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Learner Engagement and Factors Influencing Mathematics Achievement of Grade 8 Students of Maria Clara L. Lobregat National High School

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Abstract

This study examined learner engagement and the factors influencing mathematics achievement among Grade 8 students of Maria Clara L. Lobregat National High School during School Year 2025–2026. It was anchored in Self-Determination Theory, Constructivist Learning Theory, Expectancy-Value Theory of Achievement Motivation, and Engagement Theory. A quantitative descriptive-correlational design was employed involving 283 Grade 8 students selected from a population of 1,069 through stratified random sampling with proportional allocation. Data were gathered using an adapted and modified questionnaire measuring behavioral, emotional, and cognitive engagement and student-related, teacher-related, and social factors, while mathematics achievement was determined from official school grades. Results showed that students were generally engaged in mathematics, with an overall engagement mean of 2.87; cognitive engagement obtained the highest mean, followed by behavioral and emotional engagement. Factors influencing mathematics achievement were generally rated Often, with teacher-related factors obtaining the highest mean. The respondents had a mean mathematics grade of 86.23, classified within the Very Satisfactory range. Age was the only profile variable that showed a significant difference in learner engagement ($p = .009$), while sex and parents' educational qualifications showed no significant differences. Learner engagement was moderately and significantly related to factors influencing mathematics achievement ($r = .590$, $p = .000$), but was not significantly related to mathematics achievement ($r = .071$, $p = .236$). Factors influencing mathematics achievement had a very weak but significant relationship with mathematics performance ($r = .176$, $p = .003$). The findings support the development and implementation of the Integrated Mathematics Engagement and Achievement Program (IMEAP), which addresses student development, instructional practices, collaboration, and parental support. The study primarily supports SDG 4 – Quality Education and is also relevant to SDG 10 – Reduced Inequalities through its emphasis on responsive and equitable mathematics learning. It contributes to educational, institutional, community, and technological sustainability by supporting coordinated, evidence-based interventions for sustained learner engagement and mathematics achievement.

Keywords: Academic Achievement; Learner Engagement; Parental Support; Self-Regulation; Social Factors; Student-Related Factors; Teacher-Related Factors

1. Introduction

Mathematics achievement remains a persistent educational concern, particularly during Grade 8, when learners transition toward more abstract mathematical concepts. Evidence suggests that achievement is shaped not only by cognitive ability but also by learner engagement and the psychological, social, and instructional conditions

surrounding learning (Maamin et al., 2022). Philippine performance in the Programme for International Student Assessment (PISA, 2022) further emphasizes the need to understand the conditions associated with mathematics learning and performance. Learner engagement is especially important because it encompasses behavioral, emotional, and cognitive involvement in learning (Fredricks, Blumenfeld, & Paris, 2019), while motivation, self-efficacy, attitudes, social support, teaching strategies, classroom conditions, feedback, and technology also influence students' learning experiences (Yang et al., 2024) (Sen, 2022; Saliao & Cajandig, 2025). This study therefore examines learner engagement and the factors influencing mathematics achievement among Grade 8 students of Maria Clara L. Lobregat National High School. It considers the interaction of engagement with student-related, teacher-related, and social conditions and uses mathematics achievement as the outcome from which an appropriate intervention program may be developed.

Grade 8 is a critical stage in mathematics education as learners encounter more complex topics that may affect motivation, confidence, participation, and achievement (Leal, 2024). Digital pedagogy may enhance engagement at this level (Saliao and Cajandig, 2025), while stronger engagement is generally associated with greater effort, persistence, and mathematics performance (Maamin et al., 2022; Joshi et al., 2022). Learner engagement is multidimensional, encompassing behavioral participation, emotional interest and belonging, and cognitive effort and strategic learning (Maamin, Maat, & Iksan, 2021; Ryan, 2022) (Fredricks, Blumenfeld, & Paris, 2004). Although these dimensions remain fundamental (Seker, 2023), their interaction and relative importance may vary across learners and instructional contexts (Papageorgiou et al., 2025; Li, 2022; Fung, 2018), with continuing differences in how engagement is conceptualized and measured (Wang, 2025; Maguire and O'Keeffe, 2023). Mathematics engagement is also influenced by psychological, social, and instructional conditions. Self-efficacy, motivation, and mathematics anxiety affect persistence and self-regulation (Liu & Wang, 2024; Kaya & Akyüz, 2025; Dowker & Sheridan, 2022), while support from parents, peers, and teachers can strengthen confidence and motivation (Wang & Wei, 2024; Shao et al., 2024). Collaborative, problem-based, technology-enhanced, and autonomy-supportive instructional practices may further promote active participation and engagement (Chen, Zhang, & Li, 2021; Hansen & Eriksson, 2022; Park & Choi, 2023; Nowak & Schmidt, 2024).

Psychological factors are central to mathematics engagement and achievement. Self-efficacy and intrinsic motivation strengthen persistence, self-regulation, and participation, while mathematics anxiety can reduce confidence and performance (Zakariya, 2022; Valenzuela-Peñuñuri, Tapia-Fonllem, Fraijo-Sing & Manríquez-Betanzos, 2024; Hidayatullah, 2024; Maamin, Maat, & Iksan, 2021; Shimizu, 2025; Maamin et al., 2022; Smith, 2025). Similar patterns are evident internationally and in Philippine studies, where motivation, mindset, confidence, and anxiety are linked with engagement and achievement (Balila & Gerona, 2023; Santos & Villanueva, 2024; Ramos & Soriano, 2025; Campanilla, 2025). Social support also plays an important role. Parental involvement, teacher encouragement, positive classroom relationships, and peer collaboration can strengthen motivation, belonging, self-efficacy, and participation (Wang & Wei, 2024; Shao et al., 2024; Zhang, Lee & Chan, 2024; Sukmawati & Rahman, 2023; Yang et al., 2021; Gan, 2024). Philippine evidence similarly highlights the value of parental support, teacher-student relationships, school-home coordination, and collaborative learning (Lachica, 2024; Samson, 2024; Valdez and Rances, 2023; Santos & Villanueva, 2025; Garcia, 2024). Instructional quality represents another major influence. Clear instruction, inquiry, problem-based learning, collaboration, formative feedback, technology integration, and real-life applications can enhance engagement and achievement when supported by effective pedagogy (Akram, Abdelrady, Al-Adwan, and Ramzan, 2022; Chen, Jalaludin, and Rasul, 2024; Holmes et al., 2021; Kim and Bolger, 2022; Chen et al., 2023; Richardson et al., 2022; Vetter et al., 2022; Hansen & Eriksson, 2022). Philippine studies likewise support learner-centered, collaborative, problem-based, and technology-enhanced approaches (Valdez & Rances, 2023; Santos & Villanueva, 2024; Ramos & Soriano, 2025; Macapayad, 2025; Macapayad, 2024; Palisbo, Pilvera, and Baluyos, 2025). Overall, mathematics achievement is a multidimensional outcome resulting from the interaction of engagement, psychological dispositions, teaching quality, social support, and learning resources. Positive emotions, self-efficacy, metacognition, effective instruction, parental involvement, and collaboration contribute to stronger outcomes, while anxiety and limited resources may hinder performance (Papageorgiou et al., 2025; Joshi et al. (2022); Barroso et al., 2021; Denis et al., 2025; Fry, 2025; Jailani et al., 2025). Thus, mathematics performance should be understood as the product of interconnected learner, instructional, and social conditions rather than a single factor.

Mathematics achievement is influenced by learner engagement, psychological readiness, social support, instructional quality, and access to learning resources. Engaged learners generally show stronger persistence, confidence, conceptual understanding, and problem-solving (OECD, 2023; Fry, 2025). In the Philippines, learner-centered instruction, positive teacher-student relationships, supportive classroom environments, metacognition, parental involvement, collaboration, and growth mindset are associated with stronger engagement and learning (Department of Education [DepEd], 2025; Valdez & Rances, 2023; Santos and Villanueva, 2024; Dodongan, 2022; Garcia, 2024; Santos & Villanueva, 2025). However, mathematics achievement remains a concern, particularly among learners in under-resourced settings, and is affected by study habits, motivation, attitudes, learning resources, and instructional modality (Cabuquin and Abocejo, 2023; Pecjo, 2022; Macaso & Dagohoy,

2022; DepEd FOI, 2024; Bernardo, 2022; OECD, 2023). Overall, supportive teachers, parents, peers, and effective instructional approaches such as inquiry, collaboration, feedback, and technology-supported learning contribute to stronger engagement and achievement (Holmes et al., 2021; Kim & Bolger, 2022; Chen et al., 2023).

The study is anchored in four complementary theoretical perspectives. Self-Determination Theory [Deci & Ryan, 2000] explains engagement through the psychological needs for autonomy, competence, and relatedness. Deci and Ryan (2000) propose that satisfying these needs promotes intrinsic motivation, persistence, and engagement. Constructivist Learning Theory [Vygotsky, 1978] emphasizes active, socially mediated knowledge construction. Vygotsky's Constructivist Learning Theory (1978) further explains how scaffolding within the Zone of Proximal Development can support cognitive engagement and understanding. Expectancy-Value Theory of Achievement Motivation [Eccles et al., 1983] explains that engagement depends partly on learners' expectations of success and the value they assign to a task. The Expectancy-Value Theory developed by Eccles and colleagues (1983) therefore provides a basis for examining self-efficacy, confidence, task relevance, persistence, and achievement. Engagement Theory [Kearsley & Shneiderman, 1998] emphasizes meaningful interaction, collaboration, and authentic activity. Kearsley and Shneiderman's (1998) Engagement Theory organizes meaningful engagement through Relate, Create, and Donate, reinforcing the social, emotional, behavioral, and instructional dimensions of mathematics learning. Together, the four perspectives explain internal motivation, cognitive construction, expectancy and task value, and socially meaningful participation. Conceptually, the study treats learner engagement and the factors influencing mathematics achievement as independent variables examined in relation to mathematics achievement. Learner engagement consists of behavioral, emotional, and cognitive dimensions, while the manuscript's conceptual model groups the influencing conditions into student-related, teacher-related, and social factors. Mathematics achievement serves as the dependent variable, and the findings provide the basis for an intervention program designed to strengthen engagement and achievement.

Despite substantial international and Philippine research, a localized gap remains in examining the combined relationships among behavioral, emotional, and cognitive engagement; the broader student-related, social, and instructional conditions of learning; and mathematics achievement specifically among Grade 8 students. Existing studies frequently examine engagement in broader academic contexts or investigate individual influences separately rather than assessing their relationships within a specific Philippine secondary-school setting. This gap justifies examining Grade 8 students of Maria Clara L. Lobregat National High School during the academic year 2025–2026. The study focuses on a developmental stage in which learners encounter more abstract mathematical concepts and examines whether learner engagement and influencing factors differ according to student profile, whether engagement and influencing factors are significantly related to mathematics achievement, and what intervention program may be developed from the findings. Its scope is limited to Grade 8 mathematics and the factors included in the study framework; other conditions, including socioeconomic status, learning disabilities, and institutional policies, are not specifically investigated.

Based on its substantive focus, the study aligns most directly with SDG 4 – Quality Education because it seeks evidence that can support more engaging, learner-centered, and effective mathematics instruction. Its examination of student engagement, instructional quality, teacher support, learning interventions, and mathematics achievement is consistent with improving meaningful learning and educational outcomes. The study also has a relevant connection to SDG 10 – Reduced Inequalities because the reviewed evidence identifies differences in learning resources, socioeconomic contexts, under-resourced schools, and marginalized communities as conditions associated with mathematics performance (Large-Scale Assessments in Education, 2023) (Bernardo, 2022). The study itself does not test socioeconomic inequality as a principal variable; rather, its contribution to SDG 10 is through generating localized evidence that may support more responsive and equitable mathematics-learning interventions. The literature also stresses differences in resources and educational opportunity in interpreting Philippine mathematics performance (DepEd FOI, 2024; Bernardo, 2022; OECD, 2023).

The study primarily contributes to educational sustainability by examining conditions that can help schools maintain meaningful learner participation, strengthen mathematics learning, and develop evidence-based interventions rather than relying on isolated instructional responses. Its emphasis on behavioral, emotional, and cognitive engagement recognizes that sustained educational performance depends on the interaction of learners' internal dispositions, instructional experiences, and social support. It also contributes to institutional and community sustainability because the literature demonstrates that mathematics learning is influenced by teachers, school administrators, parents, peers, and the wider learning environment. Coordinated teacher encouragement, parental involvement, peer support, and school-home relationships can create conditions in which engagement is more likely to translate into achievement (Lachica, 2024; Samson, 2024). The study can therefore support school-level planning and intervention development involving multiple educational stakeholders. Finally, the research has relevance to technological sustainability in education because the literature does not treat technology as an isolated solution. Digital and blended approaches are most useful when they are deliberately aligned with pedagogy, teacher guidance, scaffolding, interaction, and feedback (Springer, 2024; Jailani et al., 2025). This perspective supports the sustainable use of educational technology as part of an integrated learning system rather

than as a substitute for effective teaching. Overall, the study links learner psychology, pedagogy, social relationships, institutional practice, and technology in explaining mathematics engagement and achievement, thereby providing a multidisciplinary basis for developing more sustainable mathematics-learning interventions.

2. Material and methods

2.1 Research Design

The study employed a quantitative descriptive-correlational research design. The descriptive component determined the levels of behavioral, emotional, and cognitive learner engagement and the extent of psychological, social, and instructional factors. The correlational component examined the relationships among these variables and mathematics achievement without manipulating existing conditions as noted by Miksz et. Al., (2023). Data were gathered through standardized survey questionnaires and students' official mathematics grades and analyzed using descriptive and inferential statistical procedures. The design enabled the examination of existing conditions and relationships within the natural classroom setting and provided a basis for developing an intervention program.

2.2 Locale of the Study

The study was conducted at Maria Clara L. Lobregat National High School, a public secondary school located in Divisoria, Zamboanga City, Philippines. The school serves students from urban and rural barangays and different socioeconomic backgrounds and offers Junior and Senior High School programs from Grades 7 to 12. At the time of the study, the school had more than 3,000 learners, including 1,069 Grade 8 students distributed across several sections. It utilized traditional and technology-assisted teaching approaches and had classrooms, learning facilities, and teaching personnel appropriate for investigating learner engagement and factors influencing mathematics achievement in a Philippine public secondary school context.

2.3 Respondents of the Study

The respondents consisted of 283 Grade 8 students drawn from a total population of 1,069 learners enrolled at Maria Clara L. Lobregat National High School during School Year 2025–2026. The respondents represented the school's 22 Grade 8 sections and provided data on behavioral, emotional, and cognitive engagement and psychological, social, and instructional factors. Their official mathematics grades served as the measure of mathematics achievement. Of the 283 respondents, 195 or 68.9% were female and 88 or 31.1% were male. Most were 14 years old, comprising 136 or 48.1%, followed by 106 or 37.5% who were 13 years old, 32 or 11.3% who were 15 years old, and 9 or 3.2% who were 16 years old and above. Regarding parental educational qualifications, college graduates constituted the largest group for both mothers, with 101 or 35.7%, and fathers, with 102 or 36.0%. Other parents had educational backgrounds ranging from no formal schooling to doctorate degrees.

2.4 Sample and Sampling Procedure

A stratified random sampling technique was employed, with each of the 22 Grade 8 sections treated as a stratum. Using Raosoft's sample size calculator with a 0.05 margin of error, a required sample of 283 students was determined from the total population of 1,069. Respondents were randomly selected from each section through proportional allocation so that every section was represented according to its share of the Grade 8 population. This procedure was intended to provide adequate representation and minimize sampling bias. Section samples ranged from six respondents in the smaller classes to 15 respondents in the larger classes, producing a total sample of 283 students.

2.5 Research Instrument

An adapted and modified questionnaire was used to measure learner engagement and factors influencing mathematics achievement. Behavioral, emotional, and cognitive engagement items were adapted from Flores, S. B. L., Tamban, V. E., Lacuarin, N. M., Bandoy, M. M., and Cortezano, G. P. (2021) and covered classroom participation, interest, perseverance, and learning strategies. The engagement scale had a reported Cronbach's Alpha of 0.87 as reported by Flores et al. (2021) and used a four-point Likert scale ranging from very low to high engagement. Items on psychological, social, and instructional factors were partly adapted from Balbalosa (2010), particularly the student- and teacher-related components, while the social factors were researcher-developed. The original instrument by Balbalosa (2010) had a Cronbach Alpha of 0.84. These items covered interest, study habits, peer and parental support, collaboration, learning environment, teacher personality, teaching skills, and instructional materials and were rated using a five-point Likert scale from very low to very high. Mathematics achievement was measured using students' official final mathematics grades for School Year 2025–2026, while age, sex, section, and parents' educational attainment were also collected. The instrument underwent expert validation for clarity, relevance, and alignment with the study variables, with construct validity guided by Flores, S. B. L., Tamban, V. E., Lacuarin, N. M., Bandoy, M. M., & Cortezano, G. P. (2021). Pilot testing was conducted with 30 Grade 9 students from the same school who were not included in the actual study. The resulting Cronbach's Alpha of 0.881 indicated high internal consistency, exceeding the acceptable coefficient of 0.70 suggested by George and Mallery (2019).

2.6 Data Gathering Procedure

Before data collection, the researcher secured approval from the Universidad de Zamboanga School of Graduate Studies and ethical clearance from the Universidad de Zamboanga Ethics Review Committee. Formal permission was subsequently obtained from the Schools Division Superintendent of the Department of Education Division of Zamboanga City and the Principal of Maria Clara L. Lobregat National High School. The researcher then coordinated with Grade 8 mathematics teachers and class advisers and explained the study's purpose, scope, procedures, and voluntary nature. Parental or guardian consent and student assent were obtained, and only students who submitted the required forms participated. The standardized survey questionnaire was administered through an online platform to minimize disruption to regular classroom instruction. Respondents were given instructions before completing items concerning behavioral, emotional, and cognitive engagement and psychological, social, and instructional factors. After questionnaire administration, the researcher retrieved and organized the responses. Students' mathematics grades were obtained directly from official school records with authorization from the school administration and were used solely as the measure of mathematics achievement. The collected data were then coded, organized, and prepared for statistical analysis.

2.7 Data Analysis Techniques

The collected data were coded, organized, and analyzed using appropriate descriptive and inferential statistical procedures. For determining significant differences in learner engagement and factors influencing mathematics achievement according to respondents' profiles, the independent samples t-test was applied to variables with two categories, such as sex. One-way Analysis of Variance (ANOVA) was used for profile variables with more than two categories, including age and parents' educational attainment. The Pearson Product-Moment Correlation Coefficient (Pearson r) was used to determine the strength and direction of the relationships between learner engagement and mathematics achievement and between factors influencing mathematics achievement and mathematics achievement. Statistical results were interpreted using the appropriate level of significance to determine whether observed differences and relationships were statistically significant.

2.8 Ethical Considerations

The study observed ethical standards for protecting the rights and welfare of participants. Prior to data collection, the research proposal was submitted to the University of Zamboanga Ethics Review Board for evaluation and approval, and written permissions were secured from the Department of Education, Division of Zamboanga City and the school principal. Respondents were informed of the purpose, objectives, scope, procedures, potential benefits, and minimal risks of the research. Parents or guardians provided written consent, while student respondents provided assent. Participation was voluntary, and participants could refuse or withdraw at any stage without penalty or disadvantage. Confidentiality and anonymity were maintained by assigning code numbers instead of student names and reporting only aggregated results. Individual questionnaire responses and mathematics grades were kept confidential and used solely for research purposes. Printed documents were stored securely, while electronic records were encrypted and password protected. The study was conducted with impartiality and integrity for academic purposes. Research data were retained for five years and were to be securely disposed of afterward through shredding of printed materials and permanent deletion of electronic files in accordance with the ethical standards of Universidad de Zamboanga and the Department of Education.

3. Results and Discussion

3.1 Learner Engagement in Mathematics

3.1.1 Behavioral Engagement

The respondents demonstrated an overall behavioral engagement mean of 2.91, interpreted as Engage. Following the teacher's directions received the highest rating (M = 3.61), while stopping work when confronted with difficult mathematics problems received the lowest rating (M = 1.95). Students also reported relatively strong listening, participation, effort, correction of mistakes, and help-seeking behaviors, although some indicators showed difficulty sustaining effort when mathematical tasks became challenging. The findings suggest that students participate more consistently when mathematics activities are clearly structured and teacher-directed, while persistence during difficult tasks is comparatively weaker. This finding is consistent with Maamin et al. (2021), who emphasized the importance of active participation and sustained effort in students' learning. Similarly, Joshi et al. (2022) highlighted the role of behavioral engagement in students' participation and persistence in academic activities. Guided practice and activities that develop perseverance may therefore strengthen students' behavioral engagement in demanding mathematics tasks.

3.1.2 Emotional Engagement

Emotional engagement obtained a grand mean of 2.62, interpreted as Engage. Interest in learning new things in mathematics received the highest positive rating (M = 3.48), while the negatively phrased statement regarding dislike of attending mathematics classes obtained the lowest mean (M = 1.40), indicating that students generally did not express strong dislike toward the subject. Learning mathematics was also regarded positively, although excitement toward difficult problems and the desire to spend more time solving mathematics problems received

comparatively moderate ratings. Emotional engagement involves learners' interest, enjoyment, attitudes, and emotional connection to learning (Fredricks, Blumenfeld, & Paris, 2004). The results indicate generally positive feelings toward mathematics but less consistent enthusiasm when students encounter difficult tasks. This is consistent with Maamin, Maat, and Iksan (2022), who emphasized the importance of engagement in students' learning experiences. Papageorgiou et al. (2025) similarly emphasized that positive emotional engagement supports students' motivation and continued involvement in learning. The findings suggest that challenging mathematical activities may need to be presented in ways that sustain learners' interest and enjoyment.

3.1.3 Cognitive Engagement

Cognitive engagement obtained a grand mean of 3.07, interpreted as Engage. The strongest response concerned the desire to obtain good grades in mathematics (M = 3.82). Students also reported self-questioning to check understanding (M = 3.30), considering different approaches to mathematical problems (M = 3.03), connecting mathematics with real-life situations (M = 3.01), developing personal strategies (M = 3.02), and setting learning goals (M = 3.00). The comparatively lower rating for thinking about something else while studying mathematics (M = 2.58) indicated some inconsistency in sustained attention. Cognitive engagement reflects the mental effort and learning strategies used in understanding academic content (Fredricks, Blumenfeld, & Paris, 2004). Students generally demonstrated a positive achievement orientation and willingness to employ cognitive strategies, although maintaining concentration remained less consistent. Maamin, Maat, and Iksan (2021) emphasized that cognitive engagement is associated with students' motivation and academic performance, while Papageorgiou et al. (2025) highlighted that cognitive engagement is strengthened when supported by behavioral and emotional engagement. Activities involving reflection, problem-solving, and sustained attention may therefore reinforce this dimension.

3.1.4 Overall Learner Engagement

Overall learner engagement obtained a grand mean of 2.87, interpreted as Engage. Cognitive engagement was the strongest dimension (M = 3.07), followed by behavioral engagement (M = 2.91), while emotional engagement had the lowest mean (M = 2.62). The pattern indicates that students were relatively more invested in thinking, accomplishing academic tasks, and participating in mathematics than in experiencing strong emotional connection or enthusiasm toward the subject. Fredricks, Blumenfeld, and Paris (2004) emphasized that learner engagement is multidimensional, involving behavioral, emotional, and cognitive components. Similarly, Maamin, Maat, and Iksan (2021) found that these dimensions contribute to students' involvement and academic learning. Although all dimensions were within the Engage range, emotional engagement represents the comparatively weaker area.

3.2 Factors Influencing Mathematics Achievement

3.2.1 Student-Related Factors: Interest

Interest-related factors obtained a grand mean of 4.07, interpreted as Often. The strongest indicator was the desire to obtain good grades in tests, quizzes, assignments, and projects (M = 4.78), followed by attentive listening to the mathematics teacher (M = 4.52). Frustration when lessons were interrupted or the teacher was absent obtained the lowest rating (M = 3.15). The findings show strong achievement motivation, attentiveness, and participation among the respondents. Liu and Wang (2025) found that motivated students are more likely to remain engaged and persistent in mathematics. Similarly, Chen et al. (2021) emphasized that structured and supportive instruction strengthens students' interest and engagement. The lower rating associated with interruptions also suggests that interest may vary depending on continuity and conditions within the learning environment.

3.2.2 Student-Related Factors: Study Habits

Study habits obtained an overall mean of **3.84**, interpreted as Often. Studying harder after receiving low grades was the strongest behavior (M = 4.34), followed by regularly completing assignments (M = 4.27). Spending less time with friends to concentrate on studies received the lowest mean (M = 3.26), while preventing extracurricular activities from interfering with studies also received a comparatively lower rating (M = 3.39).

The findings indicate generally positive study behaviors but some difficulty balancing academic responsibilities with social and extracurricular activities. Zakariya (2022) found that students with stronger self-efficacy tend to exert greater effort and persist when facing academic difficulties. Similarly, Balila and Gerona (2023) reported that motivation and self-discipline contribute to better study habits among Filipino students. The results therefore emphasize the importance of persistence, self-regulation, time management, and consistent study practices.

3.2.3 Overall Student-Related Factors

Student-related factors obtained an overall mean of 3.96, interpreted as Often. Interest received a higher mean (M = 4.07) than study habits (M = 3.84), indicating stronger achievement orientation and interest than consistency in study behaviors. Interest and study habits both represent important learner-related conditions in mathematics learning. Liu and Wang (2024) found that students with stronger intrinsic motivation are more likely to engage deeply and persist in learning tasks. Similarly, Balila and Gerona (2023) emphasized that motivation and self-discipline contribute to better study habits and mathematics learning among Filipino students. The results suggest

that students' existing interest can be complemented by strengthening time management, preparation, and independent study practices.

3.2.4 Teacher Personality Traits

Teacher personality traits obtained a grand mean of 4.34, interpreted as Often. Having good relationships with students and teachers received the highest rating (M = 4.54), while imposing proper discipline and following prescribed rules received the lowest rating (M = 3.99). Confidence, firmness, openness to suggestions, and an appealing personality also received high ratings. The findings suggest that respondents particularly valued positive interpersonal relationships and supportive teacher characteristics. Liu and Wang (2024) found that supportive relationships strengthen students' motivation and self-efficacy. Similarly, Chen et al. (2021) emphasized that supportive and student-centered teaching practices promote greater student engagement and participation. The stronger rating for interpersonal relationships than strict discipline indicates that supportive teacher-student interaction is a prominent feature of the students' mathematics learning experience.

3.2.5 Teaching Skills

Teaching skills obtained a grand mean of 4.45, interpreted as Often. Clearly explaining lesson objectives at the start of each period received the highest mean (M = 4.58). Subject-matter mastery and organized presentation both obtained M = 4.47, while remaining updated with trends relevant to the subject obtained the lowest mean (M = 4.35). The consistently high ratings indicate that students positively perceived clear, organized, and competent instruction. Chen et al. (2021) found that organized and supportive instruction promotes active student participation and engagement. Similarly, Akram et al. (2022) emphasized that teachers' pedagogical competence and effective instructional planning are associated with greater student engagement. The narrow difference across indicators further suggests consistently favorable perceptions of teaching skills.

3.2.6 Instructional Materials

The use of instructional materials obtained a grand mean of 3.87, interpreted as Often. Chalk and blackboard were the most frequently reported resources (M = 4.49), followed by PowerPoint presentations, workbooks or textbooks, and project-development materials. Articles received the lowest rating (M = 3.28), interpreted as Sometimes. The results demonstrate continued reliance on traditional classroom resources alongside other instructional materials. Akram et al. (2022) found that appropriate instructional tools can increase student interaction and participation. Similarly, Chen, Jalaludin, and Rasul (2024) emphasized that diverse instructional materials can support behavioral, emotional, and cognitive engagement. The greater variation among these ratings suggests that supplementary materials may be less consistently integrated than conventional resources.

3.2.7 Overall Teacher-Related Factors

Teacher-related factors obtained an overall mean of 4.22, interpreted as Often. Teaching skills received the highest mean (M = 4.45), followed by personality traits (M = 4.34), while instructional materials received the lowest mean (M = 3.87). The findings indicate that instructional competence and supportive teacher characteristics were more strongly perceived than instructional resources alone. Akram et al. (2022) emphasized that teacher competence and effective instructional planning contribute to student engagement. Similarly, Liu and Wang (2024) found that positive teacher-student interactions strengthen students' motivation, self-efficacy, and engagement. These findings emphasize that instructional materials appear most useful when accompanied by effective teaching and supportive teacher-student relationships.

3.2.8 Peer Relationships

Peer relationships obtained a grand mean of 3.97, interpreted as Often. Asking classmates for assistance when a mathematics lesson was not understood obtained the highest mean (M = 4.21), while studying and reviewing mathematics together with classmates received the lowest mean (M = 3.74). The results indicate that peer relationships function particularly as a source of immediate academic assistance and encouragement. Wang and Wei (2024) found that social support contributes to students' behavioral, emotional, and cognitive engagement. Similarly, Shao et al. (2024) emphasized that positive peer relationships can promote motivation, participation, and academic achievement. Peer support can therefore strengthen confidence, persistence, and participation, although regular collaborative study was less frequently reported than help-seeking.

3.2.9 Parental Support

Parental support obtained a grand mean of 3.92, interpreted as Often. Providing materials or tools needed for mathematics lessons received the highest rating (M = 4.34), followed by appreciating students' mathematics achievements (M = 4.17). Monitoring assignments and school activities obtained the lowest mean (M = 3.36), interpreted as Sometimes. The findings show that parents generally provided practical and emotional support but were less consistent in monitoring academic activities. Wang and Wei (2024) found that parental involvement positively influences students' motivation and mathematics engagement. Similarly, Balila and Gerona (2023) emphasized that consistent parental support and encouragement strengthen students' self-efficacy and engagement

in mathematics. The findings therefore point to the potential value of strengthening academic monitoring and home-school communication.

3.2.10 Collaboration and Learning Environment

Collaboration and the learning environment obtained a grand mean of 4.41, interpreted as Often. Listening to and respecting others' opinions during group discussions received the highest mean (M = 4.60), while feeling more confident when supported by classmates received the lowest mean (M = 4.30). The remaining indicators concerning group work, project participation, and a cooperative learning environment were also highly rated.

The findings indicate consistently positive perceptions of cooperative learning and mutual respect. Shao et al. (2024) found that positive peer relationships promote motivation and academic engagement. Similarly, Chen et al. (2024) emphasized that interactive and cooperative learning strategies strengthen students' cognitive, behavioral, and emotional engagement. The results suggest that a supportive classroom environment promotes participation, persistence, and confidence in mathematics learning.

3.2.11 Overall Social Factors

Social factors obtained an overall mean of 4.10, interpreted as Often. Collaboration and learning environment received the highest mean (M = 4.41), followed by peer relationships (M = 3.97) and parental support (M = 3.92). The findings indicate that school-based collaborative experiences were more strongly perceived than home-based support. Shao et al. (2024) found that positive peer relationships enhance motivation and learning engagement, while Pennington et al. (2024) emphasized that supportive classroom environments promote students' persistence and confidence. The results therefore emphasize the importance of collaborative and supportive social environments in mathematics learning.

3.2.12 Overall Factors Influencing Mathematics Achievement

Across all categories, the factors influencing mathematics achievement obtained an overall grand mean of 4.09, interpreted as Often. Teacher-related factors received the highest rating (M = 4.22), followed by social factors (M = 4.10) and student-related factors (M = 3.96). The results indicate that student, teacher, and social conditions were all perceived as relevant, although teacher-related conditions were rated slightly more strongly. Chen et al. (2021) emphasized that quality and well-structured instruction promotes student engagement and academic performance. Similarly, Shao et al. (2024) found that positive peer interactions and collaboration enhance students' motivation and achievement. However, these descriptive ratings do not independently establish causal effects on mathematics achievement; their statistical associations were examined through correlation analysis.

3.3 Mathematics Achievement

The respondents obtained an overall mathematics mean grade of 86.23, with a highest grade of 97, a lowest grade of 75, and a standard deviation of 4.67. Most students, 117 or 41.3%, were classified as Very Satisfactory; 74 or 26.1% were Satisfactory; 70 or 24.7% were Outstanding; and 22 or 7.8% were Fairly Satisfactory. No respondent obtained a grade below 75. The distribution indicates that all respondents met the minimum expected mathematics performance level, with the largest proportion performing at the Very Satisfactory level. Smith, Lee, and Torres (2025) emphasized that effective teacher practices and professional development can improve mathematics performance, while Papageorgiou, Wong, and Liu (2025) found that behavioral, cognitive, and emotional engagement are associated with better mathematics achievement. The achievement profile provided the basis for subsequently examining whether learner engagement and the identified factors were statistically associated with students' mathematics grades.

3.4 Differences According to Respondent Profile

3.4.1 Learner Engagement According to Profile

Learner engagement did not significantly differ according to sex, with males obtaining M = 2.90 and females M = 2.85 ($F = 1.537$, $p = .216$). Significant differences were found according to age ($F = 3.364$, $p = 0.009$), with students aged 16 and above obtaining the highest mean engagement (M = 3.15) and 15-year-old students the lowest (M = 2.80). No significant differences were found according to mother's educational qualification ($F = 1.177$, $p = .313$) or father's educational qualification ($F = 1.149$, $p = .331$). Thus, age was the only profile variable associated with a statistically significant difference in engagement. The findings indicate that engagement may differ according to developmental stage rather than sex or parental educational attainment. The relationship between the impact of the quality of the instruction on mathematics performance (from the student's perspective) is mediated by the amount of cognitive and emotional engagement (refer to Kim and Bolger [2022] and Holmes et al. [2021]). Consequently, age-responsive instructional approaches, differentiated learning, cooperative problem-solving, and scaffolding may help strengthen engagement (Richardson et al., 2022; Santos & Villanueva, 2024).

3.4.2 Factors Influencing Mathematics Achievement According to Profile

Perceptions of factors influencing mathematics achievement did not significantly differ according to sex ($F = 2.698$, $p = 0.102$), age ($F = 0.833$, $p = 0.477$), mother's educational qualification ($F = 0.525$, $p = 0.838$), or father's

educational qualification (F = 1.027, p = 0.416). Male and female means were 4.03 and 4.12, respectively; age-group means ranged from 4.05 to 4.21; mothers' educational groups ranged from 4.01 to 4.56; and fathers' groups ranged from 3.99 to 4.38. All corresponding null hypotheses were therefore not rejected. These findings indicate that respondents generally perceived student-related, teacher-related, and social factors similarly regardless of demographic profile. Unlike learner engagement, where age showed a significant difference, perceptions regarding the conditions influencing mathematics achievement remained statistically comparable across groups.

3.5 Relationships Among Learner Engagement, Influencing Factors, and Mathematics Achievement

The analysis revealed a moderate positive and statistically significant relationship between learner engagement and factors influencing mathematics achievement (r = 0.590, p = 0.000), resulting in rejection of the null hypothesis. The relationship between learner engagement and mathematics performance was very weak and not statistically significant (r = 0.071, p = 0.236); therefore, the null hypothesis was not rejected. In contrast, the relationship between factors influencing mathematics achievement and mathematics performance was very weak but statistically significant (r = 0.176, p = 0.003), resulting in rejection of the null hypothesis. The findings indicate that learner engagement was strongly associated with students' perceptions of the student-related, teacher-related, and social conditions surrounding mathematics learning, but engagement alone did not show a significant direct association with final mathematics grades. The identified influencing factors showed only a small but statistically significant relationship with mathematics performance. The results therefore portray mathematics achievement as a complex outcome associated with multiple learning conditions rather than learner engagement alone.

3.6 Proposed Integrated Mathematics Engagement and Achievement Program

Based on the findings from the first and second research problems, the manuscript developed the Integrated Mathematics Engagement and Achievement Program (IMEAP) to address identified concerns in learner engagement, learning habits, instructional practices, and social support. The proposed program contains four major areas: student development, teacher empowerment, social and collaborative support, and holistic engagement. It is intended to strengthen study habits, critical thinking, self-regulation, differentiated instructional strategies, peer support, parental involvement, and behavioral, emotional, and cognitive engagement through reflective and technology-enhanced activities. The proposed intervention reflects the study's overall finding that mathematics learning is associated with multiple learner, teacher, and social conditions. Rather than addressing engagement as an isolated factor, the program integrates student development, instructional improvement, and social support to respond to the different areas identified in the results.

4. Conclusion & Recommendations

The study concludes that Grade 8 students' mathematics learning is shaped by the combined influence of learner engagement and the student-related, teacher-related, and social conditions surrounding their learning. Age was the only profile variable that produced a significant difference in learner engagement (p = .009), while sex and parents' educational qualifications showed no significant differences. No significant differences were found in the factors influencing mathematics achievement when respondents were grouped according to profile. Learner engagement had a moderate positive and significant relationship with the factors influencing mathematics achievement (r = .590, p = .000), but its relationship with mathematics achievement was very weak and not significant (r = .071, p = .236). In contrast, the factors influencing mathematics achievement had a very weak but significant positive relationship with mathematics achievement (r = .176, p = .003). These findings indicate that mathematics achievement cannot be explained by engagement alone and support a multidimensional approach addressing engagement, study habits, self-regulation, instructional practices, peer collaboration, and parental support.

The Department of Education and school administrators may strengthen school-based, age-appropriate, and learner-centered mathematics programs and implement the Integrated Mathematics Engagement and Achievement Program (IMEAP), particularly for students with lower engagement. Mathematics teachers may employ differentiated and age-appropriate activities, structured group problem-solving, peer tutoring, clear lesson objectives, organized instruction, varied instructional materials, self-questioning, and collaborative learning. Parents and guardians may support regular study routines, monitor mathematics assignments, provide necessary learning resources, encourage persistence, and communicate with teachers regarding students' progress, while students may strengthen their study habits, self-regulation, lesson review, timely task completion, help-seeking, and participation in collaborative mathematics activities. Future researchers may replicate the study using larger samples, other schools or grade levels, and longitudinal or experimental designs to examine interventions addressing study habits, self-regulation, instructional practices, and social support.

The study was limited to Grade 8 students of Maria Clara L. Lobregat National High School during School Year 2025–2026 and focused only on learner engagement and the psychological, social, and instructional factors included in its framework. Students from other grade levels and subjects were excluded, and other possible influences such as socioeconomic status, learning disabilities, and institutional policies were not specifically

investigated. Consequently, the findings are specific to the study setting and may not be generalized to all Grade 8 learners in other schools, contexts, or regions.

5. Compliance with ethical standards

The authors declare no conflict of interest. The study complied with ethical standards for research involving minors, including parental/guardian consent, student assent, voluntary participation, the right to withdraw without penalty, and strict confidentiality of survey responses and mathematics grades. Ethical clearance and necessary permissions were obtained from the University of Zamboanga, the Department of Education–Division of Zamboanga City, and the school administration. All collected data were securely stored and used solely for research purposes.

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