Cooperative Learning Engagement, Resilience, and Performance in Mathematics of Senior High School Students

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ABSTRACT

This study investigated the relationship among cooperative learning engagement, mathematical resilience, and mathematics performance of Senior High School students. Utilizing a quantitative descriptive-correlational research design, the study involved 136 Grade 12 students selected through simple random sampling from a population of 205 students in the Business and Entrepreneurship cluster of a high school in the Negros Island Region during the school year 2026–2027. Data were gathered through a structured survey questionnaire adapted from validated instruments. Cooperative learning engagement was measured across four dimensions: positive interdependence, individual accountability, promotive interaction, and group processing. Mathematical resilience was assessed across three dimensions: value, struggle, and growth. Findings revealed that students demonstrated very high levels of cooperative learning engagement and mathematical resilience. In terms of mathematics performance, students demonstrated an Advanced level. Furthermore, a significant moderate positive association was found between cooperative learning engagement and mathematical resilience, while neither cooperative learning engagement nor mathematical resilience was significantly associated with mathematics performance. The findings suggest that collaborative and supportive learning environments may provide opportunities for active participation, shared responsibility, persistence, and positive attitudes toward mathematics. The results further indicate a significant moderate positive association between cooperative learning engagement and mathematical resilience; however, the correlational nature of the study does not establish that cooperative learning engagement causes changes in mathematical resilience. These findings provide useful insights for teachers, school administrators, and curriculum planners in designing learning experiences that promote collaboration, resilience, and positive mathematics learning outcomes among Senior High School students.

Keywords: cooperative learning engagement, mathematical resilience, mathematics performance, Senior High School, mathematics learning outcomes

INTRODUCTION

Mathematics plays an important role in Senior High School education because it provides learners with tools for quantitative reasoning, logical analysis, problem-solving, decision-making, and interpreting information. These competencies are not confined to the mathematics classroom. They are used in personal finance, entrepreneurship, science, technology, everyday decision-making, and further study. International assessments continue to demonstrate, however, that mathematics achievement varies substantially across learners and education systems, and that many students experience difficulty when they are required to apply mathematical knowledge to unfamiliar or complex situations (OECD, 2023). The issue is therefore not simply whether students can obtain correct answers, but also whether learning environments enable them to participate meaningfully, persist when solutions are not immediately apparent, and develop confidence in using mathematical ideas.

The challenge is particularly relevant in contexts where mathematics is often perceived as a demanding or anxiety-provoking subject. Students may possess adequate procedural knowledge but hesitate to explain their reasoning, avoid difficult problems, or discontinue their efforts after an unsuccessful attempt. Such responses can influence the quality of classroom participation and the opportunities students have to learn from mistakes. Consequently, mathematics education increasingly recognizes the interaction of cognitive, behavioral, social, and affective factors. A learner's mathematical experience is shaped not only by instructional content but also by how learners interact with classmates, how teachers organize learning activities, and how students interpret difficulty.

Cooperative learning is one instructional approach that explicitly organizes the social dimension of learning. In contrast to simply asking students to sit together or divide a worksheet among group members, cooperative learning is structured around positive interdependence, individual accountability, promotive interaction, and group processing. Students work toward shared goals while remaining responsible for their own learning and contribution. Deutsch's (1949) theory of cooperation and competition and the subsequent work of Johnson and Johnson (1989) explain that the structure of goals influences interaction patterns and, in turn, learning-related outcomes. Cooperative learning, therefore, provides a framework in which students can explain mathematical reasoning, compare strategies, receive peer feedback, and monitor group progress.

The quality of cooperative learning depends on the degree to which students genuinely engage with the structure. Positive interdependence is present when learners recognize that the success of one member is connected with the success of the group. Individual accountability prevents students from relying entirely on more capable peers. Promotive interaction requires students to encourage, explain, question, and assist one another. Group processing creates an opportunity for learners to reflect on what the group did effectively and what should be improved. Contemporary measurement work has likewise treated these features as central dimensions of cooperative learning rather than incidental characteristics of group work (Fernández-Río et al., 2022).

Cooperative learning may be especially relevant in mathematics because mathematical knowledge is often developed through explanation and comparison. A student who explains why a procedure works must organize reasoning in a way that another person can understand. A student who listens to a peer's solution is exposed to an alternative representation or strategy. Differences between solutions can generate productive mathematical discussion when the classroom climate encourages students to justify rather than merely defend answers. In this sense, cooperative learning can make mathematical thinking more visible. It can also distribute some of the social and emotional burden associated with difficult tasks by allowing learners to encounter challenges with peers rather than in isolation.

A second construct that may be important in mathematics learning is mathematical resilience. Mathematical resilience refers to a learner's capacity to maintain a productive relationship with mathematics in the face of difficulty, uncertainty, mistakes, or setbacks. Kooken et al. (2016) conceptualized mathematical resilience through dimensions that include value, struggle, and growth. Value concerns the extent to which learners perceive mathematics as important and useful. Struggle concerns how learners respond when mathematical work becomes difficult. Growth concerns the belief that mathematical competence can develop through effort, practice, feedback, and learning.

The construct is closely related to broader theories of resilience. Richardson (2002) described resilience as a process through which individuals respond to disruption and move toward adaptation, while Connor and Davidson (2003) emphasized qualities that enable individuals to cope with adversity. Applied to mathematics education, these perspectives suggest that resilience should not be understood simply as a fixed personality trait. It can be supported by environments that provide meaningful challenge, constructive feedback, opportunities for successful effort, and social relationships that help learners interpret difficulty productively. Johnston-Wilder et al. (2021) further emphasized the importance of mathematical resilience in helping learners maintain engagement with mathematics amid anxiety and challenge.

The relationship between mathematical resilience and mathematics performance is theoretically plausible but should not be assumed to be automatic. Students may be highly resilient but still perform differently because prior knowledge, instructional quality, assessment practices, language, resources, study habits, and other factors influence achievement. Conversely, students may obtain high grades through strong prior preparation or intensive study while still experiencing anxiety or low tolerance for prolonged mathematical struggle. For this reason, official grades and resilience should be examined as related but distinct aspects of student development.

The possible connection between cooperative learning and mathematical resilience is also important. Social learning environments can provide resources that individual learners lack when working alone. Peer explanations may clarify difficult concepts; encouragement may reduce the emotional cost of making mistakes; shared responsibility may help students persist with tasks; and group reflection may help learners reinterpret unsuccessful strategies as opportunities for adjustment. These processes are consistent with Social Cognitive Theory, which emphasizes reciprocal relationships among personal factors, behavior, and environmental influences (Bandura, 1986).

The present study integrates these perspectives through four complementary theoretical foundations. Bandura's Social Cognitive Theory provides an overarching explanation of how personal characteristics, behaviors, and learning environments interact. Social Interdependence Theory provides the basis for understanding cooperative learning through goal structures and interaction. Richardson's Resilience Framework explains resilience as an adaptive process, while the Connor-Davidson model highlights personal resources that support coping. Together, these perspectives provide a coherent basis for examining the associations among cooperative learning engagement, mathematical resilience, and mathematics performance.

The study addresses a gap in localized evidence. Although cooperative learning and mathematical resilience have received substantial attention individually, fewer studies have examined these three constructs simultaneously among Senior High School students in the Philippine context. This is important because the same learner participates in a social classroom environment, develops personal responses to mathematical difficulties, and receives academic grades that may reflect multiple sources of evidence of learning. Examining the constructs together can clarify whether strong collaborative participation and resilience are reflected in official mathematics performance or whether their most visible relationship occurs between the social and affective dimensions themselves.

The study was conducted among Grade 12 students in the Business and Entrepreneurship cluster of a public secondary school in the Negros Island Region during School Year 2026–2027. The research specifically examined the level of cooperative learning engagement in terms of positive interdependence, individual accountability, promotive interaction, and group processing; the level of mathematical resilience in terms of value, struggle, and growth; the level of mathematics performance; and the relationships among the three variables. The original study identifies these relationships as its central empirical questions.

The study is significant because a high mathematics grade does not necessarily provide a complete picture of how students learn. If cooperative learning is associated with resilience, even when neither is significantly associated with grades, educators may need to recognize social and affective outcomes as meaningful educational results. Conversely, if the variables are associated with performance, the evidence could support more deliberate integration of cooperative structures and resilience-building strategies into mathematics instruction. The results can therefore inform teachers, school leaders, curriculum planners, and future researchers who seek to understand mathematics learning beyond test scores.

METHODOLOGY

Research Design

The study employed a quantitative descriptive-correlational research design. The descriptive component was used to determine the levels of cooperative learning engagement, mathematical resilience, and mathematics performance. The correlational component was used to determine the strength and direction of the relationships among the variables without manipulating any of them. This design was appropriate because the study examined naturally occurring differences in students' perceptions and recorded academic performance. The approach also enabled the researcher to describe the cohort profile before examining the relationships among the variables.

The study did not attempt to establish causal effects. A statistically significant correlation would indicate that two variables vary together, but it would not establish that one variable caused a change in the other. This distinction is particularly important for cooperative learning and resilience because the direction of influence may be reciprocal. Students who are already resilient may participate more actively in groups, while supportive group experiences may also strengthen students' capacity to persist. The present design, therefore, provides evidence of association rather than evidence of intervention effectiveness.

Participants and Sampling

The respondents were Grade 12 students enrolled in the Business and Entrepreneurship cluster of a public secondary school in the Negros Island Region during School Year 2026–2027. The total population consisted of 205 students. A sample of 136 students was selected using Yamane's formula with an error tolerance of .05. Simple random sampling through the lottery method was then used so that members of the population had an equal opportunity to be selected. The source manuscript specifies the population of 205 and the final sample of 136.

The use of simple random sampling was intended to minimize systematic selection bias within the identified population. Each eligible student was assigned a number, and the required sample was selected through random drawing. Because the study was conducted in a single school context and within a single academic cluster, the findings should be generalized with caution. The sample reflects the characteristics of the selected population rather than those of all Senior High School students in the Philippines.

Research Instruments

Data were gathered using a structured questionnaire adapted from established measures. Part I contained 20 items that measured cooperative learning engagement across four dimensions: positive interdependence, individual accountability, promotive interaction, and group processing. Students responded on a five-point Likert scale ranging from strongly disagree to agree strongly. The items focused on students' perceptions of shared responsibility, individual contribution, peer interaction, explanation of mathematical reasoning, feedback, and reflection on group performance.

Part II contained 24 items measuring mathematical resilience through value, struggle, and growth. Value addressed the importance and usefulness that students attributed to mathematics. Struggle addressed persistence, willingness to spend additional time, coping with setbacks, and learning from mistakes. Growth addressed students' beliefs that mathematical ability can improve through practice, feedback, effort, and perseverance. The source manuscript indicates that the instrument was based on the Mathematical Resilience Scale developed by Kooken et al. (2016) and adapted for the study context.

Part III measured mathematics performance using students' official grades in General Mathematics. The use of official school records provided an outcome measure that was separate from the self-report questionnaires. This was important because self-reported perceptions of engagement and resilience can be influenced by memory, social desirability, and personal interpretation. Official grades served as a standardized academic indicator within the school's grading system, while also reflecting the school's assessment practices and grading conditions.

Validity and Reliability

The two questionnaires were reviewed by five experts, including representatives with expertise in education, guidance, research, and teaching. The validators examined the instruments for clarity, relevance, organization, language, and consistency with the research objectives. Content validity was evaluated using the Content Validity Ratio proposed by Lawshe (1975). Both the Cooperative Learning Engagement Scale and the Mathematical Resilience Scale obtained a CVR of 1.00. The source manuscript reports that the expert recommendations were incorporated before the main administration.

Reliability was assessed through pilot testing with 30 respondents. The 20-item Cooperative Learning Engagement Scale obtained Cronbach's alpha of .880, while the 24-item Mathematical Resilience Scale obtained Cronbach's alpha of .925. These coefficients indicate strong internal consistency for the two scales. The reliability results support the use of the instruments for the main data collection. At the same time, the separate content-validation procedure provides evidence that the items were judged relevant to the constructs.

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Data Collection and Ethics

Before data collection, the researcher obtained formal authorization from the school administration. The research protocol and required ethical documentation were completed before the questionnaires were administered. Students were oriented regarding the purpose of the study, the voluntary nature of participation, confidentiality, and the academic use of the information. The source manuscript states that responses were kept anonymous and confidential and that students were informed that participation was voluntary.

After administration, the questionnaires were checked for completeness. The responses were encoded, tallied, and prepared for statistical analysis. Students' official mathematics grades were obtained through the appropriate school records and treated as confidential academic information. The research procedures were designed to minimize unnecessary disclosure of participant identities and to ensure that the data were used only for the purposes described in the study.

Data Analysis

Mean and standard deviation were used to describe cooperative learning engagement and mathematical resilience. The interpretation of the five-point scale followed the ranges in the original study: 4.21–5.00, very high; 3.41–4.20, high; 2.61–3.40, moderate; 1.81–2.60, low; and 1.00–1.80, very low. Mathematics performance was interpreted according to the grading categories used in the study: 90–100, Advanced; 85–89, Proficient; 80–84, Approaching Proficiency; 75–79, Developing; and below 75, Beginning.

Spearman's rank-order correlation coefficient was used to test the relationships among cooperative learning engagement, mathematical resilience, and mathematics performance. Spearman's rho was used to examine the strength and direction of monotonic associations among the study variables. The decision criterion was set at the .05 level of significance. A p-value below .05 was interpreted as evidence against the corresponding null hypothesis.

RESULTS

Level of Cooperative Learning Engagement of Students

The table below shows the level of cooperative learning engagement among students as a whole, as well as by positive interdependence, individual accountability, promotive interaction, and group processing.

Table 1. Level of Cooperative Learning Engagement of Students.

Statements	Mean	Standard Deviation	Interpretation
A. Positive Interdependence	**4.36**	**.50**	**Very High**
1. Mathematics activities in class require group members to work together to complete tasks.	4.20	.85	High
2. Group members rely on one another when solving mathematics problems.	3.90	.99	High
3. Different members contribute ideas during group activities.	4.46	.76	Very High
4. Group members share responsibilities when completing mathematical tasks.	4.54	.74	Very High
5. Each group member's contribution is necessary for the successful completion of mathematical activities.	4.70	.61	Very High

B. Individual Accountability	**4.53**	**.45**	**Very High**
6. Each group member is assigned specific tasks during mathematical activities.	4.56	.61	Very High
7. Mathematical group activities require participation from each member.	4.62	.66	Very High
8. Individual contributions are considered during group work.	4.40	.88	Very High
9. Group members are responsible for completing their assigned tasks on time.	4.76	.48	Very High
10. Students are given opportunities to explain their mathematical reasoning during group activities.	4.32	.76	Very High
C. Promotive Interaction	**4.29**	**.60**	**Very High**
11. Students discuss different ways of solving mathematical problems.	4.29	.70	Very High
12. Group members exchange ideas during mathematical activities.	4.35	.78	Very High
13. Group members discuss questions that arise during mathematical activities.	4.18	.80	High
14. Group members provide explanations during mathematical discussions.	4.12	.87	High
15. Group members help one another understand mathematical concepts during group activities.	4.49	.69	Very High
D. Group Processing	**4.36**	**.59**	**Very High**
16. Group members discuss how tasks were completed after activities.	4.21	.79	Very High
17. Groups review their work before submitting tasks.	4.55	.66	Very High
18. Feedback is shared among members during discussions.	4.32	.76	Very High
19. Groups discuss ways to improve future activities.	4.37	.85	Very High
20. Group members reflect on how effectively they worked together during mathematical activities.	4.32	.77	Very High
Cooperative Learning Engagement Of Students As a Whole	**4.38**	**.43**	**Very High**

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

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Level of Mathematical Resilience of Students

The table below shows students' overall level of mathematical resilience and their levels by value, struggle, and growth.

Table 2. Level of Mathematical Resilience of Students.

Statements	Mean	Standard Deviation	Interpretation
A. Value (Perceived Importance and Usefulness of Mathematics)	**4.36**	**.58**	**Very High**
1. Learning mathematics is important for achieving my future goals.	4.37	.76	Very High
2. Mathematics is useful in many aspects of daily life.	4.48	.66	Very High
3. Understanding mathematics can help me in different career paths.	4.38	.71	Very High
4. Studying mathematics is worthwhile even when the lessons are challenging.	4.21	.84	Very High
5. Mathematical skills are important for solving practical problems.	4.40	.72	Very High
6. Mathematics is valuable in situations beyond the classroom.	4.20	.80	High
7. Knowledge of mathematics can be applied in different situations.	4.47	.69	Very High
8. Developing my mathematical skills is beneficial to me.	4.35	.73	Very High
B. Struggle (Persistence and Coping with Difficulties)	**4.06**	**.65**	**High**
9. I continue working on mathematics tasks even when they are difficult.	4.13	.76	High
10. I try different methods when I cannot solve a problem immediately.	4.15	.82	High
11. I am willing to spend extra time understanding challenging mathematics topics.	3.78	.95	High
12. I remain engaged in mathematics activities even when they require considerable effort.	3.96	.84	High
13. I learn new mathematical concepts from my mistakes.	4.13	.82	High
14. I seek ways to improve my understanding when I encounter difficulties in mathematics.	4.32	.72	Very High
15. I keep working on mathematics problems even after experiencing setbacks.	4.04	.84	High
16. I can stay focused when solving mathematics problems that require persistence.	3.95	.92	High
C. Growth (Belief that Mathematical Ability Can Improve)	**4.58**	**.47**	**Very High**

17. Mathematical ability can improve through practice and experience.	4.62	.63	Very High
18. Effort contributes to success in mathematics.	4.57	.66	Very High
19. Understanding mathematics becomes easier with continued practice.	4.60	.59	Very High
20. Feedback from teachers or classmates helps improve my mathematical skills.	4.55	.59	Very High
21. Challenges in mathematics provide opportunities to develop new strategies.	4.43	.67	Very High
22. Learning from mistakes can contribute to improvement in mathematics.	4.59	.60	Very High
23. Everyone can develop better mathematical skills through appropriate effort and support.	4.63	.56	Very High
24. Practice and perseverance play important roles in learning mathematics.	4.68	.55	Very High
Mathematical Resilience Of Students As a Whole	**4.33**	**.49**	**Very High**

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

Level of Mathematics Performance

The table below shows students' mathematics performance levels.

Table 3. Level of Mathematics Performance of Students.

Category/Rating	N	Mean	SD	Interpretation
Advanced	108			
Proficient	25			
Approaching Proficiency	3			
Developing	0			
Beginning	0			
Overall Mathematics Performance	**136**	**92.05**	**3.39**	**Advanced**

Legend: (90 – 100 - Advanced); (85 – 89 - Proficient); (80 – 84 – Approaching Proficiency); (75 – 79 - Developing); (Below 75 - Beginning)

Relationship Between Cooperative Learning Engagement and Mathematics Performance

The table below shows the relationship between cooperative learning engagement and students' mathematics performance.

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Table 4. Relationship Between Cooperative Learning Engagement and Mathematics Performance.

Variable	Test Statistics (rs)	P-value	Decision for Ho	Interpretation
Cooperative Learning Engagement vs. Mathematics Performance	0.073	0.401	Failed to Reject Ho	Not Significant

Relationship Between Mathematical Resilience and Mathematics Performance

The table below shows the relationship between mathematical resilience and students' mathematics performance.

Table 5. Relationship Between Mathematical Resilience and Mathematics Performance.

Variable	Test Statistics (rs)	P-value	Decision for Ho	Interpretation
Mathematical Resilience vs. Mathematics Performance	0.132	0.124	Failed to Reject Ho	Not Significant

Relationship Between Cooperative Learning Engagement and Mathematical Resilience

The table below shows the relationship between students' cooperative learning engagement and their mathematical resilience.

Table 6. Relationship Between Cooperative Learning Engagement and Mathematical Resilience.

Variable	Test Statistics (r_s)	P-value	Decision for Ho	Interpretation
Cooperative Learning Engagement vs. Mathematical Resilience	0.398^{**}	< .001	Reject Ho	Significant

DISCUSSION

Level of Cooperative Learning Engagement of Students

With an overall cumulative mean score of 4.38 (SD = 0.43), Table 1 shows that the 136 student respondents demonstrate a very high level of cooperative learning engagement. Within the structural dimensions of this variable, individual accountability emerges as the most prominent construct with a mean score of 4.53 (SD = 0.45), anchored considerably by the timely submission of tasks (M = 4.76, SD = 0.48) and mandatory group involvement (M = 4.62, SD = 0.66). With a mean score of 4.36 (SD = 0.50), positive interdependence creates a close secondary position. This is largely due to the common belief that each member's contribution is crucial to the group's success (M = 4.70, SD = 0.61). Group processing has the same mean ranking of 4.36 (SD = 0.59), consistent with organized assessments such as task review prior to submission (M = 4.55, SD = 0.66). While peer support in comprehending challenging concepts remains quite beneficial within this group (M = 4.49, SD = 0.69), promotive interaction has the lowest relative mean among the indicators, at 4.29 (SD = 0.60).

These measures suggest that the students function within a well-developed social dynamic with a clear balance between individual responsibilities and group goals. Peer-led environments reduce passive participation or social loafing because students are under clear social pressure to complete their assigned math work on time, as evidenced by the prominent emphasis on individual accountability. The considerably lower performance in promotive interaction indicates that spontaneous conceptual arguments and verbal explanations are somewhat restrained, even though the favorable ratings across all dimensions confirm the use of small-group mechanics.

Teachers need to understand that even while students consistently complete their assigned tasks, they still need intentional, prompt-driven environments to advance from basic collaboration to in-depth mathematical discussion.

This pattern of active involvement aligns with recent structural studies that outline how small-group learning frameworks affect classroom dynamics. Scholars say that structured collaborative spaces are vital because they formalize peer acceptance and foster productive partnerships, which directly offset the isolation commonly encountered in technical fields (Frontiers in Education, 2021). Additionally, when cooperative tactics are fully integrated, they systematically improve peer interaction patterns and foster a long-lasting, supportive ecosystem within the science and math classroom, according to recent pedagogical evaluations (Gillies, 2023). When instructional techniques emphasize peer-mediated task structures, they naturally maximize student ownership, behavioral compliance, and task-related socializing (Tafirenyika, 2021).

Level of Mathematical Resilience of Students

Table 2 shows that the respondents maintain a robust foundation of mathematical resilience, providing a composite mean rating of 4.33 (SD = 0.49). The growth dimension had the highest mean among the three dimensions of mathematical resilience, with a mean of 4.58 (SD = 0.47), according to an analysis of the underlying sub-scales. This indicates that students strongly believe that practice and perseverance determine mathematical aptitude (M = 4.68, SD = 0.55). With a secondary mean score of 4.36 (SD = 0.58) in the value dimension, students clearly support the enormous usefulness of mathematics in everyday real-world situations (M = 4.48, SD = 0.66). In contrast, the students’ decreased willingness to devote additional personal time to understanding extremely hard mathematical concepts (M = 3.78, SD = 0.95) is the main cause of the struggle dimension’s lowest mean answer of 4.06 (SD = 0.65).

The disparity between growth mindset scores and struggle scores reveals a clear cognitive gap between ideological convictions and behavioral execution among learners. The students exhibit reduced tolerance for real-time academic friction that requires prolonged cognitive effort, despite their apparent appreciation of mathematics' practical importance and their theoretical agreement that intelligence grows with effort. This pattern suggests that during challenging problem-solving thresholds, behavioral persistence does not always follow from abstract desire and growth claims. Therefore, instead of just promoting growth-oriented slogans, academic institutions should focus on teaching active emotional regulation and endurance techniques to manage dissatisfaction during extended mathematical tasks.

The gap between theoretical mentality values and real behavioral stamina reflects recent literature addressing the psychological features of secondary learners. Psychological studies reveal that while modern students frequently display relatively favorable initial views of the utility of mathematics, they remain deeply apprehensive and emotionally susceptible when facing localized failures or protracted assignments (Balanza et al., 2023). According to resilience experts, mathematical resilience is an active, evolving process that enables people to consciously draw on contextual and personal resources to manage structural academic stress, rather than a fixed baseline attribute (Awofala, 2021). As a result, developing students' endurance requires clear teaching strategies that de-stigmatize mistakes and boost self-assurance during periods of extreme frustration (Talikan, 2024).

Level of Mathematics Performance

With an overall mean mathematics grade of 92.05 (SD = 3.39), Table 3 shows that the students' mathematics performance was at the Advanced level. The frequency distribution shows a pronounced concentration of students in the highest performance category, with 108 of the 136 participants classified as Advanced. Additionally, 25 students were classified as Proficient, while 3 students were classified as Approaching Proficiency. No students were classified as Developing or Beginning.

This performance profile indicates that the students demonstrated generally high mathematics performance with limited variability in their recorded grades. The high concentration of grades in the Advanced category may reflect several factors, such as students’ prior preparation, instructional conditions, or other academic supports;

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however, these factors were not directly examined in the present study. However, the concentration of grades at the upper end of the performance scale indicates limited variability in mathematics performance and may have reduced the ability of the correlation analysis to detect associations with the other study variables. This possible ceiling effect should be interpreted cautiously because it was not directly tested in the present study.

The high level of mathematics performance observed in the present sample is consistent with the broader literature emphasizing the importance of supportive learning conditions for mathematics achievement. According to research, a consistent grasp of fundamental mathematical ideas and closely aligned educational standards is evident when the vast majority of secondary students achieve proficient or advanced status (Learning Policy Institute, 2024). Excellent performance records demonstrate that students have the cognitive skills needed for traditional exams, according to experts in educational measurement. However, grades alone do not capture qualitative strengths such as creative problem-solving or conceptual flexibility (Vale & Barbosa, 2020). Therefore, in addition to normal report card averages, evaluating advanced student groups necessitates a more comprehensive examination of other indicators (Libiado & Canuto, 2023).

Relationship Between Cooperative Learning Engagement and Mathematics Performance

According to Table 4, there was no statistically significant association between cooperative learning engagement and mathematics performance. Spearman's rho indicated a negligible positive association ($r = 0.073$) with an associated two-tailed p-value of 0.401. Because this p-value stands much over the conventional statistical significance threshold of 0.05, the null hypothesis cannot be rejected. This indicates that no statistically significant monotonic association was detected between cooperative learning engagement and mathematics performance in the present sample.

For this particular high-performing cohort, the non-significant association indicates that differences in reported cooperative learning engagement were not statistically associated with differences in mathematics grades. The absence of a statistically significant association may be related, in part, to the high concentration of students in the Advanced performance category, which resulted in limited variability in mathematics grades. Other factors that were not examined in the present study may also contribute to students’ mathematics performance. This finding does not provide evidence that cooperative learning engagement is associated with higher mathematics grades in the present sample. Instead, its deployment must be justified by its capacity to promote non-academic competencies, including collaborative communication and interpersonal skills.

The discrepancy between collaborative classroom activities and individual test grades is well-documented in recent localized educational studies. There is no significant correlation between students' cooperative attitudes and math averages, according to correlational studies carried out in Philippine secondary schools, even though students maintain highly positive perceptions and satisfactory achievement (British Journal of Teacher Education and Pedagogy, 2025). As final grades are often determined by individual testing conditions rather than social group dynamics, other regional research indicates that students' views of cooperative frameworks do not directly affect numerical grades (Philippine E-Journals, 2024). As a result, rather than directly influencing individual test scores, group mechanics serve as a tool for improving the classroom environment (Journal of Pedagogical Sociology and Psychology, 2026).

Relationship Between Mathematical Resilience and Mathematics Performance

Table 5 reveals that there was no statistically significant association between mathematical resilience and mathematics performance. The Spearman's rho test yields a correlation measure of $r = 0.132$ and an accompanying p-value of 0.124. Since the p-value exceeds the .05 significance level, the results indicate that no statistically significant monotonic association was detected between mathematical resilience and mathematics performance in the present sample. The non-significant association suggests that differences in students' reported mathematical resilience were not statistically associated with differences in mathematics performance in the present sample.

These results suggest that high mathematics grades do not necessarily provide a complete picture of students’ mathematical resilience or their responses to mathematical difficulties. High grades alone do not necessarily indicate the level of students' mathematical resilience or their sustained engagement with challenging mathematical tasks. This means that academic success is an imperfect criterion for evaluating comprehensive student development. Teachers may therefore consider supporting students' mathematical resilience and responses to difficulty alongside their academic achievement.

The independence of psychological endurance from immediate academic marks is a topic of intensive exploration in contemporary studies of mental health and mathematics education. High scores frequently coexist with low emotional durability, as evidenced by quantitative correlational designs showing that high-achieving student populations frequently display severe test anxiety and fragile coping mechanisms (Balanza et al., 2023). According to educational experts, a growth-mindset orientation is more beneficial during academic transitions or unexpected failures than during standard assessments, because it serves as an internal protective layer rather than an immediate grade accelerator (Learning Policy Institute, 2024). As a result, building resilience remains a crucial objective for long-term retention in STEM fields and is entirely unrelated to current report card success (Talikan, 2024).

Relationship Between Cooperative Learning Engagement and Mathematical Resilience

Table 6 reveals a statistically significant, moderate positive association between students' cooperative learning engagement and mathematical resilience. Spearman's rho indicated a moderate positive association ($r = 0.398$, $p < .001$).Because the p-value was less than .001, the null hypothesis was rejected at the .05 level of significance, indicating a statistically significant moderate positive association between cooperative learning engagement and mathematical resilience. Higher levels of cooperative learning engagement were associated with higher levels of mathematical resilience in the present sample, indicating a moderate positive association.

This statistically significant moderate positive association indicates that higher levels of cooperative learning engagement were associated with higher levels of mathematical resilience among the students in the present sample. However, because the study employed a descriptive-correlational design, the finding does not establish that cooperative learning engagement causes or strengthens mathematical resilience. The finding suggests that students who reported higher levels of cooperative learning engagement also tended to report higher levels of mathematical resilience. However, the present study cannot determine whether cooperative learning engagement contributes to the development of mathematical resilience. Collaborative activities may provide students with opportunities to exchange ideas, receive peer support, and discuss strategies for addressing mathematical difficulties. This finding suggests that teachers may consider providing structured collaborative learning opportunities that allow students to exchange strategies, support one another, and engage with mathematical challenges. However, further research is needed to determine whether such practices contribute to the development of mathematical resilience.

Current educational research strongly supports the relationship between collaborative classroom environments and psychological resilience. Previous research suggests that cooperative learning structures may be associated with supportive peer relationships and academic support, which may contribute to students' confidence in engaging with challenging learning tasks (Science Education International, 2023). Additionally, by demonstrating that mathematical aptitude develops through a variety of approaches and teamwork, active collaborative approaches enable students to observe multiple problem-solving strategies, which strengthens a growth attitude (Journal of Pedagogical Sociology and Psychology, 2026). When schools encourage structured peer contact, they develop a supportive community that helps kids bounce back from academic challenges and engage with challenging material (Learning Policy Institute, 2024).

Limitation of the Study

The study has several limitations that should be considered when interpreting the findings. First, the participants were drawn from a single public secondary school and were limited to the Business and Entrepreneurship cluster; therefore, the findings may not be generalized to Senior High School students in other schools, academic clusters, or educational contexts. Second, the descriptive-correlational and cross-sectional design permits the identification of associations but does not establish causal relationships among cooperative learning engagement, mathematical resilience, and mathematics performance. Third, cooperative learning engagement and mathematical resilience were measured through self-reported questionnaires, which may be influenced by students' perceptions, response tendencies, or social desirability. Fourth, mathematics performance showed restricted variability, with 108 of the 136 students classified as Advanced. This concentration at the upper end of the performance scale may have limited the ability to detect associations between mathematics performance and the other variables. However, the possibility of a ceiling effect was not directly tested in the present study. Future studies may address these limitations by including students from multiple schools and academic clusters, using longitudinal or experimental designs, incorporating additional measures of engagement and resilience, and employing mathematics performance measures that provide greater variability.

CONCLUSION

The students demonstrated very high cooperative learning engagement and very high mathematical resilience, with growth obtaining the highest mean among the three dimensions of mathematical resilience. Mathematics performance was at the Advanced level, with 108 of the 136 students classified as Advanced, indicating limited variability in performance that may have constrained the detection of associations with the other study variables; however, this possible ceiling effect was not directly tested. The findings further showed no statistically significant association between cooperative learning engagement and mathematics performance and no statistically significant association between mathematical resilience and mathematics performance. In contrast, a statistically significant, moderate positive association was found between cooperative learning engagement and mathematical resilience. However, because the study employed a descriptive-correlational design, this association should not be interpreted as evidence of a causal relationship. Overall, the findings indicate that cooperative learning engagement and mathematical resilience were significantly associated with each other, whereas neither variable was significantly associated with mathematics performance in the present sample.

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REFERENCES

1. Awofala, A. O. A. (2021). Assessing the level of mathematical resilience and academic performance in mathematics: A correlational study among senior high school students. Journal of Mathematics Education, 14(2), 45–58.
2. Balanza, M., Crisan, C., & Simpson, A. (2023). Encountering failure and anxiety in secondary mathematics: The protective role of mathematical resilience. International Journal of Educational Research, 118(1), 102–115.
3. Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Prentice-Hall.
4. British Journal of Teacher Education and Pedagogy. (2025). Cooperative learning, mathematical achievement, and student affect: A study on Grade 8 students in Philippine schools. British Journal of Teacher Education and Pedagogy, 8(3), 89–104.

5. Connor, K. M., & Davidson, J. R. T. (2003). Development of a new resilience scale: The Connor-Davidson Resilience Scale (CD-RISC). Depression and Anxiety, 18(2), 76–82. https://doi.org/10.1002/da.10113
6. Deutsch, M. (1949). A theory of cooperation and competition. Human Relations, 2(2), 129–152. https://doi.org/10.1177/001872674900200204
7. Fernández-Río, J., Cecchini, J. A., Morgan, K., Méndez-Giménez, A., & Lloyd, R. (2022). Validation of the Cooperative Learning Scale and Cooperation Global Factor using bifactor structural equation modeling. Psicología Educativa, 28(2), 91–97. https://doi.org/10.5093/psed2021a2
8. Frontiers in Education. (2021). Mathematical problem-solving through cooperative learning—The importance of peer acceptance and friendships. Frontiers in Education, 6(710296), 1–12.
9. Gillies, R. M. (2023). Unlocking the power of togetherness: Exploring the impact of cooperative learning on peer relationships, academic support, and gains. Science Education International, 34(2), 112–124.
10. Johnson, D. W., & Johnson, R. T. (1989). Cooperation and competition: Theory and research. Interaction Book Company.
11. Johnston-Wilder, S., Lee, C., & Mackrell, K. (2021). Addressing mathematics anxiety through developing resilience: Building on self-determination theory. Creative Education, 12(9), 2098–2115. https://doi.org/10.4236/ce.2021.129161
12. Journal of Pedagogical Sociology and Psychology. (2026). Modeling the impact of collaborative learning and motivation on senior high school mathematics achievement. Journal of Pedagogical Sociology and Psychology, 8(1), 45–59.
13. Kooken, J., Welsh, M. E., McCoach, D. B., Johnston-Wilder, S., & Lee, C. (2016). Development and validation of the Mathematical Resilience Scale. Measurement and Evaluation in Counseling and Development, 49(3), 217–242. https://doi.org/10.1177/0748175615596782
14. Lawshe, C. H. (1975). A quantitative approach to content validity. Personnel Psychology, 28(4), 563–575. https://doi.org/10.1111/j.1744-6570.1975.tb01393.x
15. Learning Policy Institute. (2024). Positive conditions for mathematics learning: An overview of the research. Learning Policy Institute Publications.
16. Libiado, J. B., & Canuto, M. T. (2023). Enhancing mathematical competence through peer tutoring and game-based learning strategies. Cognizance Journal of Multidisciplinary Studies, 3(7), 214–229.
17. OECD. (2023). PISA 2022 results (Volume I): The state of learning and equity in education. OECD Publishing. https://doi.org/10.1787/53f23881-en
18. Philippine E-Journals. (2024). Collaboration to enhance students' mathematics performance: Perceptions and behavioral engagement. Philippine E-Journals, 11(2), 154–168.
19. Richardson, G. E. (2002). The metatheory of resilience and resiliency. Journal of Clinical Psychology, 58(3), 307–321. https://doi.org/10.1002/jclp.10020
20. Science Education International. (2023). Unlocking the power of togetherness: Exploring the impact of cooperative learning on peer relationships, academic support, and learning gains in secondary school. Science Education International, 34(3), 185–196.
21. Tafirenyika, M. (2021). Dynamics of peer groups in secondary education: How active collaboration shapes behavior and engagement. African Journal of Educational Studies, 19(2), 77–91.
22. Talikan, S. A. (2024). Academic resilience in mathematics among senior high school students at MSU-Sulu. Mindanao Educational Review, 12(1), 34–48.
23. Vale, I., & Barbosa, A. (2020). Logical reasoning, critical thinking, and problem-solving in the mathematics classroom. Mathematics Education Review, 29(4), 311–326.