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Mathematics Anxiety as a Gateway to Learner Agency and Confidence Building

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ABSTRACT

This study investigated how mathematics anxiety functioned as a gateway to understanding learner agency and mathematical confidence among secondary learners in San Pablo, Isabela. A cross-sectional person-centered explanatory design was employed involving 306 secondary learners selected through proportionate stratified random sampling. Data were gathered using an adapted questionnaire measuring mathematics anxiety, learner agency, and mathematical confidence. Descriptive statistics, Latent Profile Analysis, and the Bolck-Croon-Hagenaars three-step procedure were used to identify anxiety profiles and compare outcomes across groups. Results revealed three distinct profiles: Low-Anxiety Secure, Moderate Evaluative Anxiety, and High Pervasive Anxiety. The Moderate Evaluative Anxiety group represented the largest proportion of learners, indicating that anxiety was especially pronounced during assessment situations. Significant differences were found in learner agency and mathematical confidence across the three profiles. Learners in the Low-Anxiety Secure profile demonstrated the highest levels of agency and confidence, while those in the High Pervasive Anxiety profile recorded the lowest levels in both outcomes. Mathematical confidence showed the strongest decline as anxiety intensified. The findings indicated that mathematics anxiety was not a uniform learner experience but a differentiated condition associated with meaningful variations in students' sense of capability and participation in mathematics learning. The study recommends differentiated classroom support, reduced evaluative pressure, structured opportunities for learner decision-making, and targeted confidence-building interventions for students experiencing persistent mathematics anxiety.

Keywords: *confidence building, learner agency, latent profile analysis, mathematical confidence, mathematics anxiety, secondary learners*

INTRODUCTION

Mathematics learning is shaped not only by what students know but also by how they feel when they are asked to use what they know. For some learners, mathematics evokes worry, tension, and fear of failure that can interfere with attention, problem solving, and willingness to participate. Mathematics anxiety therefore extends beyond simple dislike of the subject because it can influence how learners interpret mathematical tasks and respond to academic difficulty (Ramirez et al., 2018).

The academic consequences of this anxiety have been consistently documented. A large-scale meta-analysis found a significant negative association between mathematics anxiety and mathematics achievement across different grade levels and measures of mathematical performance (Barroso et al., 2021). This relationship suggests that repeated experiences of uncertainty or failure may gradually affect how students approach mathematics, particularly when difficult tasks are interpreted as evidence that they are incapable of succeeding.

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Confidence becomes important at this point because students who believe that they can manage mathematical tasks are more likely to remain engaged and persist when solutions are not immediately apparent. Mathematics self-efficacy has been associated with engagement, persistence, and academic performance, while also changing as students encounter new mathematical content and experiences (Street et al., 2022). Thus, understanding anxiety may provide a useful entry point for identifying the experiences that weaken confidence and for creating learning conditions that help students rebuild a stronger sense of mathematical capability.

Confidence is also closely connected with the learner's capacity to act rather than merely respond to instruction. Learner agency is reflected when students take constructive initiative, communicate their needs, seek assistance, make choices, and contribute actively to their learning. Experimental evidence indicates that greater agentic engagement can support motivation, classroom participation, and effective academic functioning (Reeve & Jang, 2022). Viewed this way, mathematics anxiety can serve as a gateway for understanding when learners withdraw from mathematical activity and what forms of support may encourage them to regain confidence and exercise greater agency.

This concern carries particular weight in Philippine secondary education. PISA 2022 reported that only 16% of Filipino students reached at least Level 2 proficiency in mathematics, compared with 69% across OECD countries (OECD, 2023). Academic performance alone, however, does not fully explain how learners experience mathematics. Examining mathematics anxiety alongside learner agency and confidence may provide a more complete picture of how students respond to mathematical demands. For secondary learners in San Pablo, Isabela, such an inquiry may help clarify how anxiety can become a basis for identifying appropriate instructional and learner-support practices that strengthen participation, confidence, and ownership of mathematics learning.

Literature Review

Mathematics Anxiety as a Developmental Barrier

Mathematics anxiety can develop into a continuing pattern that affects how learners judge their own competence and approach mathematical work. Among adolescents, anxiety is particularly important because repeated difficulty in mathematics may shape both achievement and perceived mathematical ability over time. Wang et al. (2020) found longitudinal associations between mathematics anxiety, mathematics achievement, and self-perceived ability, indicating that anxiety is tied to the development of both performance and confidence. This suggests that mathematics anxiety should not be treated only as an immediate emotional reaction. For secondary learners, it may gradually influence whether they attempt challenging tasks, persist after mistakes, or withdraw from situations that expose their perceived weaknesses.

Mathematics Confidence and Self-Efficacy

Confidence in mathematics is closely related to students' beliefs about whether they can successfully perform mathematical tasks. Du et al. (2021) showed that mathematics anxiety and mathematics self-efficacy were reciprocally related, while both were also connected with mathematics achievement across time. A learner who repeatedly doubts his or her mathematical capability may become more vulnerable to anxiety, while anxious experiences may further weaken confidence. This reciprocal pattern is important for confidence building because it indicates that improvement may require more than raising achievement scores. Learners also need experiences that allow them to recognize progress, approach problems with greater assurance, and develop stronger beliefs in their capacity to learn mathematics.

Learner Agency in Mathematical Activity

Learner agency becomes visible when students contribute ideas, make decisions, question solutions, explain their reasoning, and take an active role in mathematical problem solving. Hansen (2022) found that students exercised different forms of agency during collaborative mathematics tasks, with productive interactions emerging when learners shared ideas, negotiated mathematical reasoning, and jointly developed solutions. Such

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findings indicate that agency is not limited to independent learning. It can also develop through meaningful participation with peers where learners are given room to think, speak, revise, and defend their mathematical ideas. For students experiencing mathematics anxiety, these opportunities may be especially valuable because active participation can shift their role from passive recipients of procedures toward contributors who exercise greater ownership of mathematical learning.

Supportive Mathematics Classrooms for Confidence and Agency

The classroom environment can either reinforce learners' anxiety or create conditions in which confidence and participation become more attainable. Lazarides and Buchholz (2019) found that teacher support and effective classroom management were associated with lower mathematics anxiety, showing that students' emotional experiences are partly connected with how they perceive instruction. Similarly, Zhou et al. (2020) reported that positive teacher-student relationships contributed to mathematical problem-solving ability through self-efficacy and mathematics anxiety. Together, these findings highlight the role of teachers in creating learning experiences where mistakes are manageable, assistance is accessible, and learners feel capable of participating. Such conditions provide a strong basis for examining mathematics anxiety as a gateway for identifying practices that may strengthen learner agency and confidence among secondary students.

METHODS

Research Design

The study employed a cross-sectional person-centered explanatory design to examine mathematics anxiety as a condition associated with differences in learner agency and mathematical confidence. Rather than treating all students as belonging to a single homogeneous group, the design allowed learners to be classified according to naturally occurring patterns of mathematics anxiety and subsequently examined whether agency and confidence varied across these patterns. This approach was selected because mathematics anxiety can occur at different intensities and forms among secondary learners. A person-centered treatment therefore provided a more differentiated account of how anxiety was connected with students' willingness to act, persist, make learning decisions, and believe in their mathematical capability. Latent profile analysis has previously been applied successfully in distinguishing meaningful mathematics-anxiety profiles among adolescent learners (Luttenberger et al., 2019).

Research Locale

The study was conducted in San Pablo, Isabela, a municipality within the Schools Division of Isabela. The locale provided an appropriate setting because secondary learners were exposed to mathematics across junior and senior high school levels, allowing the study to examine anxiety, agency, and confidence across a broad span of secondary mathematics learning. The Philippine Statistics Authority reported a municipal population of 26,320 in the 2020 Census of Population and Housing, with a substantial portion belonging to the school-age population (Philippine Statistics Authority, 2025).

Participants and Sampling Technique

The participants were 306 secondary learners enrolled in Grades 7 to 12 who were taking Mathematics during the conduct of the study. The sampling frame was anchored on a publicly indexed Department of Education enrollment record that reported a combined 1,497 secondary learners in San Pablo, Isabela. Using Cochran's finite-population adjustment at a 95% confidence level and a 5% margin of error yielded a required sample of approximately 306 learners. Proportionate stratified random sampling was applied by grade level so that representation reflected the distribution of the eligible secondary population. Only learners officially enrolled in a Mathematics subject, with secured parental consent and learner assent, were included in the final sample.

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Research Instrument

Data were collected using an adapted Mathematics Anxiety, Learner Agency, and Confidence Questionnaire composed of three measurement sections. The mathematics anxiety component was anchored on the *Scale for Assessing Math Anxiety in Secondary Education* of Yáñez-Marquina and Villardón (2017), which measures anxiety associated with everyday mathematical situations, mathematics learning, and mathematics testing. Learner agency indicators were adapted from Code's (2020) *Agency for Learning Questionnaire*, particularly those addressing intentionality, decision confidence, motivation, self-regulation, and self-efficacy. Mathematical confidence was represented through mathematics self-efficacy indicators adapted from the instrument of Facultad and Sebial (2019) for Filipino high school learners. These established measures provided the conceptual basis for adapting the questionnaire to the secondary mathematics context of the present study.

The adapted items were subjected to expert validation by five specialists in mathematics education, educational psychology, educational measurement, and research methodology. The panel evaluated the statements for construct relevance, clarity, developmental appropriateness, and correspondence with the intended variables. Content validation produced an S-CVI/Ave of .95 for Mathematics Anxiety, .93 for Learner Agency, and .96 for Mathematical Confidence, with an overall S-CVI/Ave of .95. Items identified as needing clarification were revised based on the experts' recommendations before pilot administration.

The refined questionnaire was pilot tested with 30 secondary learners who possessed characteristics comparable with the study participants but were not included in the final sample. Reliability analysis yielded a Cronbach's alpha of .89 for Mathematics Anxiety, .91 for Learner Agency, and .87 for Mathematical Confidence. The overall questionnaire obtained a Cronbach's alpha of .92, indicating strong internal consistency. Corrected item-total correlations ranged from .42 to .73, and all retained items met the established reliability criterion.

Data Gathering

Approval to conduct the study was secured from the appropriate education authorities before data collection. Coordination was undertaken with authorized personnel for the identification and random selection of eligible learners. Parental consent and learner assent were obtained before questionnaire administration. The purpose of the study, voluntary nature of participation, confidentiality provisions, and participants' right to discontinue were explained before answering began. Questionnaires were administered during an agreed period that did not interfere with major instructional activities. Completed forms were checked for response completeness, coded without student names, and entered into a secured dataset for analysis.

Data Analysis

Descriptive statistics were first used to summarize the distributions of mathematics anxiety, learner agency, and mathematical confidence. The principal inferential procedure was Latent Profile Analysis with the Bolck-Croon-Hagenaars three-step approach. Mathematics-anxiety indicators were used to identify unobserved groups of learners who demonstrated distinct anxiety patterns. Competing profile solutions were evaluated through the Akaike Information Criterion, Bayesian Information Criterion, sample-size-adjusted Bayesian Information Criterion, entropy, Bootstrap Likelihood Ratio Test, and interpretability of the resulting classes. Lower information-criterion values and stronger classification accuracy guided model selection. After the optimal anxiety-profile solution had been established, the BCH procedure compared learner agency and mathematical confidence across the identified profiles while accounting for classification uncertainty. This treatment was preferred over ordinary correlation or regression because it revealed whether different configurations of mathematics anxiety corresponded with meaningfully different levels of agency and confidence rather than assuming that every learner followed the same linear pattern.

Ethical Considerations

The study protected the rights and welfare of participating learners through informed parental consent, learner assent, voluntary participation, confidentiality, and anonymous data coding. No personally identifying

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information was included in the analytical dataset. Participants were informed that withdrawal carried no academic consequence, and all electronic and printed records were secured and used solely for research purposes.

RESULTS AND DISCUSSION

Table 1. *Descriptive Statistics for Mathematics Anxiety, Learner Agency, and Mathematical Confidence (N = 306)*

Variable	Mean	SD
Everyday Mathematics Anxiety	3.02	0.88
Mathematics Learning Anxiety	3.16	0.91
Mathematics Testing Anxiety	3.50	0.93
Overall Mathematics Anxiety	3.23	0.79
Learner Agency	3.45	0.72
Mathematical Confidence	3.31	0.82

Table 1 presents the general pattern of mathematics anxiety, learner agency, and mathematical confidence among the participating secondary learners. Mathematics testing anxiety obtained the highest mean of 3.50, followed by mathematics learning anxiety at 3.16 and anxiety involving everyday mathematical situations at 3.02. This pattern showed that anxiety became more pronounced when mathematical performance was subject to evaluation. Learner agency registered a mean of 3.45, while mathematical confidence was slightly lower at 3.31. The findings suggested that many learners remained willing to participate and exercise some control over their learning, yet their belief in their mathematical capability was less stable. The difference between agency and confidence was meaningful because students could still attempt tasks and participate even while carrying doubts about whether they would succeed. The overall results therefore pointed to a problem that was not simply a lack of engagement. Rather, a considerable portion of learners appeared to participate in mathematics while experiencing uncertainty, particularly during assessments.

Table 2. *Latent Profile Model Fit Indices*

Number of Profiles	Log-Likelihood	AIC	BIC	SSA-BIC	Entropy	BLRT p-value
1	-1260.42	2532.84	2555.18	2536.15	—	—
2	-1153.10	2326.20	2363.44	2331.72	.77	<.001
3	-1101.65	2231.30	2283.43	2239.03	.86	<.001
4	-1100.42	2236.84	2303.86	2246.78	.79	.274
5	-1099.83	2243.66	2325.58	2255.81	.76	.411

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; SSA-BIC = sample-size-adjusted Bayesian Information Criterion; BLRT = Bootstrap Likelihood Ratio Test.

Table 2 shows that the three-profile solution provided the strongest representation of the data. It produced the lowest AIC, BIC, and SSA-BIC values and achieved an entropy value of .86, indicating good classification accuracy. The significant BLRT result for the three-profile model showed that it improved substantially over the two-profile solution. Adding a fourth or fifth profile did not produce a significant improvement and resulted in poorer information criteria and lower entropy. The three-profile solution was therefore retained. This result was important because it demonstrated that mathematics anxiety was not distributed among learners as a single uniform condition. Instead, three distinguishable patterns emerged, supporting the person-centered premise of the study.

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Table 3. *Characteristics and Distribution of the Three Mathematics Anxiety Profiles*

Anxiety Indicator	Profile 1: Low-Anxiety Secure	Profile 2: Moderate Evaluative Anxiety	Profile 3: High Pervasive Anxiety
Everyday Mathematics Anxiety	1.96	3.01	4.12
Mathematics Learning Anxiety	2.08	3.17	4.24
Mathematics Testing Anxiety	2.41	3.58	4.48
Number of Learners	82	143	81
Percentage	26.8%	46.7%	26.5%

Table 3 reveals three clearly differentiated groups. The Low-Anxiety Secure profile consisted of 82 learners or 26.8 percent of the sample. These students reported comparatively low anxiety across all dimensions, although testing situations still produced slightly greater tension than routine mathematics activities. The largest group was the Moderate Evaluative Anxiety profile, comprising 143 learners or 46.7 percent. Their anxiety was moderate during ordinary learning but increased considerably during mathematics testing. This group represented the central concern of the study because almost half of the learners were neither highly distressed nor fully comfortable with mathematics. Their difficulty became more visible when performance was formally evaluated.

The High Pervasive Anxiety profile included 81 learners or 26.5 percent of the participants. Anxiety among these students was high across everyday mathematics, classroom learning, and testing, reaching its strongest level during assessments. The presence of approximately one in every four learners in this profile indicated a substantial educational concern. Anxiety for this group was not confined to examinations but appeared across different encounters with mathematics. Taken together, the distribution showed that only about one fourth of the sample belonged to the low-anxiety profile, while nearly three fourths experienced either moderate or high mathematics anxiety. The problem was therefore broad enough to warrant instructional attention but varied sufficiently to require differentiated forms of support.

Table 4. *BCH Comparisons of Learner Agency and Mathematical Confidence Across Mathematics Anxiety Profiles*

Outcome Variable	Low-Anxiety Secure M (SE)	Moderate Evaluative Anxiety M (SE)	High Pervasive Anxiety M (SE)	Wald χ^2	p-value	Pairwise Pattern
Learner Agency	4.09 (.06)	3.47 (.05)	2.89 (.07)	124.76	<.001	P1 > P2 > P3
Mathematical Confidence	4.18 (.07)	3.32 (.05)	2.55 (.08)	202.44	<.001	P1 > P2 > P3

Note. BCH = Bolck-Croon-Hagenaars procedure. All pairwise comparisons were significant at $p < .001$.

Table 4 presents the central finding of the study. Learner agency differed significantly across the three anxiety profiles, $\chi^2 = 124.76$, $p < .001$. Learners in the Low-Anxiety Secure profile recorded the strongest agency at 4.09, followed by those in the Moderate Evaluative Anxiety profile at 3.47. The High Pervasive Anxiety group obtained the lowest mean at 2.89. The ordered pattern showed that greater mathematics anxiety was accompanied by progressively weaker learner agency. Students with high anxiety appeared less inclined to take initiative, sustain effort, make learning decisions, and exercise control over their mathematical learning.

An even sharper separation appeared in mathematical confidence, $\chi^2 = 202.44$, $p < .001$. The Low-Anxiety Secure group achieved a confidence mean of 4.18, compared with 3.32 among learners with moderate evaluative anxiety and 2.55 among those with high pervasive anxiety. All profile differences were statistically significant. Confidence therefore showed the clearest vulnerability associated with mathematics anxiety. Learners could retain

some degree of agency despite moderate anxiety, but their confidence declined more noticeably as anxiety intensified. For students in the highest-anxiety profile, low confidence appeared alongside reduced agency, indicating that persistent anxiety was associated not only with discomfort but also with a weaker sense of capability and ownership in mathematics learning.

These results supported the central proposition of the study that mathematics anxiety may serve as a gateway for identifying conditions related to learner agency and confidence building. The findings did not suggest that anxiety itself was beneficial. Rather, recognizing its pattern and intensity provided a practical means of locating learners whose confidence and active participation required greater support. The moderate profile was particularly important because it contained the largest number of learners and showed that difficulties could remain partly concealed during ordinary classroom activity but become pronounced under evaluative pressure. The high-anxiety profile required more intensive attention because diminished confidence and agency occurred simultaneously. Thus, mathematics anxiety functioned as a diagnostic point from which differentiated confidence-building and agency-support strategies could be developed rather than treating secondary learners as a single group with identical mathematical needs.

CONCLUSION

Mathematics anxiety was meaningfully associated with differences in learner agency and mathematical confidence among secondary learners in San Pablo, Isabela. Three distinct anxiety profiles emerged, with learners in the low-anxiety group demonstrating the strongest agency and confidence, while those experiencing high pervasive anxiety showed the weakest levels in both outcomes. The large proportion of learners classified under moderate evaluative anxiety further indicated that assessment situations remained a major source of difficulty even among students who were otherwise able to participate in mathematics learning. Based on these findings, Mathematics teachers should adopt differentiated support strategies that reduce unnecessary evaluative pressure, normalize productive mistakes, strengthen problem-solving persistence, and provide structured opportunities for learners to make choices and explain their reasoning. Schools may also integrate brief anxiety screening, confidence-building activities, and learner agency practices into mathematics support programs, while students identified with persistent high anxiety should receive more focused instructional and psychosocial assistance. Future studies may examine how these anxiety profiles change over time and whether targeted classroom interventions can move learners toward stronger confidence, greater agency, and more positive engagement with mathematics.

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