified parental roles that include organizing, monitoring, and supporting children's learning. Their work suggests that effective involvement can take different forms depending on the learning context and the needs of the child. This perspective is relevant to the present finding because the parents of the respondents appear to provide encouragement and informal support but have limited participation in activities requiring coordination with teachers and the school. Greater parental involvement may therefore require opportunities for parents to move from simply supporting their children at home toward becoming more informed partners in the learning process.

The findings can also be viewed in relation to Lachica (2024), who reported that parental support, monitoring, encouragement, and participation in mathematics-related activities were positively associated with students' mathematics academic performance. Similarly, Corvera et al. (2024) emphasized the importance of parental monitoring and communication with teachers in supporting students' mathematics learning. Anicoy and Regidor (2025) likewise found that parental involvement, including monitoring academic progress and supporting mathematics learning at home, can contribute to mathematics achievement. These studies reinforce the idea that parental involvement becomes more meaningful when support is accompanied by active attention to students' learning progress.

The present findings also complement Cabigas and Cabalquinto (2025), who found that parental involvement can contribute directly and indirectly to mathematics performance through study habits and attitudes toward mathematics. Likewise, Ruiz (2025) and Versaga and Escandallo (2025) emphasized the importance of parental encouragement, guidance, supervision, and communication in supporting students' academic outcomes. However, the current results reveal that while encouragement and communication are relatively strong, collaboration with teachers and participation in school-based mathematics activities remain very

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limited. This difference suggests that parents may already provide a supportive home environment but may not yet be fully integrated into the broader educational partnership involving students, teachers, and the school.

Overall, the results indicate that parental involvement among Grade 11 students is moderate and is characterized primarily by positive parental beliefs, encouragement, communication, and basic home support rather than active collaboration with the school. The findings are consistent with recent literature emphasizing that parental involvement is multidimensional and that its effectiveness depends on the nature and quality of participation. Nicoletti et al. (2024) highlight the role of parental beliefs, Garcia et al. (2025) point to contextual factors that shape parental participation, while Li and Rahman (2025) emphasize the different roles parents can assume in supporting learning. Together with the findings of Wang and Wei (2024) and the other cited studies, the present results suggest that parents already provide an important foundation for students' mathematics learning, but stronger and more sustained coordination between parents, mathematics teachers, and the school may further enhance the comprehensiveness of parental involvement.

Level of Engagement in Learning of Students

Table 4. Level of Engagement in Learning of Grade 11 Students.

Statements	Mean	SD	Interpretation
Behavioral	**4.93**	**0.24**	**Very High**
1. I listen carefully when the teacher discusses math lessons.	4.95	0.32	Very High
2. I actively participate in math activities and class discussions.	4.93	0.43	Very High
3. I complete my math assignments and tasks on time.	4.82	0.63	Very High
4. I try my best even when math problems are difficult.	4.94	0.33	Very High
5. I ask questions or seek help when I do not understand a lesson.	4.99	0.14	Very High
Emotional	**2.66**	**0.29**	**Moderate**
6. I enjoy learning new things in mathematics	3.79	0.93	High
7. I feel bored during math lessons (R).	1.09	0.42	Very Low
8. I feel confident that I can learn mathematics well.	3.70	0.62	High
9. I get frustrated when solving math problems (R).	1.06	0.25	Very Low
10. I find mathematics interesting and meaningful.	3.65	0.65	High
Cognitive	**2.83**	**0.82**	**Moderate**
11. I connect what I learn in math to real-life situations.	2.74	1.52	Moderate
12. I try different ways to solve problems instead of just memorizing steps.	2.81	1.28	Moderate
13. I think deeply to understand math concepts, not just memorize them.	2.78	1.45	Moderate

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14. I relate new lessons to what I already know in math.	2.78	1.45	Moderate
15. I think about how math can help me in my future studies or work.	3.04	1.18	Moderate
Agentic	**3.91**	**0.85**	**High**
16. I share my own ideas and suggestions during math class.	4.82	0.63	Very High
17. I help my classmates understand difficult math lessons.	4.42	1.18	Very High
18. I try to improve my way of learning math based on feedback.	3.59	1.51	Moderate
19. I ask for more examples or activities to understand the lesson better.	3.33	1.47	Moderate
20. I contribute to planning group work or activities in math class.	3.39	1.55	Moderate
Engagement as a Whole	**3.58**	**0.32**	**Moderate**

Legend: (4.21 – 5.00) Very High; (3.41 – 4.20) High; (2.61 – 3.40) Moderate; (1.81 – 2.60) Low; (1.00 – 1.80) Very Low

Table 4 presents the level of engagement in learning of Grade 11 students in terms of behavioral, emotional, cognitive, and agentic engagement. The results show that the students' overall engagement was high (M = 3.58, SD = 0.32). This indicates that the respondents frequently demonstrate active participation, interest, and initiative in mathematics learning. However, the results also reveal differences among the four dimensions, showing that students' engagement is more evident in their observable classroom behaviors and willingness to contribute than in their emotional and cognitive involvement.

Among the four dimensions, Behavioral Engagement obtained the highest rating, interpreted as very high (M = 4.93, SD = 0.24). This indicates that students consistently demonstrate attentive, participatory, persistent, and responsible behaviors during mathematics learning. The highest-rated indicator was asking questions or seeking help when they do not understand a lesson (M = 4.99, SD = 0.14). This suggests that students are highly willing to take action when they encounter difficulties rather than simply remain passive during instruction. On the other hand, the lowest indicator within this dimension was completing mathematics assignments and tasks on time (M = 4.82, SD = 0.63), which nevertheless remained very high. Thus, even the least-rated behavioral indicator demonstrates a strong level of academic responsibility.

The strong behavioral engagement suggests that students are generally responsive to classroom demands and willing to participate in the learning process. This is consistent with Reeve et al. (2025), who emphasized the importance of behavioral engagement as a visible manifestation of students' involvement in learning. Similarly, Burns et al. (2022) associated behavioral engagement with persistence and academic participation, while Wang et al. (2022) noted that consistent participation and completion of academic tasks reflect students' commitment to learning. The present finding therefore suggests that Grade 11 students are particularly strong in the observable aspects of engagement, such as participation, attentiveness, persistence, and seeking assistance.

In contrast, emotional engagement obtained a moderate level (M = 2.66, SD = 0.29). This indicates that students demonstrate positive emotional involvement in mathematics only to a moderate extent. The highest-rated indicator was enjoying learning new things in mathematics (M = 3.79, SD = 0.93), interpreted as high. This suggests that students generally experience enjoyment when they encounter new mathematical ideas. The reverse-coded indicators received Very Low ratings, particularly getting frustrated when solving mathematics problems (M = 1.06, SD = 0.25) and feeling bored during mathematics lessons (M = 1.09, SD = 0.42). Because these are negatively worded statements, their low ratings indicate that students generally do not experience boredom or frustration. Nevertheless, the overall moderate rating suggests that positive emotional involvement is not as strongly expressed as their behavioral participation.

This finding may be understood in relation to Reeve et al. (2025), who described emotional engagement as involving students' affective experiences during learning. Shi and Sun (2025) likewise emphasized the importance of positive emotional experiences and emotional regulation in sustaining engagement. In the present study, students' low reports of boredom and frustration are encouraging, but their overall emotional engagement remains moderate. This suggests that minimizing negative emotions does not necessarily mean that students consistently experience strong enjoyment, enthusiasm, or emotional connection with mathematics.

Cognitive engagement was likewise interpreted as moderate (M = 2.83, SD = 0.82). This indicates that students apply cognitive strategies and deeper learning processes only to a moderate extent. The highest-rated statement was thinking about how mathematics can help in future studies or work (M = 3.04, SD = 1.18), while the lowest was connecting what is learned in mathematics to real-life situations (M = 2.74, SD = 1.52). Both indicators remained within the moderate range. The findings suggest that students recognize the future usefulness of mathematics to some extent, but they may not consistently transfer mathematical ideas to authentic situations or make connections between classroom concepts and their everyday experiences.

This result is consistent with Greene (2022), who characterized cognitive engagement as the deliberate use of strategies such as planning, monitoring, and evaluating one's learning. Similarly, Panadero and Broadbent (2023) emphasized that deeper engagement involves connecting new knowledge with prior understanding and using effective strategies to solve problems. The moderate cognitive engagement in the present study therefore suggests an opportunity to strengthen activities that require students to explain their reasoning, connect concepts, apply mathematics to real-world situations, and explore multiple ways of solving problems rather than relying primarily on routine procedures.

Meanwhile, agentic engagement was high (M = 3.91, SD = 0.85), indicating that students frequently contribute to and take an active role in shaping their learning experiences. The highest-rated indicator was sharing their own ideas and suggestions during mathematics class (M = 4.82, SD = 0.63), interpreted as very high. This demonstrates that students are highly willing to express their thoughts and contribute to classroom discussions. In contrast, asking for more examples or activities to understand the lesson better (M = 3.33, SD = 1.47) received the lowest rating and was interpreted as moderate. This difference suggests that students are comfortable expressing ideas but may be less likely to proactively request additional instructional support when they need deeper clarification.

The result supports Utami and Kurniawati (2024), who described agentic engagement as students' active efforts to influence and contribute to their learning experiences. Cheon et al. (2022) likewise emphasized that autonomy-supportive learning environments can encourage students to express ideas and participate actively, while Jang et al. (2023) associated agentic engagement with students' motivation, confidence, and sense of ownership of learning. The present finding indicates that Grade 11 students already demonstrate considerable initiative in contributing to classroom interactions, although their tendency to request additional examples or learning opportunities can still be strengthened.

Overall, the findings indicate that Grade 11 students demonstrate their strongest engagement through behavioral participation and agentic contribution, while emotional and cognitive engagement remain moderate. Students are highly attentive, responsible, willing to seek help, and comfortable expressing their ideas during mathematics lessons. However, their moderate cognitive engagement indicates that deeper thinking, real-life application, and meaningful connections with mathematical concepts may not yet occur consistently. Similarly, the moderate emotional engagement suggests that although students generally do not report strong boredom or frustration, their positive emotional connection with mathematics can still be further developed. The results therefore highlight the importance of learning experiences that do not only encourage students to participate and complete tasks, but also help them enjoy mathematics, think deeply, connect concepts to real-life situations, and actively request learning experiences that address their needs. This interpretation is consistent with the multidimensional view of engagement presented by Reeve et al. (2025), Wong et al. (2024), and Freire et al. (2025), wherein meaningful student engagement involves the interaction of behavioral, emotional, cognitive, and agentic dimensions.

Level of Academic Performance

Table 5. Level of Academic Performance of Grade 11 Students.

Level of Academic Performance	f	Mean	SD	Interpretation
Outstanding	249	91.64	3.25	Outstanding
Very Satisfactory	84			
Satisfactory	5			
Poor	0			
Very Poor	0			
Total	338			

Legend: (90 – 100) Outstanding; (85 – 89) Very Satisfactory; (80 – 84) Satisfactory; (75 – 79) Fairly Satisfactorily; (Below 75) Did Not Meet Expectations

Table 5 presents the academic performance of Grade 11 students during school year 2025–2026. The results show an overall mean grade of 91.64 (SD = 3.25), interpreted as outstanding. This indicates that the respondents generally demonstrated a high level of academic achievement in mathematics. The relatively small standard deviation suggests that the grades were fairly close to the overall mean, indicating that academic performance was generally consistent among the respondents.

In terms of grade distribution, 249 students (73.96%) obtained an outstanding rating, making this the most prevalent category. This was followed by 84 students (24.85%) who obtained a very satisfactory rating, while only 5 students (1.48%) were classified as Satisfactory. The distribution therefore indicates that almost all respondents achieved at least a satisfactory level of academic performance, with nearly three-fourths attaining the highest performance classification.

The predominance of students in the Outstanding category supports Piosang (2025), who viewed mathematics academic performance as an indicator of students' mathematical proficiency and attainment of expected competencies. Similarly, Insorio and Librada (2025) described mathematics performance as measurable learning outcomes that demonstrate students' mastery of mathematical concepts and competencies after instruction. Lazarra (2025) likewise considered academic performance an indication of students' success in meeting course expectations and learning mathematical concepts and skills. In this context, the large proportion of students obtaining Outstanding grades suggests that the respondents generally attained the expected mathematics learning outcomes.

The findings are further consistent with Umac et al. (2025), who regarded recorded mathematics grades as concrete indicators of students' attainment of learning objectives and overall competence. Balansag et al. (2025) similarly considered final grades an objective measure of students' mastery of prescribed competencies in General Mathematics, while Acoba and Ariola (2025) emphasized that official mathematics grades reflect students' successful attainment of intended learning outcomes. Likewise, Evora (2025) viewed academic performance based on official school records as an indicator of students' demonstrated mathematical proficiency. Gorosin et al. (2025) and Bautista and Dones (2025) also regarded final mathematics grades as appropriate measures of overall academic achievement because they represent students' performance across various academic requirements. Taken together, these studies provide support for interpreting the high academic ratings of the respondents as evidence of generally strong achievement in mathematics.

The absence of students in the Poor and Very Poor categories is also noteworthy. This indicates that none of the respondents fell below the satisfactory level of performance based on the classification used in the study. While this does not necessarily establish that every student mastered every mathematical competency, it demonstrates that the respondents' recorded academic performance generally met or exceeded the expected level. The small proportion classified as Satisfactory may also indicate that only a limited number of students may benefit from additional academic assistance to move toward higher levels of achievement.

The result can also be viewed in relation to the broader conception of mathematics performance presented by the OECD (2023), which defines mathematical performance in terms of learners' ability to formulate, apply, and interpret mathematics in different contexts, including reasoning and problem-solving. Similarly, the IEA (2024) emphasizes students' proficiency in understanding mathematical concepts, applying mathematical knowledge, and solving problems across different content and cognitive domains. Although the present study used students' official mathematics grades rather than standardized international assessments, the Outstanding overall performance indicates that the respondents generally achieved a high level of the learning outcomes reflected in their school-based assessments.

Overall, the findings demonstrate that the Grade 11 respondents exhibited an Outstanding level of academic performance during School Year 2025–2026. The high overall mean, the large proportion of students classified as Outstanding, and the absence of students in the Poor and Very Poor categories collectively indicate a generally high-performing group. The result provides a strong basis for the succeeding analysis of the study, particularly in examining whether mathematical identity, parental involvement, and engagement in learning are significantly associated with students' academic performance, rather than assuming that the high achievement level alone establishes such relationships.

Relationship Between the Level of Mathematical Identity and Academic Performance of Grade 11 Students

Table 6. Relationship Between the Level of Mathematical Identity and the Level of Academic Performance of Grade 11 Students.

Variable	Test Statistics (r_s)	p-value	Decision for Ho	Interpretation
Level of Mathematical Identity vs. Level of Academic Performance	0.030	0.587	Failed to Reject Ho	Not Significant

Table 6 presents the relationship between the level of mathematical identity and the level of academic performance of Grade 11 students. The analysis yielded a Spearman's rho (r_s) of 0.030 with a p-value of 0.587. Since the obtained p-value is greater than the 0.05 level of significance, the null hypothesis was not rejected. Therefore, the findings indicate that there is no significant relationship between the level of mathematical identity and the level of academic performance of Grade 11 students.

The computed correlation coefficient of 0.030 indicates a very weak positive relationship, suggesting that although the variables move in the same direction, the association is too weak to be considered statistically meaningful. This implies that differences in students' mathematical identity were not accompanied by corresponding differences in their academic performance. In other words, students with either stronger or weaker mathematical identities obtained relatively similar mathematics grades.

The present finding differs from the results of several recent studies that reported a significant positive relationship between mathematical identity and mathematics achievement. Fernández et al. (2024) found that students with stronger mathematical identities consistently demonstrated higher mathematics achievement, even after controlling for prior achievement and other background characteristics. Similarly, Nickson et al. (2025) reported that mathematical learner identity significantly influenced mathematics achievement among secondary school students, concluding that learners with positive mathematical identities generally performed better than those with weaker identities.

Likewise, Satmaz and Kıncal (2025) emphasized that students who viewed themselves as confident and persistent mathematics learners tended to exhibit stronger engagement and greater academic success. Furthermore, Cribbs and Utley (2024) reinforced previous longitudinal evidence showing that mathematical identity is positively associated with mathematics achievement and continued participation in mathematics learning. Caminse et al. (2025) likewise observed that students with stronger mathematical identities demonstrated greater confidence, engagement, and overall academic development, suggesting that mathematical identity contributes to successful mathematics learning.

However, the present findings are consistent with the study of Ulum (2025), who reported that mathematics achievement did not significantly predict mathematical identity after accounting for learners' mathematical beliefs, attitudes, and motivation. Ulum argued that although mathematical identity and academic achievement are conceptually related, mathematical identity is influenced more strongly by intrinsic motivational and affective factors than by achievement itself. This perspective provides a plausible explanation for the present findings, suggesting that students' confidence, beliefs, and sense of belonging in mathematics may not necessarily translate into higher academic performance, particularly when other factors exert stronger influences on achievement.

The absence of a significant relationship in the present study may also be explained by the characteristics of the respondents. As presented in Table 5, the respondents obtained an Outstanding overall academic performance, with the majority of students clustered within the highest achievement category. This limited variation in academic grades may have reduced the statistical relationship between mathematical identity and academic performance because most students performed at similarly high levels regardless of how they perceived themselves as mathematics learners. Consequently, differences in mathematical identity may not have been sufficiently reflected in the students' grades.

Moreover, academic performance is influenced by numerous factors beyond mathematical identity, including instructional quality, learning strategies, classroom engagement, parental support, prior knowledge, motivation, and assessment practices. Although mathematical identity may contribute to learners' confidence and persistence, these characteristics alone may not be sufficient to produce measurable differences in academic achievement. Students with relatively low mathematical identity may still attain high grades through effective study habits and supportive learning environments, while students with stronger mathematical identities may not necessarily outperform their peers when academic performance is already consistently high across the group.

Overall, the findings indicate that mathematical identity was not significantly associated with the academic performance of Grade 11 students. While previous studies generally reported a positive relationship between the two variables, the present study supports the argument of Ulum (2025) that the relationship between mathematical identity and academic achievement is not always direct and may depend on other motivational, affective, and contextual factors. Therefore, the null hypothesis stating that there is no significant relationship between the level of mathematical identity and the level of academic performance of Grade 11 students is accepted.

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Relationship Between the Level of Parental Involvement and Academic Performance of Grade 11 Students

Table 7. Relationship Between the Level of Parental Involvement and the Level of Academic Performance of Grade 11 Students.

Variable	Test Statistics (r_s)	p-value	Decision for Ho	Interpretation
Level of Parental Involvement vs. Level of Academic Performance	0.073	0.178	Failed to Reject Ho	Not Significant

Table 7 presents the relationship between the level of parental involvement and the level of academic performance of Grade 11 students. The analysis yielded a Spearman's rho (r_s) of 0.073 with a p-value of 0.178. Since the computed p-value is greater than the 0.05 level of significance, the null hypothesis was not rejected. Therefore, the findings indicate that there is no significant relationship between the level of parental involvement and the level of academic performance of Grade 11 students.

The computed correlation coefficient of 0.073 indicates a very weak positive relationship between parental involvement and academic performance. Although the positive coefficient suggests that academic performance tends to increase slightly as parental involvement increases, the relationship is too weak to be statistically significant. This implies that differences in the level of parental involvement among the respondents were not associated with meaningful differences in their mathematics academic performance.

The present finding is inconsistent with much of the existing literature, which generally reports that parental involvement contributes positively to students' mathematics achievement. Wang and Wei (2024), through a meta-analysis of 25 empirical studies, found a significant positive relationship between parental involvement and mathematics performance, concluding that students whose parents actively provided academic guidance and support generally achieved better mathematics outcomes. Similarly, Lachica (2024) reported that Filipino students who experienced greater parental support, monitoring, and encouragement obtained significantly higher mathematics grades than those with lower levels of parental involvement. Likewise, Corvera et al. (2024) found that students whose parents regularly monitored schoolwork, communicated with teachers, and encouraged mathematics learning demonstrated stronger mathematical skills and higher academic performance.

Similar findings were reported by Anicoy and Regidor (2025), who concluded that parental involvement significantly predicted students' mathematics achievement by promoting independent learning and creating supportive home learning environments. Likewise, Cabigas and Cabalquinto (2025) found that parental involvement exerted both direct and indirect positive effects on mathematics performance through improved study habits and more positive attitudes toward mathematics. Ruiz (2025) also reported that consistent parental encouragement, guidance, and academic monitoring significantly influenced students' mathematics achievement by strengthening their commitment to learning. Furthermore, Versaga and Escandallo (2025) found that students who experienced continuous parental support, supervision, and communication generally performed better academically, with students identifying parental encouragement as an important source of motivation.

International evidence also supports the positive role of parental involvement in mathematics achievement. The Programme for International Student Assessment (PISA, 2022) reported that students who received consistent educational support from their families generally demonstrated higher mathematics proficiency than those with limited family engagement. Similarly, the Trends in International Mathematics and Science Study (TIMSS, 2023) emphasized that supportive home learning environments and active parental participation remain important characteristics of students who achieve high levels of mathematics performance across different educational systems.

Despite these findings, the present study did not establish a statistically significant relationship between parental involvement and academic performance. One possible explanation is the nature of the respondents' academic achievement. As presented in Table 5, the respondents obtained an Outstanding overall academic performance, with 73.37% of the students classified under the Outstanding category. Because most respondents achieved similarly high grades, there was limited variability in academic performance, making it difficult to detect a meaningful statistical relationship with parental involvement.

Another possible explanation lies in the nature of parental involvement observed in this study. Although the respondents reported a moderate overall level of parental involvement, Table 3 showed that parents demonstrated high levels of attitude and beliefs and communication, but very low levels of collaboration with teachers and school activities. This suggests that while parents provided encouragement and emotional support at home, they were less involved in school-based educational activities. It is possible that students' high academic performance was influenced more strongly by other factors such as their own learning engagement, classroom instruction, study habits, or individual motivation rather than parental involvement alone.

Furthermore, recent literature acknowledges that the effectiveness of parental involvement depends not only on the frequency of parents' participation but also on the quality, appropriateness, and type of support provided. As emphasized by Wang and Wei (2024), different forms of parental involvement produce varying effects on mathematics achievement depending on students' age, educational context, and the nature of parental support. Thus, although parental involvement remains an important educational factor, its influence on academic performance may not always be directly observable, particularly among learners who already demonstrate consistently high levels of achievement.

Overall, the findings indicate that parental involvement was not significantly related to the academic performance of Grade 11 students in the present study. While numerous Philippine and international studies have consistently reported significant positive relationships between parental involvement and mathematics achievement, the current findings suggest that parental involvement alone did not explain the variations in students' mathematics performance. Therefore, the null hypothesis stating that there is no significant relationship between the level of parental involvement and the level of academic performance of Grade 11 students is accepted.

Relationship Between the Level of Engagement in Learning and Academic Performance of Grade 11 Students

Table 8. Relationship Between the Level of Engagement in Learning and the Level of Academic Performance of Grade 11 Students.

Variable	Test Statistics (r_s)	p-value	Decision for Ho	Interpretation
Level of Engagement in Learning vs. Level of Academic Performance	- 0.030	0.586	Failed to Reject Ho	Not Significant

Table 8 presents the relationship between the level of engagement in learning and the level of academic performance of Grade 11 students. The analysis yielded a Spearman's rho (r_s) of −0.030 with a p-value of 0.586. Since the obtained p-value is greater than the 0.05 level of significance, the null hypothesis is not rejected. Thus, the findings indicate that there is no statistically significant relationship between engagement in learning and academic performance among the Grade 11 students.

The correlation coefficient of −0.030 indicates a very weak negative relationship between the two variables. This means that, within the present group of respondents, variations in engagement in learning were not associated with meaningful variations in academic performance. The negative direction of the coefficient should not be interpreted as evidence that engagement decreases academic performance because the magnitude of the relationship is extremely weak and, more importantly, the relationship is statistically nonsignificant. Therefore, the results do not provide sufficient evidence to conclude that students with higher or lower engagement necessarily obtain correspondingly different mathematics grades.

The present finding differs from the results of several recent studies that reported a significant positive association between student engagement and mathematics achievement. Janubas and Lomibao (2025), through a meta-analysis of empirical studies, found a moderate and statistically significant positive relationship between student engagement and mathematics achievement. Their findings suggest that students who demonstrate stronger behavioral, emotional, cognitive, and agentic engagement generally achieve better mathematics outcomes. Similarly, Plateros et al. (2025) reported that greater participation, persistence, and involvement in mathematics learning were associated with higher academic performance among junior high school students. Rabut and Rabut (2025) likewise found that students who actively participated in classroom discussions, collaborated with peers, and remained attentive during mathematics instruction demonstrated better mathematics achievement.

Comparable findings were reported by Maonio et al. (2025), who found a significant positive relationship between student engagement and academic performance among students enrolled in mathematics programs. Sun and Pereira (2025) also reported that pupils who maintained concentration, participated actively, and invested greater effort in mathematics learning tended to obtain higher mathematics performance. These studies generally suggest that active involvement in learning can contribute to favorable academic outcomes. However, the findings of the present study indicate that this association was not evident among the Grade 11 respondents.

International evidence has likewise generally supported a positive connection between engagement and mathematics achievement. The PISA 2022 findings indicate that students who are more actively involved in school and classroom learning tend to demonstrate stronger mathematics proficiency. Similarly, TIMSS 2023 emphasized the importance of students' active participation and engagement during mathematics instruction. In addition, Papageorgiou et al. (2025) concluded in their systematic review that student engagement is associated with positive learning outcomes, including mathematics achievement, conceptual understanding, and persistence. These findings provide a contrasting perspective to the nonsignificant relationship observed in the present study.

One possible explanation for the result is the limited variability in the academic performance of the respondents. As shown in Table 5, the students obtained an overall academic performance classified as Outstanding (M = 91.64, SD = 3.25). Moreover, 249 students (73.96%) were classified as Outstanding, while 84 were Very Satisfactory and only 5 were Satisfactory. None of the respondents fell under the Poor or Very Poor categories. Because a large majority of students obtained relatively high and closely distributed grades, there may have been insufficient variation in academic performance to produce a stronger statistical association with engagement. In other words, students may have differed in how they engaged in learning, but their grades remained generally high.

The respondents' engagement profile may also help explain the finding. As presented in Table 4, overall engagement was High (M = 3.58, SD = 0.32). However, the dimensions did not exhibit the same level of engagement. Behavioral engagement was Very High (M = 4.93, SD = 0.24) and agentic engagement was High

(M = 3.91, SD = 0.85), whereas emotional engagement was Moderate (M = 2.66, SD = 0.29) and cognitive engagement was Moderate (M = 2.83, SD = 0.82). This pattern suggests that students were highly active in observable classroom behaviors and willing to contribute to learning activities, but their deeper cognitive involvement and emotional engagement were less consistently demonstrated. Consequently, the overall engagement score may not have captured the particular aspects of engagement that are most closely associated with academic performance.

Another possible consideration is that academic performance is not determined by engagement alone. Students' grades may also reflect prior mathematical knowledge, study habits, instructional practices, assessment methods, motivation, learning strategies, parental support, mathematical identity, and other individual or contextual factors. Thus, students with different levels of engagement may still obtain similar grades when other factors support their academic achievement. This possibility is particularly relevant in the present study because the respondents generally demonstrated high academic performance despite differences in their levels and dimensions of engagement.

The result should therefore be interpreted as evidence that engagement in learning, by itself, did not demonstrate a statistically significant association with academic performance within the present sample. This does not mean that engagement is unimportant to learning or that the positive relationships reported in previous studies are invalid. Rather, the finding suggests that the contribution of engagement to academic performance may vary according to the characteristics of the learners, the learning environment, the specific dimensions of engagement being emphasized, and the amount of variability in students' academic outcomes.

Overall, Table 8 shows that engagement in learning was not significantly related to the academic performance of Grade 11 students, as indicated by the very weak correlation and the p-value exceeding the 0.05 significance level. Although this result differs from the generally positive relationships reported in recent literature, the high and relatively consistent academic performance of the respondents, together with differences among the dimensions of engagement, may partly explain the nonsignificant finding. Thus, the study fails to reject the null hypothesis, indicating that there is insufficient statistical evidence to conclude that engagement in learning is significantly associated with the academic performance of the Grade 11 students in the present study.

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