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The Paradox of Accessibility: Investigating Mathematics Struggle Among College Students in the Age of Information and Artificial Intelligence

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ABSTRACT

Students today learn mathematics in a world full of digital tools and instant access to information, yet many still find the subject difficult and overwhelming. This situation raises important questions about how learning is affected when technology becomes both a support and a source of confusion. The study used a structured, quantitative approach to examine how students experience mathematics in a digital learning environment, drawing on responses from first-year college students collected through a validated questionnaire. The study found that students showed strong engagement with technological and AI-based tools. However, their mathematical competence was weakened by high anxiety, low motivation, and limited confidence. Significant differences across eight dimensions revealed that emotional, environmental, and identity-related factors were the most vulnerable areas, compared to cognitive and technological strengths. These results show that improving mathematical readiness requires not only access to digital resources but also stronger support for students' emotional well-being and learning environments.

Keywords: mathematics education, mathematics struggle, educational technology, artificial intelligence, information accessibility

INTRODUCTION

Mathematical competence is the set of knowledge, skills, and dispositions that help learners make sense of quantitative information and solve a wide range of numerical and real-world problems. It involves procedural fluency, conceptual understanding, and the ability to apply mathematical reasoning in varied contexts (Barete & Taja-on, 2024; Luzano, 2024a). In modern classrooms, this competence is even more crucial as teachers work to contextualize mathematical ideas in ways that connect with students' environments, experiences, and everyday decisions (Allic & Lunar, 2024). The twenty-first century has brought unprecedented technological tools such as interactive platforms and artificial intelligence systems. These tools aim to support learning by making complex concepts more accessible (Pabilario, 2025; Taja-on et al., 2025). These innovations propose to reshape how mathematics is taught and learned, offering more opportunities for engagement and individualized instruction.

Despite these advancements, a considerable number of students persist in encountering difficulties with mathematics, highlighting a paradox within an era characterized by abundant information and learning technologies (Melchor et al., 2023). Although digital resources are increasingly accessible, challenges involving the comprehension of core concepts, sustained engagement, and anxiety are prevalent across diverse learner populations. This contrast prompts significant inquiries regarding the persistence of mathematical difficulties, even as educational tools become more sophisticated and accessible (Cadiz et al., 2024; Luzano, 2024c). The ongoing nature of these struggles underscores the necessity of investigating not solely the existence of technological tools, but also their integration, relevance, and tangible impact on student learning.

Although a considerable number of research has addressed technology-enhanced learning, a notable empirical gap persists regarding the development—or lack thereof—of students' mathematical competence within technology-rich environments. Many studies examine isolated factors such as performance (Dodongan, 2022), attitudes (Melchor et al., 2023), or device usage (Hidayat & Firmanti, 2024); however, few investigate how competence is shaped by the complex interplay among cognitive, emotional, motivational, and sociocultural influences in the digital era (Acopio, 2025; Duterte, 2024; Taja-on et al., 2025). Furthermore, limited consideration has been given to how the overwhelming upsurge of information and digital tools may unintentionally impede learning (Engelbrecht & Borba, 2024). This lacuna highlights the necessity for a comprehensive inquiry into how students navigate mathematics within environments marked by rapid technological change and continuous information exposure.

Understanding students' mathematical competence is essential because it shapes academic progress, professional readiness, and everyday reasoning in an increasingly complex world. Rather than assuming that access to digital platforms and AI-assisted tools automatically improves learning, this study is grounded in examining how students actually experience mathematics within such environments. By focusing on learners' emotional responses, competence, and engagement with mathematical tasks, the discussion foregrounds how students interpret, manage, and cope with the demands of mathematics when information is abundant and often overwhelming. This approach provides a focused foundation for examining why persistent anxiety and difficulty remain common despite technological support, and it emphasizes the importance of aligning instructional practices with students' lived learning experiences to promote meaningful understanding, competence, and sustained engagement.

Objective of the Study

The study seeks to identify and analyze the different factors that contribute to the students' mathematical competence and influence their learning experiences in technology-rich environments. Specifically, the study sought to answer the following questions:

What is the students' level of mathematical competence, considering the following dimensions:

- mathematical anxiety;
- self-efficacy;
- relevance and value;
- artificial intelligence and digital utilization;
- learning strategies;
- teacher and classroom climate;
- math identity and mindset; and

- family and peer influence?
- Is there a significant difference between the student level of mathematical competence, considering the dimensions?

LITERATURE REVIEW

Conceptual Foundations of Mathematical Competence

Mathematical competence extends far beyond mastery of procedures and formulas, as it is widely recognized as a multifaceted construct. The literature describes it as a blend of understanding, reasoning, problem-solving, and the ability to apply mathematical ideas in varied contexts. Foundational studies emphasize that not only are internal learner factors important, but the surrounding learning environment also shapes competence. Consequently, it is essential to examine mathematics as both a cognitive activity and an experience influenced by emotions, motivation, and identity (Luzano, 2024a, 2024b, 2024d; Travero & Japos, 2024; Valencia et al., 2023). Scholars highlight that meaningful engagement with concepts, opportunities to reason and reflect, and competence in handling quantitative tasks all contribute to the evolution of competence (Papageorgiou et al., 2025). With this broader perspective, mathematics shifts from being viewed as a set of rigid steps to being positioned as a dynamic capability grounded in multiple dimensions of human learning.

These affective, cognitive, motivational, and technological dimensions together shape students' competence and overall learning experiences. Building on the understanding that mathematics involves more than just technical proficiency, affective factors—such as confidence and emotional responses—are strong predictors of engagement and persistence, with studies consistently showing that positive emotions support deeper understanding (Bendol & Dalayap, 2025; Luzano, 2024c; Travero & Japos, 2024; Zakariya et al., 2024). Cognitive skills, including working memory, reasoning, and conceptual knowledge, form the core of mathematical performance and determine how well students process and apply new information (Gamit, 2022; Luzano, 2024a, 2024b; Papageorgiou et al., 2025; Pasigon, 2024). Motivation influences the desire to learn, seek help, and persevere through challenges, making it a vital component of competence (Acopio, 2025; Melchor et al., 2023; Nob et al., 2024; Tañola & Lomibao, 2024). In recent years, the technological dimension has gained prominence, as digital tools, learning platforms, and artificial intelligence are increasingly integrated into instruction. These tools can enhance engagement and accessibility, but they also require learners to navigate unfamiliar interfaces and large amounts of information, adding new layers to what it means to be mathematically competent today (Layco, 2022; Luzano, 2024c; Taja-on et al., 2025).

In addition to these individual dimensions, the literature also underscores the importance of metacognitive, environmental, identity-based, and sociocultural factors as further contributors to mathematical competence. Metacognition, or the ability to plan, monitor, and evaluate one's learning, is essential for developing independence and flexibility in solving mathematical problems (Luzano, 2024b; Pasigon, 2024; Tañola & Lomibao, 2024; Travero & Japos, 2024). Environmental factors, such as classroom climate, instructional methods, and the availability of support systems, shape learners' exposure to meaningful mathematical tasks and influence their competence in tackling them (Aguilar, 2021; Bendol & Dalayap, 2025; Luzano, 2023; Luzano, 2024a). Identity-based dimensions relate to how students see themselves as learners of mathematics—whether they feel capable, included, and valued within mathematical spaces (Aguilar, 2021; Barete & Taja-on, 2024; Ridho & Muhammad, 2023; Taja-on et al., 2025). Sociocultural influences, including expectations from family, peers, and cultural norms, further guide how learners interpret the purpose and value of mathematics in their lives (Espinosa & Elipane, 2025; Luzano, 2024d; Taja-on et al., 2024). Concurrently, these dimensions demonstrate that competence emerges from a complex interplay of personal and contextual factors, highlighting the need for a holistic understanding of mathematical learning.

Bringing these dimensions together shows that mathematical competence is not a singular trait but a combination of abilities, beliefs, emotional responses, and experiences shaped by the environments in which learners grow. Research shows that competence is strengthened when cognitive understanding is supported by positive emotions, strong motivation, effective learning strategies, and meaningful social and cultural contexts. However, when one or more dimensions are weakened, students may struggle despite having access to abundant resources (Allic & Lunar, 2024; Barete & Taja-on, 2024; Luzano, 2024a; Pabilario, 2025; Travero & Japos, 2024; Taja-on et al., 2025). This interconnected view is especially relevant in the current age, where learners must navigate new technologies, shifting expectations, and varied learning conditions that constantly shape what it means to be competent in mathematics.

Technology Integration in Mathematics Education

This broader context of multiple dimensions sets the stage for understanding the impact of technology integration in mathematics education. Building on the interplay of these dimensions, literature on technology integration shows that digital tools, online platforms, and artificial intelligence have transformed mathematics education by offering interactive content, instant feedback, and personalized learning pathways. These technologies are often designed to simplify complex ideas and provide students with multiple ways to explore mathematical concepts (Ali et al., 2023; Cadiz et al., 2024; Engelbrecht & Borba, 2024; Melchor et al., 2023).

However, research also advises that the effectiveness of technology depends heavily on how it is used and how well students can manage the information it provides. When integrated thoughtfully, technology can enhance understanding, support practice, and encourage exploration. Yet when introduced without clear guidance, it can increase cognitive load, create confusion, and widen differences in students' competence and readiness (Acopio, 2025; Hidayat & Firmanti, 2024; Luzano, 2024c; Roble et al., 2020; Sweller, 2022). This dual impact reflects the paradox of accessibility, where tools meant to support learning may also complicate it, particularly for students who already feel unsure about their mathematical abilities.

Mathematics Anxiety and Affective Responses in Learning

This emphasis on the affective dimension becomes more evident when considering the extensive literature on mathematics anxiety, which is consistently identified as a major barrier to competence. Studies show that anxiety affects cognitive processing (Yu, 2023), limits working memory (Finell et al., 2022), and reduces students' ability to engage meaningfully with mathematical tasks (Li et al., 2021). Even with available technological supports, learners may avoid mathematical activities if they associate the subject with fear, stress, or repeated failure (Barete & Taja-on, 2024; Bendol & Dalayap, 2025; Layco, 2022; Tañola & Lomibao, 2024; Vargas, 2021). Digital tools may help some students manage their anxiety by offering private, low-pressure practice environments, however they may also amplify anxiety when tasks appear overwhelming or when students struggle to interpret automated feedback (Dodongan, 2022; Ersozlu, 2024; Luzano, 2024c; Nob et al., 2024). The persistence of mathematics anxiety, despite technological advancements, underscores how emotional responses remain central to the learning experience and reinforces the need to view competence as both cognitive and deeply affective.

THEORETICAL FRAMEWORK

The study draws on Cognitive Load Theory (Sweller, 2022) to explain how students process mathematical information in environments where digital and AI tools are widely available. According to this theory, learners have limited mental capacity, and when instructional materials or digital resources become too complex or overwhelming, understanding is hindered rather than improved. In technology-rich classrooms, students often encounter multiple representations, fast-paced information, and layered tasks that require simultaneous attention. Cognitive Load Theory helps clarify how these conditions may contribute to confusion, fatigue, or misunderstanding, even when tools are designed to support learning.

Complementary to this, Information Overload Theory (Pernagallo & Torrisi, 2022) provides a lens for understanding how the abundance of online explanations, tutorials, videos, and problem-solving platforms may exceed students' ability to filter and prioritize information. When learners are faced with too many options or conflicting explanations, they may struggle to identify which resources are reliable or relevant. The two theories complement each other by illustrating how both the structure of instructional materials (Cognitive Load) and the overwhelming volume of available content (Information Overload) can jointly affect mathematical competence. Together, these theories provide a coherent framework for analyzing how digital abundance, while promising support, may inadvertently contribute to the persistence of difficulties in learning mathematics.

Building upon this framework, as illustrated by **Figure 1**, the schematic diagram delineates the manner in which students' mathematical competence is influenced by a cluster of interconnected dimensions that affect learning in the digital era. These include affective elements such as anxiety and confidence; cognitive abilities comprising reasoning and comprehension; motivational drivers related to interest and perseverance; technological engagement and familiarity; metacognitive strategies for planning and monitoring learning; contextual factors such as social support and instructional practices; identity-based considerations including self-efficacy and belonging; and sociocultural components that inform students' experiences and expectations. The interplay among these dimensions and the challenges presented by digital tools and online information offer a comprehensive perspective on the emergence of competence within complex educational environments.

Synthesis

The literature reviewed establishes competence as a set of interrelated dimensions that were explicitly operationalized in this research to guide measurement and analysis. Cognitive, affective, motivational, technological, metacognitive, environmental, identity-based, and sociocultural factors were not discussed as independent concepts, but as coordinated domains that collectively describe how students experience and manage mathematical learning in contemporary settings. This framing provided a clear basis for translating theory into measurable indicators, ensuring that competence was examined through defined and empirically grounded dimensions rather than abstract descriptions. The study positioned mathematical competence as a multidimensional but coherent construct that can be systematically assessed within technology-rich environments by organizing prior research around these domains.

The reviewed literature further informed how these dimensions function together under conditions of high information availability. Rather than treating technology, emotions, or learning strategies as separate influences, the discussion established how students' engagement with mathematics emerges from the interaction of these factors. Prior studies consistently show that cognitive processing, emotional responses, motivation, and identity are shaped by both instructional context and the way learners navigate digital information.

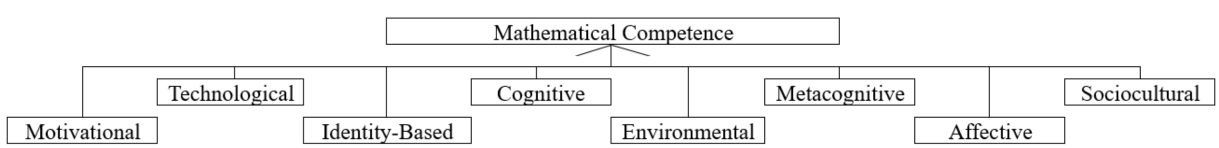

Figure 1. Schematic framework of the study (Source: Author's design, 2025)

These insights were used to justify the study's analytical focus on variation across dimensions, allowing competence to be examined as a patterned experience rather than a single outcome. In this way, the literature review did not merely catalogue influencing factors but provided a structured foundation for analyzing differences in students' mathematical competence, particularly in environments where access to information and digital tools is high.

Within this framework, technology was positioned as a contextual condition that interacts with, rather than defines, competence. The literature consistently indicates that while digital and AI-based tools increase access and engagement, they also introduce additional demands on students' cognitive and emotional resources. These demands shape how learners regulate information, manage effort, and interpret feedback. The study clarified why competence must be examined across multiple domains and why uneven development across these domains is analytically meaningful by integrating these insights into the conceptual discussion.

METHODOLOGY

Research Design

The study employed a descriptive quantitative research design (Thomas & Zubkov, 2023) to examine patterns of mathematical struggle among college learners in a technology-rich environment. The design enabled the researchers to systematically describe students' levels of mathematical competence and identify variations across different groups using measurable indicators. Through this approach, the study quantified the extent to which the dimensions of mathematical experience influenced students' experiences. The research was conducted at San Isidro College, providing a focused setting that reflects the learning realities of a diverse student population engaged in foundational mathematics courses.

Sampling Method and Respondents of the Study

The study used stratified random sampling, grouping respondents by degree program before selecting participants. This method ensured that students from different academic disciplines had equal opportunities to be included in the sample, reflecting the varied backgrounds that influence mathematical competence. Only students enrolled in Mathematics in the Modern World were included, as this course serves as the common general education mathematics course for all first-year college students. The respondents were first-year college students enrolled in Mathematics in the Modern World, forming a total sample of 873 participants as presented in **Table 1**. These students represent the entry-level population in higher education who engage with mathematics in a general education context, making them an appropriate group for exploring foundational mathematical competence in the age of accessible digital tools. Their diverse academic backgrounds provided a broad view of how different learners encounter and navigate mathematics during their transition to college life.

Table 1. Demographic profile of the first-year college students (N=873)

Demographic		Frequency	%
Gender	Male	343	39.29
	Female	530	60.71
Department	Arts and Sciences	32	3.67
	Education	155	17.75
	Accountancy	30	3.44
	Business Administration	92	10.54
	Engineering	127	14.55
	Information Technology	69	7.90
	Nursing and Midwifery	368	42.15

Table 2. Reliability of the mathematical competence questionnaire

Category	Dimensions	Items	Kα	Rel.	Cα	Int. Con.
Affective	Mathematical Anxiety	10	0.977	High	0.871	Good
Cognitive	Self-Efficacy	10	0.941	High	0.855	Good
Motivational	Relevance and Value	10	0.908	High	0.901	Excellent
Technological	AI and Digital Utilization	10	0.944	High	0.917	Excellent
Metacognitive	Learning Strategies	10	0.950	High	0.876	Good
Environmental	Teacher and Classroom Climate	10	0.973	High	0.900	Excellent
Identity-Based	Math Identity and Mindset	10	0.918	High	0.896	Good
Sociocultural	Family and Peer Influence	10	0.927	High	0.862	Good
	Overall	80	0.962	High	0.921	Excellent

Legend: Kα – Krippendorff's Alpha, Rel. – Reliability, Cα – Cronbach Alpha, Int. Con. – Internal Consistency

Research Instrument

The researchers gathered data using a researcher-made survey questionnaire designed to measure multiple dimensions of mathematical competence, which was validated by seven (7) experts in mathematics and education. As shown in **Table 2**, the analysis resulted in a strong Krippendorff's alpha of 0.962, demonstrating excellent agreement among the validators. Following this, the instrument was pilot-tested among 321 second- to fourth-year college students, producing a Cronbach's alpha of 0.921, which confirmed its high internal consistency and reliability. These procedures collectively ensured that the instrument effectively measured students' affective, cognitive, motivational, technological, metacognitive, environmental, identity-based, and sociocultural experiences in learning mathematics.

Data Gathering Procedure and Data Analysis

The data collection process was carried out with careful attention to ethical standards to protect the well-being, privacy, and voluntary participation of all respondents. Prior to the administration of the survey, students received a clear explanation of the research's purpose and scope, including how their responses would be used and the measures taken to ensure anonymity. They were informed that no personally identifiable information would be collected and that all data would be kept strictly confidential. Participation was emphasized as entirely voluntary, and students were given the option to decline or withdraw at any time without academic or personal consequences. To ensure consistency and minimize external influence, the survey questionnaires were administered online through a secure platform (Taherdoost, 2021). This method allowed students to answer the items at their own pace and in a setting that made them feel comfortable, reducing pressure and potential bias. Once the responses were submitted, each form was carefully reviewed for completeness before being encoded into a protected database. Data handling followed a systematic process in which files were stored in password-protected digital folders accessible only to the researchers, to maintain the integrity and confidentiality of the information. Data were analyzed using descriptive statistics to summarize students' levels of mathematical competence across the instrument's eight dimensions. To further examine differences in students' responses, analyses of variance (ANOVA) were conducted to determine whether statistically significant variations existed among the dimensions

RESULTS AND DISCUSSION

This section presents the findings of the study based on the assessment of students' mathematical competence across multiple dimensions and the comparison of these dimensions to determine meaningful variations in their learning experiences. These results provide the basis for understanding the different factors that influence students' performance and engagement in mathematics within the contemporary learning environment.

Table 3. Students' level of mathematical competence considering the dimensions

Dimensions	$\bar{x}$	σ_x	Qualitative Interpretation
Mathematical Anxiety	4.44	1.187	Very High Anxiety
Self-Efficacy	3.28	0.984	Moderate Confidence
Relevance and Value	2.55	2.094	Low Perception of Value
AI and Digital Utilization	4.17	0.875	High Utilization
Learning Strategies	3.07	1.642	Moderate Metacognitive Awareness
Teacher and Classroom Climate	1.82	1.778	Negative Teacher Influence and Climate
Math Identity and Mindset	2.19	1.544	Weak Mathematical Identity and Fixed Mindset
Family and Peer Influence	2.66	1.072	Moderate Socio-Cultural and Environment Support

Students' Level of Mathematical Competence Across Dimensions

Table 3 presents the students' level of mathematical competence as measured across eight key dimensions. The results summarize how students rated their cognitive, emotional, environmental, technological, and identity-related experiences in learning mathematics.

Mathematical Anxiety (Affective)

The results in **Table 3** indicate that students report very high levels of anxiety toward mathematics, reflecting a strong affective response within their learning experience. Rather than indicating performance outcomes, these scores capture students' perceived emotional readiness when engaging with mathematical tasks. High anxiety is reflected in how students experience difficulty sustaining attention, organizing information, and recalling procedures, particularly when faced with multiple explanations or resources at once. In this sense, anxiety represents an affective dimension of mathematical competence that shapes how learning demands are experienced, often making mathematical tasks feel heavier and less manageable from the students' perspective (Li et al., 2021; Ersozlu, 2024).

These findings suggest that students perceive their emotional readiness for mathematics as limited, which may influence their willingness to persist, participate, and engage deeply with mathematical content. Within the scope of self-reported experiences, anxiety appears as a constraining condition that interacts with cognitive demands and available supports, rather than as a direct cause of reduced competence. Students who report heightened anxiety may also describe tendencies to withdraw from challenging tasks or feel overwhelmed when navigating learning resources, reinforcing perceptions of difficulty (Luzano, 2024b; Tañola & Lomibao, 2024; Bendol & Dalayap, 2025). Framed within broader competence models that recognize affective dimensions alongside cognitive and contextual factors, anxiety emerges as a key indicator of perceived vulnerability, helping explain why access to information and tools does not automatically translate into confidence or sustained engagement.

Self-Efficacy (Cognitive)

The results in **Table 3** indicate that students report a moderate level of confidence in their mathematical abilities, reflecting a cognitive dimension of perceived competence rather than direct performance. This level of self-efficacy suggests that students recognize some personal capability in engaging with mathematical tasks, yet this confidence is not consistently stable as task demands increase. Students' responses indicate that confidence is generally sufficient for familiar or routine activities but becomes less reliable when they encounter unfamiliar problems, dense explanations, or competing sources of information. In such situations, students describe greater hesitation and difficulty prioritizing information, highlighting how self-efficacy shapes their experienced readiness to manage complexity rather than determining outcomes outright (Gamit, 2022; Yu, 2023).

Taken together, these findings portray self-efficacy as a functional but fragile aspect of students' mathematical competence. Moderate confidence supports engagement but does not always sustain persistence, independent reasoning, or decisive action under increased cognitive demand. Students' reported reliance on external supports or frequent reassessment reflects how they experience uncertainty in their own judgment, especially in learning environments rich in strategies and explanations (Engelbrecht & Borba, 2024; Luzano, 2024c; Pasigon, 2024; Nob et al., 2024). Positioned within multidimensional competence frameworks, self-efficacy emerges as a cognitive mediator that shapes how students experience effort, organize learning, and respond to challenge, reinforcing the view that confidence operates as an experiential condition rather than a direct indicator of mathematical ability.

Relevance and Value (Motivational)

The results in **Table 3** indicate that students report a low perceived relevance or value of mathematics in relation to their daily lives and future plans. This finding reflects a motivational dimension of perceived competence, where students' responses suggest that mathematics is experienced as distant from personal goals rather than inherently difficult. When relevance is perceived as low, students describe engagement that is more compliance-driven, with limited inclination to invest sustained effort or reflect deeply on mathematical ideas. In this sense, perceived value shapes how students experience learning demands, influencing what they choose to attend to and how meaningfully they engage with explanations, without implying direct effects on performance outcomes.

This pattern suggests that students' mathematical competence, as experienced through motivation, is constrained by weak personal meaning rather than limited access to learning resources. Students' reports indicate that tasks are often approached as requirements to be completed, not as opportunities for understanding or growth. Positioned within broader competence frameworks, perceived value functions as a motivational condition that shapes the depth and quality of engagement, guiding persistence and curiosity when meaning is present and narrowing participation when relevance is unclear (Acopio, 2025; Tañola & Lomibao, 2024; Taja-on et al., 2025; Valencia et al., 2023). These findings highlight that motivation operates through students' experiences of purpose and usefulness, underscoring its role in sustaining engagement rather than determining achievement directly.

Artificial Intelligence and Digital Utilization (Technological)

The results in **Table 3** indicate that students report frequent use of AI tools and digital platforms when engaging with mathematical tasks, reflecting a high level of perceived comfort and familiarity with technological resources. Students' responses suggest that digital tools are experienced as accessible supports for obtaining explanations, checking steps, and navigating complex information during problem solving. This pattern highlights technological competence as an experiential dimension of learning, where students perceive themselves as capable of operating and accessing digital resources rather than demonstrating direct gains in mathematical performance. The findings point to how students experience information-rich environments and manage multiple inputs while working through mathematical tasks.

At the same time, students' reported experiences indicate that strong technological engagement does not consistently coincide with deeper conceptual engagement. The data suggest that digital tools function as supportive structures whose perceived value depends on how students integrate them into their thinking processes. When tools are used to clarify ideas or reflect on reasoning, they are experienced as helpful; when used mainly to confirm answers or speed up task completion, opportunities for reflection appear more limited. Positioned within broader competence frameworks, technological engagement interacts with cognitive and metacognitive dimensions but does not replace them, underscoring the role of digital use as part of an interconnected learning system rather than a direct indicator of mathematical competence (Layco, 2022; Cadiz et al., 2024; Hidayat & Firmanti, 2024; Luzano, 2024c; Acopio, 2025).

Learning Strategies (Metacognitive)

The results in **Table 3** indicate that students report a moderate level of awareness and regulation of their learning strategies when engaging with mathematical tasks. Students' responses suggest that they perceive themselves as able to plan, monitor, and reflect on their learning to some extent, particularly during routine or familiar tasks. However, this awareness appears uneven when students encounter more complex problems or multiple sources of explanation. In such situations, students describe difficulty determining which information deserves attention, how deeply to engage with content, or when to adjust their approach. These patterns reflect how students experience the demands of learning mathematics in information-rich settings, rather than demonstrating direct mastery of strategic regulation.

Within broader mathematical competence frameworks, metacognitive competence is positioned as a coordinating dimension that shapes how students experience and manage cognitive demands. The findings suggest that students' perceived use of learning strategies supports task completion but offers limited guidance for sustained reflection, adaptation, or transfer of understanding. This places metacognition as a moderating condition that influences how students navigate mathematical challenges, rather than as a direct outcome of instruction or tool availability. Students' reported experiences highlight the importance of strengthening planning, monitoring, and evaluation practices to help them maintain clarity and direction as task demands increase (Allic & Lunar, 2024; Pasigon, 2024; Tañola & Lomibao, 2024; Travero & Japos, 2024).

Teacher and Classroom Climate (Environmental)

The results in **Table 3** indicate that students generally perceive the classroom environment and teacher-related practices as less supportive of their mathematical learning. Students' responses suggest that they experience gaps in instructional pacing, clarity of explanations, and opportunities to ask questions or seek clarification. These perceptions shape how students experience mathematical tasks within the classroom setting. When instructional support is perceived as limited, students report greater difficulty organizing information, following explanations, and maintaining engagement, particularly during lessons that involve complex or unfamiliar content.

Within broader mathematical competence frameworks, the classroom environment functions as a contextual dimension that conditions how students experience and engage with mathematical demands. The findings suggest that environmental support does not directly reflect students' competence, but rather influences their perceived readiness to participate, persist, and make sense of mathematical ideas. A classroom climate experienced as less responsive may discourage active engagement or question-asking, thereby narrowing students' opportunities to develop confidence and clarity during learning. These results underscore how instructional communication and classroom interactions shape students' experiences of mathematics, highlighting the importance of creating environments that students perceive as clear, approachable, and supportive of learning (Li et al., 2021; Ersozlu, 2024; Barete & Taja-on, 2024; Luzano, 2024a; Taja-on et al., 2024; Bendol & Dalayap, 2025).

Math Identity and Mindset (Identity-Based)

The results in **Table 3** indicate that students tend to perceive themselves as having a weak mathematical identity and limited belief in their ability to improve in mathematics. Students' responses suggest that many approach mathematical tasks with low confidence and an expectation of difficulty, which shapes how they experience learning situations. Rather than reflecting actual performance, these findings highlight students' perceived competence and internal stance toward mathematics. When students anticipate struggle, engaging with new ideas may feel more mentally demanding, and they may hesitate to explore alternative solutions or reflect on mistakes, even when learning resources are available (Aguilar, 2021).

Within established views of mathematical competence, identity, and mindset function as experiential dimensions that frame how students interpret and respond to learning demands. The findings suggest that a fragile sense of capability coincides with lower persistence and reduced openness to challenge, influencing how students engage with mathematical tasks over time. These perceptions shape the quality of engagement rather than determining outcomes directly. Supporting students' sense of belonging and perceived potential in mathematics may therefore help them experience learning tasks as more manageable and meaningful, enabling more sustained engagement with available supports (Bendol & Dalayap, 2025; Pasigon, 2024; Ridho & Muhammad, 2023; Yu, 2023;).

Family and Peer Influence (Sociocultural)

The results in **Table 3** indicate that students generally perceive a moderate level of support from family and peers in relation to their mathematics learning. Students' responses suggest that encouragement and assistance are present but uneven, shaping how supported they feel when engaging with mathematical tasks. Rather than indicating the effectiveness of support in producing outcomes, the findings reflect students' experiences of social backing as they navigate learning demands. When support is perceived as inconsistent, students may feel less assured when facing challenging problems or when managing multiple explanations and resources, making mathematical tasks feel more demanding (Luzano, 2024b; Taja-on et al., 2024).

Within broader conceptions of mathematical competence, sociocultural support operates as a contextual dimension that frames students' engagement and persistence rather than directly determining competence. The findings suggest that moderate support may be sufficient for routine participation but may not consistently sustain motivation or confidence during more demanding learning situations. Students' perceived access to encouragement and shared problem-solving influences how they experience difficulty and maintain focus over time. This pattern highlights the role of social context in shaping students' learning experiences, where consistent and meaningful support can strengthen engagement and resilience without being framed as a direct cause of performance differences (Espinosa & Elipane, 2025; Pabilario, 2025).

The overall results indicate that students' mathematical competence, as perceived through their reported experiences, is unevenly distributed across affective, cognitive, motivational, technological, and contextual dimensions. Internal dimensions such as anxiety, self-efficacy, identity, and mindset remain in the low to moderate range, suggesting that many students experience mathematics with emotional strain and uncertain confidence in their capacity to grow. These perceptions coexist with moderate cognitive and metacognitive awareness, indicating that students are able to engage with tasks but often experience difficulty sustaining focus, regulating strategies, and persisting when demands increase (Luzano, 2024a; Pasigon, 2024; Ridho & Muhammad, 2023; Travero & Japos, 2024). Taken together, these findings reflect a form of competence that students recognize as present, yet experienced as fragile under conditions that require prolonged reasoning or adaptive thinking.

Across external dimensions, students report mixed learning conditions. Family and peer support, classroom climate, and perceived relevance of mathematics are experienced as moderate to low, pointing to learning contexts that offer some encouragement but lack stability or depth. In contrast, technological engagement emerges as a consistently strong area, with students reporting frequent use of digital and AI-supported tools. Rather than indicating effectiveness, this contrast reflects differences in access and reliance as experienced by students. While digital tools are readily available and widely used, students' perceived ability to convert this access into meaningful understanding appears shaped by motivation, emotional readiness, and the consistency of social and instructional support (Acopio, 2025; Luzano, 2024b; Pabilario, 2025; Valencia et al., 2023). Synthesized across dimensions, mathematical competence in this study is best understood as an interaction of perceived strengths and constraints, where technological access coexists with emotional vulnerability and uneven contextual support, resulting in competence that students experience as functional but easily strained.

Comparison of Students' Mathematical Competence Across Dimensions

Table 4 presents the comparative analysis of the eight dimensions to determine whether statistically significant differences exist in how students experience and engage with various aspects of mathematical learning. The results in **Table 4** indicate that students' mathematical experiences vary notably across the eight competence dimensions, reflecting differences in how students perceive and navigate mathematical learning rather than uniform levels of ability. Engagement with digital tools and AI-assisted platforms emerges as the most prominent dimension, suggesting that students experience high familiarity and comfort with technology when working on mathematical tasks. Cognitive and metacognitive dimensions are perceived at moderate levels, indicating that students recognize their capacity to process information and apply learning strategies, though these experiences are not consistently stable across contexts. In contrast, motivational, sociocultural, identity-based, and environmental dimensions are perceived more weakly, pointing to limited personal meaning, uneven social support, fragile mathematical self-concept, and classroom conditions that students experience as less supportive. The affective dimension remains the lowest, highlighting persistent anxiety and discomfort that frame how students experience mathematical demands overall.

This uneven profile suggests that students' mathematical competence is experienced as situational and dependent on the interaction of personal, cognitive, and contextual conditions. Strong technological engagement coexists with moderate perceived thinking skills but is accompanied by emotional strain, weak identity, and low motivation, creating learning experiences that students may perceive as demanding and unstable. Rather than indicating that technology drives these outcomes, the findings suggest that access to digital tools operates within broader learning conditions shaped by emotional readiness, perceived support, and relevance. Students may feel capable when navigating technology-supported tasks while simultaneously experiencing difficulty with independent reasoning, sustained focus, or emotional regulation in less structured situations (Hidayat & Firmanti, 2024; Li et al., 2021; Luzano, 2024c; Yu, 2023). Overall, the results position mathematical competence as an integrated experience, where technological access is a visible strength but does not offset vulnerabilities in emotional, motivational, and contextual dimensions that influence how students experience learning mathematics (Acopio, 2025; Ali et al., 2023; Cadiz et al., 2024; Engelbrecht & Borba, 2024).

CONCLUSION

The findings suggest that students' mathematical competence varies widely across emotional, cognitive, environmental, and technological areas. Students exhibit moderate confidence, reasonable metacognitive awareness, and strong engagement with digital and AI-assisted tools.

Table 4. Comparison between categories on the students' level of mathematical competence considering the dimensions of the study

Category	Dimensions	$\bar{x}$	F	p
Technological	AI and Digital Utilization	4.17 a	26.778	<0.001
Cognitive	Self-Efficacy	3.28 b		
Metacognitive	Learning Strategies	3.07 b		
Sociocultural	Family and Peer Influence	2.66 c		
Motivational	Relevance and Value	2.55 c		
Identity-Based	Math Identity & Mindset	2.19 d		
Environmental	Teacher and Classroom Climate	1.82 de		
Affective	Mathematical Anxiety	1.56 e		

** - p<0.001, very significant

At the same time, they struggle with high anxiety, weak mathematical identity, low motivation, and unsupportive classroom environments. The significant differences found across the eight dimensions substantiates that students' mathematical experiences are not uniform. Technological engagement emerges as the strongest area, while affective, identity-based, and environmental factors present the greatest challenges. Students have the tools to access information, but still experience difficulties regulating mental demands and managing the overwhelming amount of information available to them.

These findings provide new insights into why students' struggles with mathematics persist, even with increased technological support. The results indicate that while technology reduces some burdens by simplifying procedures and offering instant feedback, it may unintentionally mask deeper difficulties related to competence, mindset, and emotional regulation. This creates an uneven learning landscape where students appear competent when assisted by tools but struggle when required to engage with concepts independently. The study highlights the need to balance technological support with intentional efforts to strengthen emotional readiness, identity formation, and classroom relationships. The result underscores that meaningful improvement in mathematical competence requires not only access to digital tools but also supportive learning environments that help students manage cognitive challenges, reduce anxiety, and build a stronger sense of belonging in the subject.

LIMITATIONS

The study is limited by its reliance on self-report measures collected from students in a single institution, which constrains the extent to which the findings may be generalized to broader populations. The use of survey data captures students' perceptions of their competence, emotional responses, learning strategies, and learning environments rather than their actual mathematical performance or observable behaviors. While this approach is appropriate for examining learners' experiences in technology-rich contexts, it also means that reported levels of confidence, anxiety, and strategy use may not fully correspond to students' demonstrated skills during mathematical tasks. As such, the results should be interpreted as reflective of students' perceived competence and engagement with mathematics, rather than definitive measures of mathematical ability.

This methodological focus is particularly relevant in environments where digital tools and AI-assisted resources are widely used. Students' reliance on technology may shape how they evaluate their own competence, sometimes inflating confidence or masking underlying difficulties that would be more visible through direct performance assessments. Although the study examined multiple dimensions to provide a comprehensive view of students' learning experiences, the absence of objective performance data limits the ability to link these perceptions directly to mathematical outcomes. These considerations highlight the need for careful interpretation of the findings and reinforce the value of future studies that integrate self-report data with performance-based or observational measures to provide a more complete understanding of mathematical learning in contemporary settings.

RECOMMENDATIONS

The findings suggest the need for targeted actions that directly address the most vulnerable dimensions of students' mathematical competence. Institutions may prioritize structured anxiety-reduction initiatives, such as short workshops on managing test-related stress, guided problem-solving sessions that emphasize low-stakes practice, and regular opportunities for reflective discussion about mathematical difficulties. Classroom practices may be strengthened by promoting clearer instructional pacing, consistent feedback, and open questioning routines that encourage student participation without fear of error. To support identity and mindset development, instructors may incorporate activities that highlight progress over correctness, normalize struggle as part of learning, and allow students to explain their reasoning in varied formats, including written, oral, or visual representations.

Given students' strong engagement with digital and AI tools, technology may be integrated more deliberately through guided use rather than open-ended reliance. Educators may provide curated digital resources with clear purposes, such as step-by-step solution analyses, concept-check prompts, or reflective questions that require students to explain outputs generated by AI tools. Structured guidelines on when and how to use technology—paired with moments where students solve problems without digital support—may help balance convenience with independent reasoning. At the institutional level, professional development may focus on aligning technology use with learning goals while maintaining supportive classroom climates. Combined, these practices may help reduce unnecessary mental strain, strengthen competence and motivation, and support more balanced mathematical learning experiences.

FURTHER STUDIES

Future research could explore how specific interventions—such as anxiety-reducing programs, learning-strategy training, or teacher-focused professional development—improve the weakest dimensions from the study. Additional studies may also compare different institutions or disciplines to see if the patterns are consistent across diverse environments. Since current results show strong technological engagement, further investigation may focus on the quality of students' digital usage. Researchers could study how different AI tools influence critical thinking, problem-solving, and long-term retention. Longitudinal studies are also encouraged to see how students' competence and behaviors change over time as technology advances. These findings may deepen the understanding of how digital access shapes both strengths and struggles.

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REFERENCES

Acopio, M. K. M. G. (2025). Technological proficiency and online resource utilization in mathematics education: A study of higher education instructors in the Philippines. *Jurnal Elemen*, *11*(4), 845-859. https://doi.org/10.29408/jel.v11i4.32134

Aguilar, J. J. (2021). High school students' reasons for disliking mathematics: The intersection between teacher's role and student's emotions, belief and self-efficacy. *International Electronic Journal of Mathematics Education*, *16*(3), Article em0658. https://doi.org/10.29333/iejme/11294

Ali, M. S. B., Yasmeen, R., & Munawar, Z. (2023). The impact of technology integration on student engagement and achievement in mathematics education: A systematic review. *International Journal on Integrated Education*, *6*(3), 222-232. https://doi.org/10.31149/ijie.v6i3.4182

Allic, C., & Lunar, B. (2024). Understanding patterns, quantifying relationships, and predicting the future with mathematics in the modern world: Inputs to pedagogical innovation. *Education & Learning Developing Nations*, *2*(1), 1-3. http://doi.org/10.26480/eldn.01.2024.01.03

Barete, M. G., & Taja-on, E. P. (2024). Students' perception in learning the course mathematics in the modern world: A qualitative study. *East Asian Journal of Multidisciplinary Research*, *3*(7), 2721-2738. https://doi.org/10.55927/eajmr.v3i7.10071

Bendol, R. L., & Dalayap Jr, R. H. (2025). Students' confidence in mathematics: A comprehensive literature review. *Indonesian Journal of Multidiciplinary Research*, *5*(1), 187-196. https://doi.org/10.17509/ijomr.v5i1.82065

Cadiz, M. C. D., Manuel, L. A. F., Reyes, M. M., Natividad, L. R., & Ibarra, F. P. (2024). Technology integration in Philippine higher education: A content-based bibliometric analysis. *Jurnal Ilmiah Ilmu Terapan Universitas Jambi*, *8*(1), 35-47. https://doi.org/10.22437/jiituj.v8i1.31807

Dodongan, E. B. (2022). Math anxiety, learning engagement and perceived usefulness of technology as predictors to mathematics performance of students. *International Journal of Trends in Mathematics Education Research*, *5*(1), 12-18. https://doi.org/10.33122/ijtmer.v5i1.104

Duterte, J. P. (2024). Technology-enhanced learning environments: Improving engagement and learning. *International Journal of Research and Innovation in Social Science*, *8*(10), 1305-131. https://dx.doi.org/10.47772/IJRISS.2024.8100111

Engelbrecht, J., & Borba, M. C. (2024). Recent developments in using digital technology in mathematics education. *ZDM–Mathematics Education*, *56*(2), 281-292. https://doi.org/10.1007/s11858-023-01530-2

Ersozlu, Z. (2024). The role of technology in reducing mathematics anxiety in primary school students. *Contemporary Educational Technology*, *16*(3), ep517. https://doi.org/10.30935/cedtech/14717

Espinosa, A. A., & Elipane, L. (2025). Cultural and linguistic factors in the effective use of lesson study with mathematics and science teachers in the Philippines. *International Journal of Innovation in Science and Mathematics Education*, *33*(1). https://doi.org/10.30722/33.01.003

Finell, J., Sammallahti, E., Korhonen, J., Eklöf, H., & Jonsson, B. (2022). Working memory and its mediating role on the relationship of math anxiety and math performance: A meta-analysis. *Frontiers in Psychology*, *12*, 798090. https://doi.org/10.3389/fpsyg.2021.798090

Gamit, A. M. (2022). Cognitive skills in basic mathematics of college freshmen in the Philippines. *Journal of Applied Mathematics and Physics*, *10*(12), 3616-3628. https://doi.org/10.4236/jamp.2022.1012240

Hidayat, A., & Firmanti, P. (2024). Navigating the tech frontier: A systematic review of technology integration in mathematics education. *Cogent Education*, *11*(1), Article 2373559. https://doi.org/10.1080/2331186X.2024.2373559

Layco, E. P. (2022). Mathematics education 4.0: Teachers competence and skills readiness in facing the impact of industry 4.0 on education. *Journal of Positive School Psychology*, *6*(2), 1233-1259. https://journalppw.com/index.php/jpsp/article/view/1642

Li, Q., Cho, H., Cosso, J., & Maeda, Y. (2021). Relations between students' mathematics anxiety and motivation to learn mathematics: A meta-analysis. *Educational Psychology Review*, *33*(3), 1017-1049. https://doi.org/10.1007/s10648-020-09589-z

Luzano, J. F. (2023). Understanding the disparities in PISA (Programme for International Student Assessment) implementation in the Philippines: An integrative review in the mathematics education context. *International Journal of Academic and Applied Research*, *8*(5), 122-128. https://dx.doi.org/10.2139/ssrn.5479309

Luzano, J. (2024a). A scoping review of the professional practices and standards in mathematics in higher education. *Journal of Harbin Engineering University*, *45*(3), 1-6. https://harbinengineeringjournal.com/index.php/journal/article/view/2597

Luzano, J. F. (2024b). Multifaceted structures of mathematics education in the Philippines: a case analysis. *Diversitas Journal*, 9(3), 1170-1186. https://doi.org/10.48017/dj.v9i3.3062

Luzano, J. F. (2024c). New frontier in mathematics education: A review of emerging trends and critical issues on artificial intelligence. *International Journal of Technology in Education, 8*(1), 208-219. https://doi.org/10.46328/ijte.1028

Luzano, J. F. (2024d). Optimizing ipsative assessment in the Philippines: A narrative review on the experiences of mathematics teachers. *Diversitas Journal*, *9*(2). https://doi.org/10.48017/dj.v9i2.2964

Melchor, P. J. M., Lomibao, L. S., & Parcutilo, J. O. (2023). Exploring the potential of AI integration in mathematics education for generation alpha—approaches, challenges, and readiness of Philippine tertiary classrooms: A literature review. *Journal of Innovations in Teaching and Learning*, *3*(1), 39-44. https://doi.org/10.12691/jitl-3-1-8

Nob, J. M. R. O., Roble, D. B., & Lomibao, L. S. (2024). Unveiling the effects of gamification on math learning: A literature review in the Philippine context. *Journal of Innovations in Teaching and Learning*, *4*(1), 13-19. https://doi.org/10.12691/jitl-4-1-3

Pabilario, L. (2025). Impact of technological tools on mathematics pedagogy: Data-driven insights into educators' practices in math classrooms. *Engineering Proceedings*, *107*(1), Article 5. https://www.mdpi.com/2673-4591/107/1/5#

Papageorgiou, E., Wong, J., Liu, Q., Khalil, M., & Cabo, A. J. (2025). A systematic review on student engagement in undergraduate mathematics: Conceptualization, measurement, and learning outcomes. *Educational Psychology Review*, 37, Article 66. https://doi.org/10.1007/s10648-025-10046-y

Pasigon, C. P. (2024). Mathematical Proficiency, scientific reasoning, metacognitive skills, and performance of learners in physics: A mathematical model. *International Journal of Learning, Teaching and Educational Research*, *23*(4), 252-278. https://doi.org/10.26803/ijlter.23.4.14

Pernagallo, G., & Torrisi, B. (2022). A theory of information overload applied to perfectly efficient financial markets. *Review of Behavioral Finance*, *14*(2), 223-236. https://doi.org/10.1108/RBF-07-2019-0088

Ridho, M. H., & Muhammad, I. (2023). Mathematical identity in learning mathematics: Bibliometric review. *Studies in Learning and Teaching*, *4*(3), 551-565. https://doi.org/10.46627/silet.v4i3.287

Roble, D. B., Ubalde, M. V., & Castillano, E. C. (2020). The good, bad and ugly of technology integration in mathematics from the lens of public-school mathematics teachers. *Science International (Lahore)*, *32*(5), 525-528. http://bit.ly/4rgnnp7

Sweller, J. (2022). The role of evolutionary psychology in our understanding of human cognition: Consequences for cognitive load theory and instructional procedures. *Educational Psychology Review*, *34*(4), 2229-2241. https://doi.org/10.1007/s10648-021-09647-0

Taherdoost, H. (2021). Data collection methods and tools for research; A step-by-step guide to choose data collection technique for academic and business research projects. *International Journal of Academic Research in Management*, *10*(1), 10-38. https://hal.science/hal-03741847

Taja-on, E. P., Dajero, B. K. C., & Barete, M. G. (2025). Mathematics and modern society: A Delphi study exploring Mathematics Education towards Education 4.0. *Educational Point*, *2*(1), e120. https://doi.org/10.71176/edup/16534

Taja-on, E. P., Tabor, H. R., Namoco, S. O., & Tan, R. G. (2024). A phenomenological investigation of teachers' understanding of the ethnomathematics approach. *School of Education Research Journal*, *5*(1), 85-97. https://doi.org/10.5281/zenodo.14066524

Tañola, M. D., & Lomibao, L. S. (2024). Understanding how students learn mathematics: A systematic literature review of contemporary learning strategies in mathematics education post-2020. *Journal of Innovations in Teaching and Learning*, *4*(1), 66-75. https://doi.org/10.12691/jitl-4-1-11

Thomas, D., & Zubkov, P. (2023). Quantitative research designs. In: S. Wa-Mbaleka, P. Zubkov, P. Činčala, & D.K. Penno (Eds.), *Quantitative research for practical theology* (pp.103-114). Andrews University.

Travero, A. S., & Japos, G. V. (2024). Affective determinants of mathematics learning: A literature review. *Basic & Applied Education Research Journal*, *5*(2). https://doi.org/10.11594/baerj.05.02.02

Valencia, A. D., Fernandez, D. L. S., & Tinapay, A. O. (2023). Reading proficiency as predictor of mathematical competence of junior high school learners. *International Journal of Multidisciplinary Research and Publications*, *5*(11), 50-56. https://ijmrap.com/wp-content/uploads/2023/04/IJMRAP-V5N11P33Y23.pdf

Vargas, R. A. V. (2021). A literature review on math anxiety and learning mathematics: A general overview. *Journal of Educational Research and Reviews*, *9*(5), 102-108. https://doi.org/10.33495/jerr_v9i5.21.112

Yu, H. (2023). The neuroscience basis and educational interventions of mathematical cognitive impairment and anxiety: a systematic literature review. *Frontiers in Psychology*, *14*, Article 1282957. https://doi.org/10.3389/fpsyg.2023.1282957

Zakariya, Y. F., Awofala, A. O., & Radmehr, F. (2024). Affective constructs in mathematics education. *Frontiers in Psychology*, *15*, Article 1373804. https://doi.org/10.3389/fpsyg.2024.1373804