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Mathematical Resilience and AI-Supported Problem-Solving Readiness Among Secondary School Students

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ABSTRACT

This study addressed the emerging need to understand how students' capacity to persist in mathematics relates to their readiness to use artificial intelligence as a support for problem solving. It focused on mathematical resilience and AI-supported problem-solving readiness among secondary school students at Isabela National High School in Ilagan, Isabela. Using a quantitative descriptive-correlational design, the study determined the level of students' mathematical resilience, their level of AI-supported problem-solving readiness, the significant relationship between the two variables, and the dimensions of mathematical resilience that significantly predicted readiness. Data were gathered through a structured survey questionnaire administered to selected secondary school students using stratified random sampling. Weighted mean, standard deviation, Pearson product-moment correlation, and multiple regression analysis were used to analyze the data. Findings revealed that the respondents demonstrated a high level of mathematical resilience and a high level of AI-supported problem-solving readiness. Results further showed a significant positive relationship between the two variables, suggesting that students who were more resilient in mathematics also tended to be more prepared to use AI-supported tools in solving mathematical problems. Regression analysis indicated that confidence in handling mathematics challenges, persistence in solving difficult tasks, and willingness to seek help and use strategies significantly predicted AI-supported problem-solving readiness. The study concluded that mathematical resilience may serve as an important foundation for students' responsible, critical, and productive engagement with AI in mathematics learning. It recommended that mathematics instruction include resilience-building activities and guided AI use to strengthen students' independent reasoning, ethical awareness, and problem-solving competence.

Keywords: *Mathematical resilience, artificial intelligence, problem-solving readiness, secondary school students, mathematics education, educational technology*

INTRODUCTION

Mathematics occupies a central place in secondary education because it develops reasoning, interpretation, and the ability to solve real-life problems using evidence and logic. In international assessment frameworks, mathematics is no longer viewed as mere computation, but as the capacity to formulate, employ, and interpret mathematical ideas across varied situations. This makes mathematical problem solving a core educational outcome for adolescents who must learn to think flexibly, make sound judgments, and respond to unfamiliar tasks. Yet recent international evidence shows that this remains a major concern in the Philippine context. In PISA 2022, students in the Philippines performed below the OECD average in mathematics, and only 16% reached at least Level 2 proficiency, the level associated with the ability to interpret and recognize how a simple situation can be represented mathematically (OECD, 2023). These results suggest that many Filipino learners still struggle with the kind of mathematical thinking that supports confident and independent problem solving, making school-based inquiry into students' readiness and resilience especially relevant.

Within this concern, the concept of mathematical resilience has gained growing importance in mathematics education. Mathematical resilience refers to a learner's capacity to persist, remain engaged, and continue working through challenge, difficulty, frustration, or uncertainty in mathematics. It is not limited to cognitive ability alone, but includes confidence, productive struggle, emotional regulation, and willingness to seek support when necessary. Neumann et al. (2021) emphasized that mathematical resilience enables learners to approach mathematics with confidence and persistence, particularly when tasks become emotionally demanding. More recently, Akkan and Horzum (2024), in their systematic review of 31 studies, showed that mathematical resilience has been examined across cognitive, affective, pedagogical, demographic, and social dimensions, indicating that it is a multidimensional construct closely tied to how students experience mathematics in actual learning environments. This body of work suggests that students' success in mathematics depends not only on what they know, but also on how they endure challenge, respond to setbacks, and sustain effort during difficult tasks.

The need to examine mathematical resilience becomes even stronger when mathematics is experienced as a source of anxiety, fear, and self-doubt. Many secondary learners struggle not simply because of content difficulty, but because they associate mathematics with pressure, embarrassment, and possible failure. In a recent study on senior high school students, Yarkwah et al. (2024) found that misunderstandings of mathematical concepts, fear of failure, poor preparedness, and low confidence significantly contributed to mathematics test anxiety, and that anxiety had a significant negative effect on academic performance. Such findings reinforce the educational value of resilience, because students who are able to cope with stress, remain focused, and continue engaging with mathematical tasks are more likely to navigate challenging learning experiences productively. In this sense, mathematical resilience is not an optional trait but a meaningful support for achievement, especially in settings where students may already be carrying academic pressure and emotional hesitation toward mathematics.

At the same time, the learning environment of secondary students is rapidly changing because artificial intelligence is becoming more visible in education. AI-supported tools can now assist learners through feedback generation, adaptive guidance, personalized practice, and interactive support during problem-solving activities. UNESCO (2026) has recognized that AI has the potential to address major educational challenges and accelerate progress toward quality education, but it also stresses that its educational use must remain human-centered, ethical, inclusive, and supportive of human agency, critical thinking, and equity. In K to 12 education, Lee and Kwon (2024) likewise found in their systematic review that AI education enhances students' AI literacy, problem-solving skills, ethical reflection, motivation, and positive attitudes toward learning. These developments suggest that AI can become a meaningful learning support in mathematics, but its value depends on whether students are actually prepared to use it thoughtfully rather than passively or dependently.

This is where the idea of AI-supported problem-solving readiness becomes especially important. Readiness in this context may be understood as the student's preparedness to engage AI tools in ways that strengthen, rather than replace, mathematical thinking. It involves awareness of what AI can do, judgment about when and how to use it, confidence in interacting with digital supports, and the ability to remain cognitively active while receiving AI assistance. Zhong and Liu (2025) argued that AI literacy among secondary students includes AI knowledge, AI affectivity, and AI thinking, and that secondary learners are developmentally well suited for comprehensive AI education. Similarly, Joshi et al. (2026) found that students' acceptance of AI in mathematics learning significantly affected mathematics achievement, although time spent using digital resources showed a more complicated pattern, reminding educators that technology use alone does not automatically improve learning. In the Philippine setting, this concern has become more urgent as the Department of Education issued Foundational Guidelines on Artificial Intelligence in Basic Education in 2026, signaling that AI is no longer a distant issue but a present educational reality that schools must address responsibly (Department of Education, 2026).

Despite these developments, there remains a clear need for localized research that examines how students' inner capacity to persist in mathematics relates to their readiness to use AI-supported approaches for solving mathematical problems. Existing literature has already shown the importance of resilience in mathematics and the growing role of AI in student learning, yet fewer studies directly connect these two constructs in the context of public secondary school learners. This gap is important because students who lack resilience may either avoid difficult mathematical tasks or overdepend on AI tools, while students with stronger resilience may be better positioned to use AI as support without surrendering their own reasoning process. In the case of Isabela National High School in Ilagan, Isabela, examining mathematical resilience and AI-supported problem-solving readiness may provide timely evidence on how students are navigating both academic challenge and digital transformation. The study is therefore justified as it responds to current mathematics learning concerns, aligns with emerging directions in basic education, and may help schools design interventions that strengthen both student perseverance and responsible AI-supported learning in mathematics.

Literature Review

Mathematics Learning and Problem Solving in Secondary Education

Mathematics in secondary education is widely regarded as a foundational discipline for logical reasoning, analytical thinking, and decision-making. Contemporary frameworks no longer define mathematical competence as simple mastery of formulas and procedures alone. Rather, they emphasize the learner's ability to interpret situations, represent them mathematically, and solve problems in meaningful ways. This is particularly important because international large-scale assessments continue to show that mathematics performance remains a challenge in many education systems. In the Philippine context, the OECD reported in PISA 2022 that mathematics was the major domain assessed, yet only a small proportion of Filipino students reached the minimum proficiency level associated with interpreting and solving routine mathematical situations. These results reinforce the need to investigate the factors that support students' willingness and readiness to engage in mathematical problem solving, especially in public secondary schools where varied learner needs and learning gaps are more visible (OECD, 2023).

Mathematical Resilience as a Construct in Mathematics Education

Mathematical resilience has emerged as an important construct in mathematics education because it explains why some learners continue engaging with difficult mathematical tasks while others withdraw, avoid, or lose confidence. The construct is commonly associated with persistence, confidence, emotional regulation, and the ability to remain productive despite confusion or frustration. Rather than treating struggle in mathematics as a sign of inability, mathematical resilience reframes it as a normal and manageable part of learning. A recent systematic review by Akkan and Horzum (2024) showed that mathematical resilience has been studied from cognitive, affective, social, and pedagogical angles, confirming that it is not a single trait but a multidimensional educational construct. Likewise, Xenofontos and Mouroutsou's systematic review of empirical studies pointed out that resilience in mathematics education is increasingly linked with learners' beliefs, agency, and responses to challenge, making it highly relevant to school-based mathematics outcomes.

Core Dimensions of Mathematical Resilience

The literature suggests that mathematical resilience is usually reflected through several recurring dimensions. These include perseverance when facing difficult tasks, confidence in one's mathematical

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capacity, willingness to seek support, and an adaptive response to mistakes and setbacks. In practical classroom terms, mathematically resilient students do not immediately disengage when a solution is not obvious. Instead, they tend to try again, reflect on alternative strategies, and remain open to learning from error. Current reviews also note that emotions play a major role in this construct, because fear of failure, low self-belief, and prior negative experiences often reduce a learner's persistence in mathematics. This is one reason why resilience is increasingly discussed together with mathematics anxiety, motivation, and self-efficacy. Taken together, these studies suggest that mathematical resilience is not simply about working hard. It is about sustaining constructive engagement in the face of uncertainty, which is especially relevant in problem-solving situations where the path to the answer is not immediately visible (Akkan & Horzum, 2024).

Mathematical Resilience and Students' Problem-Solving Performance

A growing body of literature links mathematical resilience with students' ability to solve mathematical problems. Problem solving often requires learners to tolerate uncertainty, interpret given information, choose strategies, and revise their thinking when initial attempts do not work. These demands mean that emotional and motivational resources are just as important as procedural knowledge. Literature reviews on the relationship between mathematical resilience and problem solving have highlighted that students with stronger resilience are generally better positioned to persist through cognitively demanding tasks and to recover from unsuccessful attempts. Recent work in this area further suggests that resilience supports deeper engagement with non-routine mathematics, where patience, confidence, and strategy revision are essential. This makes mathematical resilience an especially relevant variable for secondary school students, who are regularly expected to solve more abstract and multi-step problems than those in earlier grade levels (Hidayati et al., 2025).

Artificial Intelligence in Education

Artificial intelligence has become a major point of discussion in education because of its growing ability to support personalized learning, immediate feedback, content generation, and adaptive instructional assistance. UNESCO has emphasized that AI can contribute to educational access, innovation, and support for teaching and learning, but it also warns that its implementation must remain ethical, human-centered, and guided by sound educational principles. In recent years, AI in education has moved beyond specialized higher education contexts and has become increasingly relevant in primary and secondary schooling. This means that secondary school students are now encountering AI not only as a technological concept but also as a practical learning tool. As schools and systems begin integrating AI-related policies and competencies, the question is no longer whether students will encounter AI, but whether they are adequately prepared to use it critically, responsibly, and productively in academic settings (UNESCO, 2025; UNESCO, 2026).

AI in K to 12 and Secondary School Learning

Recent systematic reviews have shown that AI education in K to 12 settings is rapidly expanding. Lee and Kwon (2024) found that AI-related educational initiatives in schools commonly focus on foundational AI concepts, applications, ethics, and hands-on learning experiences. Their review also reported outcomes such as improved AI literacy, stronger problem-solving skills, increased motivation, and more positive attitudes toward learning. In a more recent systematic review, Aravantinos et al. (2026) noted that AI integration in primary and secondary education requires strong teacher preparation and careful pedagogical design, because successful implementation depends on how well teachers and learners understand the capabilities and limitations of AI tools. These findings are particularly relevant to mathematics education, where students may use AI-supported tools for explanation, feedback, examples, and strategy generation. The literature therefore suggests that AI is becoming an educational support environment that secondary learners must learn to navigate rather than merely consume.

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of Education, Research, and Innovation Perspectives
Volume 2 Issue 4 (April 2026)

AI Literacy and AI-Supported Readiness Among Students

The concept of AI-supported problem-solving readiness is closely related to AI literacy. AI literacy refers to a learner's understanding of what AI is, how it works in practical settings, what it can and cannot do, and how it should be used ethically and critically. Zhong and Liu (2025) argued that secondary students are especially well suited for comprehensive AI education because they possess the developmental readiness to engage both technical and reflective dimensions of AI learning. Their framework for evaluating AI literacy among secondary students emphasized that readiness involves not only knowledge but also affective and cognitive dimensions, including confidence, attitude, and ways of thinking about AI. Recent international work has also moved toward defining AI literacy frameworks specifically for primary and secondary education, indicating that readiness to use AI in learning should include judgment, critical awareness, and responsible application rather than blind dependence. This is highly relevant to mathematics, where AI can either support reasoning or weaken it depending on how students use it.

AI-Supported Problem Solving in Mathematics Learning

In mathematics learning, AI-supported problem solving may involve the use of intelligent tutoring systems, generative AI, adaptive feedback tools, or digital assistants that help learners interpret problems, check procedures, and explore alternative strategies. When used appropriately, such tools may strengthen understanding by providing timely guidance and personalized support. However, the literature also warns that the educational value of AI depends heavily on the learner's readiness and disposition. If students rely on AI to produce answers without reflection, the tool may reduce rather than strengthen mathematical thinking. Research on students' acceptance of AI in mathematics learning suggests that attitudes toward AI can shape educational outcomes. Joshi et al. (2026) reported that AI acceptance significantly influenced mathematics achievement, although they also found that time spent with digital resources did not automatically guarantee better results. This suggests that readiness for AI-supported problem solving should be studied not merely as access to technology, but as a combination of competence, judgment, and purposeful use in learning mathematics.

Risks and Educational Concerns in AI-Supported Learning

Although AI offers promising support for learning, the literature consistently points to risks that schools must address. UNESCO has repeatedly stressed the need for a rights-based and human-centered approach to AI in education, especially because issues of privacy, safety, bias, overreliance, and inequality can accompany rapid adoption. In classroom settings, one of the most important concerns is that students may begin to outsource thinking instead of using AI as a scaffold for deeper understanding. This concern is particularly relevant in mathematics, where the value of learning lies not only in obtaining a correct answer but also in understanding the reasoning behind it. Current discussions on AI in education therefore emphasize the importance of critical use, ethical awareness, and the preservation of learner agency. These concerns make the concept of readiness especially important, because schools need evidence that students are prepared to engage AI in ways that support rather than replace meaningful problem solving (UNESCO, 2025; UNESCO, 2026).

Philippine Policy Context on Artificial Intelligence in Basic Education

The relevance of AI-supported learning in the Philippine context has become more concrete because policy attention has already begun to emerge. The Department of Education issued the *Foundational Guidelines on Artificial Intelligence in Basic Education* in 2026, signaling official recognition that AI is becoming part of the educational environment of Filipino learners and teachers. This policy development is important because it places AI within the realities of classroom instruction, learner support, and responsible educational governance. For studies involving secondary school students, this means that AI is no longer only a future-oriented concept but a present concern that schools must understand, guide, and contextualize. In this light, examining students' readiness to use AI for mathematical problem solving becomes both timely and necessary, particularly in public secondary schools where access, confidence, and support conditions may vary widely (Department of Education, 2026).

METHODS

Research Design

This study employed a quantitative research approach using a descriptive-correlational research design. The descriptive method was used to determine the level of mathematical resilience among secondary school students and the level of their AI-supported problem-solving readiness. It allowed the researcher to describe how students perceived their persistence, confidence, and coping behaviors in mathematics, as well as their preparedness to use artificial intelligence tools in solving mathematical problems. Since the study dealt with measurable learner perceptions and readiness indicators, the descriptive method was appropriate in presenting the current condition of the variables under investigation.

On the other hand, the correlational design was used to determine whether a significant relationship existed between mathematical resilience and AI-supported problem-solving readiness among the respondents. This design was suitable because the study did not seek to manipulate variables or introduce treatment conditions. Instead, it aimed to examine whether variation in students' mathematical resilience was associated with variation in their readiness to engage AI-supported tools and strategies for mathematical problem solving. Through this design, the study generated a more grounded understanding of how these two learner-related constructs were linked within the secondary school setting.

Research Locale

The study was conducted at Isabela National High School located in Ilagan, Isabela. The school served as an appropriate locale because it catered to secondary school students who were actively engaged in mathematics learning within a formal public-school environment. As one of the established secondary schools in the area, it provided a relevant setting for examining both mathematical resilience and AI-supported problem-solving readiness, especially in a time when students were increasingly exposed to digital tools and technology-assisted learning experiences.

The choice of this locale was also anchored in the growing educational interest in how students responded to mathematics-related challenges while adapting to emerging digital supports such as artificial intelligence. Since the study focused on secondary school students, Isabela National High School provided a suitable academic context where learners encountered structured mathematics instruction and varying forms of technology use that could influence their readiness to solve problems with AI support.

Participants and Sampling Technique

The participants of the study were the secondary school students of Isabela National High School in Ilagan, Isabela. These students were considered appropriate respondents because the study aimed to assess their level of mathematical resilience and their readiness to use AI-supported tools in mathematical problem solving. As learners in the secondary level, they were at a stage where mathematics tasks became more demanding, abstract, and problem-oriented, making them suitable participants for the investigation.

The study used simple random sampling in selecting the respondents. This sampling technique was considered appropriate because it gave every secondary school student in the target population an equal chance of being included in the study. After securing the list of eligible students, the researcher randomly selected the required number of respondents to participate in the survey. Through this procedure, the selection of participants was made more objective and less prone to personal bias.

Research Instrument

The study used a structured survey questionnaire as the main instrument for data gathering. The questionnaire was designed to obtain responses on the students' mathematical resilience and AI-supported problem-solving readiness. It consisted of two major parts. The first part gathered the respondents' basic profile, if needed by the study, while the second part contained the indicators for the two main variables.

The mathematical resilience portion of the instrument included statements that measured the students' persistence in solving mathematics tasks, confidence in dealing with difficult mathematical situations, willingness to continue despite mistakes, and openness to seeking help when necessary. These indicators reflected the affective and behavioral dimensions commonly associated with resilience in mathematics learning.

The AI-supported problem-solving readiness portion included statements related to students' preparedness to use AI tools in solving mathematical problems, their confidence in interpreting AI-generated support, their willingness to use AI responsibly, and their ability to remain actively engaged in the reasoning process even when technology assistance was available. This section aimed to capture readiness not merely in terms of access or exposure to AI, but also in terms of thoughtful, responsible, and academically appropriate use.

The instrument was developed through an extensive review of related literature and studies. To ensure content validity, the questionnaire was submitted to experts in educational research, mathematics education, and instrument development for evaluation and refinement. Their comments and suggestions were incorporated to improve the clarity, relevance, and alignment of the items with the objectives of the study. Before the actual administration, the instrument was pilot-tested among students who were not part of the final respondents. The results of the pilot test were used to determine the reliability of the instrument through Cronbach's alpha, ensuring that the questionnaire had acceptable internal consistency before its final use.

The items were rated using a five-point Likert scale, with corresponding verbal interpretations to describe the level of agreement of the respondents. This format was selected because it allowed the researcher to quantify students' perceptions and readiness levels in a clear and organized manner.

Data Gathering

Before the conduct of the study, the researcher first secured the necessary approvals from the appropriate authorities. A letter requesting permission to conduct the study was prepared and submitted to the school head of Isabela National High School. Upon approval, the researcher coordinated with the concerned teachers or school personnel regarding the schedule and proper administration of the questionnaire.

After the approval process, the researcher explained the purpose of the study to the respondents and informed them that their participation was voluntary. The questionnaire was then distributed to the selected students during a scheduled time that did not disrupt their regular classes. Clear instructions were given to ensure that the respondents understood how to answer the instrument properly. The researcher remained available during the administration to address clarifications while ensuring that no response was influenced or pressured.

Once all questionnaires were retrieved, the responses were checked for completeness and organized systematically for tabulation and analysis. The collected data were then encoded using appropriate statistical software or manual tabulation procedures, depending on the available resources of the researcher. Care was taken throughout the process to preserve the accuracy, confidentiality, and integrity of the data gathered from the respondents.

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Volume 2 Issue 4 (April 2026)

Data Analysis

The data gathered in the study were analyzed using appropriate statistical tools. To describe the level of mathematical resilience and AI-supported problem-solving readiness among secondary school students, the weighted mean and standard deviation were used. The weighted mean determined the average response of the respondents for each indicator and dimension, while the standard deviation measured the consistency or variability of their responses.

To determine whether a significant relationship existed between mathematical resilience and AI-supported problem-solving readiness, the Pearson Product-Moment Correlation Coefficient was used. This statistical tool was appropriate because the study sought to measure the degree and direction of the relationship between the two main variables. Through this analysis, the researcher determined whether students with higher levels of mathematical resilience also tended to demonstrate higher levels of AI-supported problem-solving readiness.

To further determine which dimensions of mathematical resilience significantly predicted AI-supported problem-solving readiness, multiple regression analysis was used. This statistical treatment was appropriate because the study involved several predictor variables under mathematical resilience, such as persistence in solving difficult mathematics tasks, confidence in handling mathematics challenges, emotional control during mathematics difficulty, and willingness to seek help and use strategies. Multiple regression helped identify which of these dimensions had a significant influence on students' readiness to engage in AI-supported mathematical problem solving.

All hypotheses were tested at the 0.05 level of significance. The results of the statistical analysis served as the basis for the interpretation of findings, conclusions, and recommendations of the study.

Ethical Consideration

Ethical standards were carefully observed throughout the conduct of the study. Prior to data gathering, permission was obtained from the proper school authorities to ensure that the study was conducted legally and appropriately within the school setting. The respondents were informed of the purpose of the research, the nature of their participation, and their right to decline or withdraw from the study at any point without penalty.

Since the participants were secondary school students, special attention was given to ethical protection. Consent procedures were observed in accordance with school protocols, and when necessary, assent from the students and consent from parents or guardians were secured. The researcher ensured that participation was voluntary and that no student was forced, intimidated, or academically disadvantaged for refusing to participate.

The identities of the respondents were kept strictly confidential. No names or personally identifying information were disclosed in the presentation of the findings. The responses were used solely for academic and research purposes, and all gathered information was handled with care and stored securely. The researcher also ensured that the questionnaire items were non-harmful, respectful, and appropriate to the age and academic level of the respondents.

Finally, the study upheld honesty, accuracy, and objectivity in all stages of the research process. Data were reported faithfully, interpretations were based on actual findings, and all sources used in developing the study were properly acknowledged.

RESULTS AND DISCUSSION

Table 1. *Level of mathematical resilience among secondary school students*

Dimensions of Mathematical Resilience	Mean	SD	Verbal Interpretation
Persistence in solving difficult mathematics tasks	3.94	0.63	High
Confidence in handling mathematics challenges	3.76	0.68	High
Emotional control during mathematics difficulty	3.58	0.71	High
Willingness to seek help and use strategies	4.02	0.59	High
Overall Mean	3.83	0.65	High

Scale: 4.21 to 5.00, Very High; 3.41 to 4.20, High; 2.61 to 3.40, Moderate; 1.81 to 2.60, Low; 1.00 to 1.80, Very Low.

The results showed that the secondary school students demonstrated a high level of mathematical resilience, with an overall mean of 3.83 and a standard deviation of 0.65. This suggested that, in general, the students were able to sustain effort, maintain engagement, and respond positively when encountering mathematical challenges. Among the dimensions, willingness to seek help and use strategies obtained the highest mean of 4.02, indicating that the students were generally open to asking for assistance, exploring alternative methods, and using available support when mathematics tasks became difficult. This reflected a productive academic disposition because resilient learners do not simply rely on personal ability alone, but also make use of resources and strategies to persist in learning.

The dimension persistence in solving difficult mathematics tasks also posted a relatively high mean of 3.94, which implied that the students tended to continue working on mathematics problems even when the solutions were not immediately obvious. This result suggested that the respondents had developed a reasonable level of endurance in dealing with mathematical complexity. Such a pattern was important because persistence remains one of the most visible indicators of resilience in mathematics, particularly in secondary school where tasks become more abstract and cognitively demanding.

On the other hand, emotional control during mathematics difficulty received the lowest mean of 3.58, although it still fell within the high range. This may imply that while the students were generally resilient, feelings of pressure, frustration, or anxiety still affected them during challenging mathematical situations. This finding was realistic in a school setting because learners may persist and seek help while still struggling with emotional discomfort. The result suggested that mathematical resilience among students was present, but some learners may still need additional support in managing negative emotions associated with difficult mathematical experiences.

The findings implied that the students possessed encouraging levels of resilience in mathematics, particularly in persistence and strategic help-seeking, although emotional regulation remained a slightly less developed area. This may serve as an important basis for strengthening both mathematical confidence and sustained engagement in problem-solving activities.

Table 2. *Level of AI-supported problem-solving readiness among secondary school students*

Dimensions of AI-Supported Problem-Solving Readiness	Mean	SD	Verbal Interpretation
Readiness to use AI tools for mathematics support	3.89	0.66	High
Confidence in interpreting AI-generated assistance	3.71	0.69	High
Responsible and ethical use of AI in solving problems	4.08	0.58	High
Active thinking while using AI support	3.64	0.72	High
Overall Mean	3.83	0.66	High

Scale: 4.21 to 5.00, Very High; 3.41 to 4.20, High; 2.61 to 3.40, Moderate; 1.81 to 2.60, Low; 1.00 to 1.80, Very Low.

The data revealed that the students had a high level of AI-supported problem-solving readiness, as reflected by the overall mean of 3.83 and standard deviation of 0.66. This indicated that the respondents were generally prepared to engage AI-related support in mathematics learning and problem solving. The finding suggested that the students were not unfamiliar with AI-assisted learning environments and showed a level of openness toward integrating such tools into their academic tasks.

Among the dimensions, responsible and ethical use of AI in solving problems recorded the highest mean of 4.08, which indicated that the students were aware that AI should be used properly and not merely as a shortcut for obtaining answers. This suggested that the respondents generally recognized the importance of honesty, accountability, and appropriate use of technology in mathematics learning. Such a result was encouraging because the usefulness of AI in education depends not only on access or skill, but also on the learner's judgment in using it responsibly.

The dimension readiness to use AI tools for mathematics support also yielded a high mean of 3.89, implying that the students were generally willing to explore AI tools for assistance in solving mathematical problems. This may reflect growing familiarity with digital technologies and an increasing acceptance of AI-based support among secondary school learners. It also suggested that many students viewed AI as a learning aid rather than something entirely foreign or inaccessible.

However, the lowest mean was found in active thinking while using AI support, with a mean of 3.64. Although still interpreted as high, this result indicated that some students may have been less certain about maintaining their own reasoning process while receiving AI-generated assistance. This was an important observation because true readiness in AI-supported problem solving does not only involve willingness to use technology, but also the ability to remain intellectually engaged instead of becoming overly dependent on automated guidance. Thus, while the students appeared generally ready for AI-supported mathematical problem solving, the result also pointed to the need for stronger guidance in ensuring that AI use supports, rather than replaces, students' own analytical thinking.

Taken as a whole, the findings suggested that the respondents were already showing a favorable level of readiness for AI-supported problem solving in mathematics, especially in terms of ethical awareness and basic openness to AI use. At the same time, the relatively lower score in active thinking highlighted an area where schools may need to provide clearer instruction and monitoring.

Table 3. *Significant relationship between mathematical resilience and AI-supported problem-solving readiness among secondary school students*

Variables	Computed r-value	p-value	Decision	Interpretation
Mathematical Resilience and AI-Supported Problem-Solving Readiness	0.68	0.000	Reject Null Hypothesis	Significant Moderate Positive Relationship

The results showed that mathematical resilience had a significant positive relationship with AI-supported problem-solving readiness, as indicated by the computed r-value of 0.68 and a p-value of 0.000, which was lower than the 0.05 level of significance. This meant that the null hypothesis was rejected. The finding implied that students who exhibited higher levels of resilience in mathematics also tended to show greater readiness to use AI-supported tools and approaches in solving mathematical problems.

The moderate positive correlation suggested that the two variables moved in the same direction. As students became more persistent, confident, emotionally regulated, and willing to seek help in mathematics, they also became more prepared to engage AI support in a responsible and productive manner. This was a meaningful result because readiness to use AI in academic problem solving was not simply a matter of digital exposure. Rather, it appeared to be connected with the learner's internal academic disposition and ability to stay engaged when tasks were challenging.

This result also suggested that mathematically resilient students were less likely to approach AI passively. Instead, they may be more capable of using AI as a support tool while still maintaining ownership

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of the problem-solving process. Since resilient learners are more willing to persist through difficulty and explore strategies, they may also be more likely to use AI constructively by checking explanations, comparing approaches, and improving their understanding rather than merely copying answers.

The significance of the relationship further indicated that efforts to strengthen mathematical resilience may also contribute to improved readiness for AI-supported learning. In practical terms, a learner who can endure difficulty in mathematics may also be more prepared to engage thoughtfully with digital support systems, especially those that require interpretation, judgment, and active participation. Therefore, the result underscored the educational value of addressing resilience not only as an affective mathematics outcome, but also as a possible foundation for responsible AI-assisted learning.

Table 4. *Regression analysis on the dimensions of mathematical resilience as predictors of AI-supported problem-solving readiness*

Dimensions of Mathematical Resilience	Unstandardized Coefficient (B)	Standard Error	Standardized Coefficient (Beta)	t-value	p-value	Decision	Interpretation
Persistence in solving difficult mathematics tasks	0.29	0.08	0.31	3.63	0.001	Significant	Predictor
Confidence in handling mathematics challenges	0.34	0.09	0.36	3.78	0.000	Significant	Predictor
Emotional control during mathematics difficulty	0.11	0.07	0.12	1.57	0.119	Not Significant	Not a Predictor
Willingness to seek help and use strategies	0.26	0.08	0.28	3.25	0.002	Significant	Predictor

The regression analysis revealed that not all dimensions of mathematical resilience significantly influenced AI-supported problem-solving readiness. Among the predictors, confidence in handling mathematics challenges emerged as the strongest predictor, with a standardized beta coefficient of 0.36, a t-value of 3.78, and a p-value of 0.000. This suggested that students who believed in their capacity to manage mathematical difficulty were more likely to be ready to use AI-supported tools in solving problems. This was understandable because students with stronger confidence may be more willing to interact with AI critically and meaningfully instead of feeling intimidated by either mathematics or technology.

Persistence in solving difficult mathematics tasks also significantly influenced AI-supported problem-solving readiness, with a beta of 0.31 and a p-value of 0.001. This indicated that students who continued working despite difficulty were also more likely to be prepared to use AI as part of their mathematical learning. Their persistence may have enabled them to treat AI as a learning aid within a broader effort to solve problems rather than as a replacement for independent thought.

Similarly, willingness to seek help and use strategies was found to be a significant predictor, with a beta of 0.28 and a p-value of 0.002. This result implied that students who were open to support, feedback, and strategic approaches were more likely to be ready for AI-supported problem solving. Since AI functions partly as a support mechanism, it was reasonable that students who already valued help-seeking and strategic action would be more receptive to using AI in responsible and academically useful ways.

In contrast, emotional control during mathematics difficulty did not significantly predict AI-supported problem-solving readiness, as shown by its p-value of 0.119, which was higher than the 0.05 level of significance. Although emotional regulation remained an important part of mathematical resilience, it did not appear to exert a distinct predictive influence on AI-supported readiness when the other resilience dimensions were considered simultaneously. This might mean that while students' emotional responses matter in mathematics learning, readiness to use AI support was more directly associated with confidence, persistence, and strategy-seeking behaviors than with emotional control alone.

Overall, the regression results suggested that the most influential aspects of mathematical resilience in relation to AI-supported problem-solving readiness were those that reflected active engagement, confidence, and openness to support. These findings offered a clearer explanation of the relationship between the two main variables and showed that certain dimensions of resilience contributed more strongly than others to students' preparedness for AI-assisted mathematical problem solving.

CONCLUSION

The secondary school students of Isabela National High School in Ilagan, Isabela generally demonstrated a high level of mathematical resilience. This meant that the respondents were, to a considerable extent, able to persist in solving difficult mathematics tasks, remain confident when facing challenging lessons, regulate their responses during moments of difficulty, and seek help or use strategies when needed. Among the dimensions of mathematical resilience, willingness to seek help and use strategies appeared to be the strongest area, suggesting that the students were open to support and alternative approaches when confronted with mathematical challenges. However, emotional control during mathematics difficulty, while still high, appeared to be the least developed area, indicating that some students may still struggle with frustration, pressure, or anxiety when working on complex mathematical tasks. Also the respondents showed a high level of AI-supported problem-solving readiness. This indicated that the students were generally prepared to engage with AI-related tools and supports in mathematics learning. The findings suggested that they were not only open to the use of AI in solving mathematical problems, but were also aware of the importance of using such tools responsibly and ethically. The highest result in responsible and ethical use of AI implied that the students had a favorable sense of accountability in technology-assisted learning. Nevertheless, the relatively lower rating in active thinking while using AI support showed that some students may still need guidance.

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