Navigating Mathematical Landscapes: Investigating the Dynamics of Learning Environments and Attitudinal Influence on Mathematics Education

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ABSTRACT

This qualitative study explored students' attitudes toward learning mathematics within dynamic and disrupted educational environments, particularly those shaped by instructional shifts, technology integration, and crisis-related interruptions. Conducted at Agusan del Sur University (ADSSU) during the Academic Year 2024–2025, the study examined how students experienced mathematics learning across face-to-face, online, and blended modalities. The participants included nine students who joined in-depth interviews (IDIs) and fifteen students who participated in focus group discussions (FGDs), enabling the study to capture both individual experiences and shared perspectives. Data were analyzed using Braun and Clarke's six-phase thematic analysis, which guided the process of familiarization, coding, theme development, review, definition, and reporting. The interpretation of the findings was anchored on the Affective-Behavioral-Cognitive (ABC) model of attitudes, allowing the study to examine students' emotional responses, learning behaviors, and cognitive perceptions toward mathematics. The findings revealed that students' attitudes toward mathematics were strongly influenced by changes in the learning environment. The shift from face-to-face to online learning during the COVID-19 pandemic, along with recurring floods and other disruptions, affected students' motivation, confidence, focus, and persistence. Face-to-face instruction was often associated with clearer explanations, immediate feedback, and stronger emotional support, while online learning was linked to comprehension difficulties, reduced interaction, unstable connectivity, and increased dependence on digital tools. Overall, the study suggests that students' attitudes toward mathematics are not fixed but are shaped by learning conditions. Their emotional responses, behavioral engagement, and cognitive perceptions continuously interact with instructional delivery, teacher support, peer influence, technology use, and crisis experiences.

Keywords: students' attitudes, learning mathematics, ABC model, blended learning, crisis events

INTRODUCTION

In the 21st century, the ability to understand and apply mathematical knowledge is central to national development, technological advancement, and individual career success. Mathematics is not only vital for fostering critical thinking and problem-solving skills but also plays a foundational role in various disciplines, including science, engineering, economics, and data science (Pericano & Leonard, 2025). Despite its importance, mathematics remains a subject that evokes negative emotions among students across the globe. Studies consistently reveal widespread patterns of math anxiety, low self-efficacy, and avoidance behavior, which directly affect learners' academic achievement and long-term educational trajectories (Rozgonjuk et al.,2020; Daker et al.,2021).

In the Philippine context, the situation is equally concerning. Results from international large-scale assessments such as the Programme for International Student Assessment (PISA) continue to show that Filipino students lag behind their global peers in mathematical literacy (Bernardo et al., 2022; Acido & Caballes, 2024). These performance gaps are compounded by systemic challenges such as limited access to quality instruction, socioeconomic disparities, and under-resourced learning environments. The COVID-19 pandemic has further

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exacerbated these issues by forcing abrupt shifts from traditional classroom teaching to online and blended learning modalities, often without adequate preparation or infrastructure (Rotas & Cahapay, 2020; Alshaboul et al., 2024). These transitions have raised serious concerns about student engagement, particularly in subjects like mathematics that require close guidance, sustained interaction, and conceptual clarity.

As education systems respond to crisis-driven transitions and technological disruptions, student-centered research is needed to guide curriculum and instructional reform. This study explores college students' lived experiences and attitudes toward learning mathematics in face-to-face, online, and blended environments at ADSSU during the academic year 2024–2025. Focusing on affective, behavioral, and cognitive engagement, it examines how students navigate challenges shaped by the pandemic, floods, earthquakes, instructional practices, digital tools, peer interaction, and prior academic experiences. As a pioneering qualitative inquiry at ADSSU, particularly among students in mathematics-related subjects, the study addresses a gap in institutional knowledge by examining how learners emotionally respond to mathematics, adjust their learning behaviors, and form perceptions of the subject. The findings aim to inform responsive, inclusive, and crisis-sensitive mathematics education in the Philippines.

More specifically, the study sought to explore the following research questions:

1. What are the diverse perspectives and attitudes that college students hold toward learning mathematics?
2. What factors do students perceive as influencing their attitudes toward learning mathematics?
3. How do students' past experiences with mathematics contribute to their current attitudes?

METHODOLOGY

Research Design

This study employed a phenomenological qualitative design to investigate the lived experiences of college students in learning mathematics across diverse instructional settings, including face-to-face, online, and blended environments. Rooted in the framework of Creswell and Creswell (2023), phenomenology was chosen to explore the essence of students' emotional, cognitive, and behavioral engagement with mathematics. Participants were selected through purposive sampling, ensuring varied academic backgrounds and experiences. Data were gathered through semi-structured in-depth interviews and focus group discussions, which provided rich, first-hand accounts of students' attitudes, motivations, and challenges in mathematics learning. Data were analyzed using Braun and Clarke's (2006) six phases phenomenological method.

Participants

Tables 1 and 2 present the participants in both the in-depth interviews (IDIs) and focus group discussion. (FGD). The participants were college students from various academic programs, including those inclined toward mathematics as well as those who expressed disinterest in the subject. The IDI group consisted of nine participants, mostly male, aged 19 to 32, and represented all year levels. The FGD group included 15 participants with a balanced distribution of males and females, aged 18 to 22, and predominantly first-year students. This composition allowed the study to capture a wide range of perspectives, reflecting both positive and negative dispositions toward learning mathematics. The diversity in academic background, year level, and attitude toward mathematics enriched the data, offering deeper insights into students' classroom experiences and engagement with the subject.

Table 1. IDI Participants

No	Pseudonym of the Participants	Course	Age	Sex	Year Level
1	Zulo	BSEd-Math	21	M	1

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2	Cajo	BSEd-Math	32	M	3
3	Robi	BAT	22	M	3
4	Marba	BSEd-Science	25	F	4
5	Tumar	BSEd-Math	19	M	3
6	Jeta	BSEd-Math	22	M	1
7	Anta	ABEL	23	F	3
8	Jevil	BSEd-Math	31	M	2
9	Miku	BTLEd-AFA	19	M	2

Table 2. FGD Participants

No	Pseudonym of the Participants	Course	Age	Sex	Year Level
1	Navi	BSEd-Science	19	M	1
2	Benrea	BSAF	22	F	2
3	Jolo	BS-Biology	22	M	4
4	Baer	BSAF	19	F	2
5	Bjay	BTLEd-AFA	21	M	1
6	Paril	BSEd-Math	21	M	3
7	Harbe	BSEd-English	18	F	1
8	JB	BTLEd-AFA	18	M	1
9	Jaal	BSEd-English	19	M	1
10	Bonfra	BEEd	20	M	1
11	Daji	BTLEd-AFA	18	F	1
12	Mobo	BSEd-Science	18	M	1
13	Majel	BSEd-Math	22	F	4
14	Jazen	BTLEd-AFA	18	F	1
15	Nano	BSEd-Math	20	M	3

Data Collection

To explore students' attitudes toward learning mathematics in dynamic learning settings, the researcher employed a systematic data collection process. The procedure began with the development of an interview guide designed to elicit students' perceptions, attitudes, and experiences across varied learning environments. The guide was reviewed and validated by five expert evaluators, whose comments on clarity, relevance, and appropriateness were carefully considered and incorporated into the final version of the instrument.

Before data collection, ethical approval and administrative consent were secured from the College President to ensure compliance with institutional protocols. Informed consent was also obtained from all participants after they were briefed on the purpose of the study, the voluntary nature of their participation, the confidentiality of their responses, and the use of audio recording for accurate transcription. Although the interview guide was written in English, participants were allowed to seek clarification in either English or the vernacular and were encouraged to respond in the language in which they felt most comfortable. This linguistic flexibility helped create a more open and supportive interview environment, allowing students to express their experiences and attitudes more naturally.

Individual face-to-face interviews were conducted on campus during students' free time, such as breaks or after class hours. Each session began with a brief orientation and lasted approximately 25 to 60 minutes, depending on the depth of the participant's responses. The interviews focused on students' affective, behavioral, and cognitive attitudes toward learning mathematics, particularly within contexts shaped by the pandemic, online learning, blended instruction, and other academic disruptions. To complement the individual interviews, a focus group discussion was conducted with a separate group of fifteen students. The same core questions were used in both the interviews and the focus group discussion to maintain consistency and support comparative thematic analysis of students' experiences across traditional and evolving learning environments.

Data Analysis

The analysis of data from the individual interviews (IDIs) and focus group discussions (FGDs) followed Braun and Clarke's (2006) six-phase thematic analysis framework. This approach provided both flexibility and rigor, allowing the researcher to identify meaningful patterns in the data while preserving the voices and experiences of the participants. All interviews were first transcribed in the local language to maintain authenticity and then translated into English to retain meaning and support coding, interpretation, and reporting. The process began with familiarization, where the researcher repeatedly read the transcripts to gain a holistic understanding of participants' emotional tones, contextual narratives, and learning behaviors. Initial reflections and preliminary observations were recorded to guide the subsequent stages of analysis.

The second phase involved generating initial codes by systematically identifying meaningful segments of the data. The researcher coded recurring ideas related to students' emotions, learning behaviors, instructional challenges, and experiences in face-to-face, online, and blended mathematics learning. These codes captured both explicit statements and deeper meanings within the participants' responses. In the third phase, the initial codes were organized into broader thematic categories based on conceptual similarities and relevance to the study's focus on students' attitudes toward mathematics. Emerging themes reflected affective responses, such as anxiety and confidence; behavioral dispositions, such as participation and avoidance; and cognitive dimensions, such as perceptions of difficulty and problem-solving strategies, consistent with the ABC model of attitude (Breckler, 1984).

The fourth phase involved reviewing the themes by re-examining the coded data and checking whether the emerging themes accurately represented the breadth and depth of participants' experiences. Some themes were refined, merged, or removed to ensure coherence, clarity, and alignment with the research questions. In the fifth phase, the themes were clearly defined and named to capture their essential meanings and contributions to understanding students' mathematics learning experiences. Attention was given to how emotional challenges, peer influence, teacher support, and access to technology shaped students' attitudes during both stable and disrupted learning periods, including the COVID-19 pandemic. Finally, the sixth phase involved producing the report by synthesizing the thematic insights into a coherent narrative, supported by illustrative quotations that preserved the authenticity of participants' voices and situated the findings within relevant theoretical and educational contexts.

Trustworthiness and Ethical Consideration

To ensure that the findings accurately reflected students lived experiences in learning mathematics across dynamic educational environments, the study observed the trustworthiness criteria proposed by Lincoln and Guba (1985). Credibility was strengthened using both in-depth interviews (IDIs) and focus group discussions (FGDs), allowing data triangulation and a richer understanding of students' affective, behavioral, and cognitive attitudes toward mathematics. Member checking was also conducted by inviting selected participants to review and validate the thematic interpretations, helping ensure that the findings faithfully represented their experiences and perspectives.

Transferability was addressed by providing detailed descriptions of the study context, participants, and learning environments, including face-to-face, online, and blended mathematics instruction. These contextual details enable readers to assess the applicability of the findings to similar educational settings, particularly those affected by disruptions such as pandemics, calamities, and shifts in learning modality. Dependability was supported through systematic documentation of the research process, including the development and expert validation of the interview guide, transcription procedures, and iterative coding guided by Braun and Clarke's (2006) thematic analysis framework. These procedures established a clear audit trail and strengthened the transparency and consistency of the qualitative inquiry.

Confirmability was maintained through reflexive practices intended to minimize researcher bias. The researcher engaged in bracketing and reflective journaling throughout data collection and analysis to document assumptions, emerging interpretations, and possible biases. Audio-recorded interviews preserved participants' exact words, tone, and emphasis, helping reduce interpretive distortion during transcription and analysis (Ahmed, 2024; Cañeda et al., 2024; McMullin, 2023). Ethical safeguards were also observed throughout the study to protect participants' rights and well-being. Institutional approval was formally obtained from the College President, and informed consent was secured after participants were briefed on the study's purpose, voluntary participation, confidentiality, and audio recording (Xu et al., 2020). Pseudonyms were used, identifying information was removed from transcripts, and all recordings and transcriptions were securely stored and accessed only by the principal researcher (Subedi, 2025). Given the sensitivity of discussing mathematics anxiety, low academic confidence, and learning challenges, interviews were conducted in safe and supportive settings where participants could share their experiences with confidence and dignity.

RESULTS AND DISCUSSION

Based on the thematic analysis of the IDI and FGD data, Table 3 presents the major themes and subthemes generated from the participants' narratives.

Table 3. Summary of Themes and Subthemes

Theme 1: Learning Environment Dynamics
Sub-Theme 1.1 Face-to-Face Learning Preferences
Sub-Theme 1.2 Online Learning
Sub-Theme 1.3 Technology Integration
Theme 2: Influential Factors in Mathematical Attitudes
Sub-Theme 2.1 Environment (School and outside School)
Sub-Theme 2.2 Past Experiences (Successes and Failures, Teacher Influence)
Theme 3: General Attitude Towards Mathematics

Subtheme 3.1 Emotional Responses to Mathematics
Subtheme 3.2 Behavioral Engagement in Mathematics

Learning Environment Dynamics

This presents how students' attitudes toward mathematics are shaped by the learning conditions, instructional modality, and technological tools they experience. Across the narratives, students described the learning environment as a significant factor affecting their emotional comfort, classroom participation, and understanding of mathematical concepts.

Preferences for Face-to-Face Learning

Affectively, face-to-face learning strengthened students' confidence and reduced discomfort in learning mathematics. Robi shared, "For me, it seems like my confidence has increased," while Cajo explained, "I prefer face-to-face because with online, I'm not very good; the signal fluctuates, and I can't focus well."

Behaviorally, students reported that face-to-face classes encouraged more active engagement and help-seeking. Jeta stated, "I favor face-to-face classes because I can ask the instructor and classmates questions," showing the importance of immediate clarification in mathematics learning. Paril added, "My method is to write it down, then follow a step-by-step process to dissect the problem," reflecting a more systematic approach to problem solving.

Cognitively, students perceived face-to-face instruction as more effective for understanding mathematical concepts because it allowed clearer explanations and step-by-step guidance. Anta noted, "It was very difficult to understand math online… even with the formula, it's just different from face-to-face," while Jolo stated, "Math is challenging, but it's easy to understand if done step by step."

Online Learning Adaptation

Students experienced fear, frustration, and isolation during online mathematics classes. Anta shared, "I have fear in Math… I stopped during the pandemic because it's online," suggesting that the online modality intensified anxiety toward mathematics. Baer similarly explained, "I couldn't learn much online, because although the answers were all there, I had to digest everything myself… without anyone to ask how it was done."

Online learning weakened students' participation and sustained engagement. Harbe admitted, "I struggled even during face-to-face classes. I was already weak, and with online formats it just got worse," while Jaal and Robi pointed out, "Also the signal is weak in our barangay."

Moreover, students perceived online mathematics learning as more difficult because they had to process concepts with less guidance and fewer opportunities for clarification. Cajo stated, "I really don't prefer online because I just can't understand it. I also don't listen because I am working," while Robi admitted, "It takes me a long time to understand online." Zulo further noted that online learning was hindered by "internet connection issues, inability to engage with classmates, and no collaborative learning," and Jeta added, "I didn't learn much because I just relied on AI apps."

Technology Integration

Technology helped reduce students' frustration and anxiety by making mathematics appear more manageable. Zulo shared, "My learning has become easier because there is technology available. I can research online," while Robi added, "Learning is greatly enhanced when using technology, you can learn a lot." Navi expressed a similar view, stating, "I use technology in Math because I find it difficult… It feels like I'm being tutored to understand more easily."

However, students also admitted that technology sometimes encouraged dependence rather than active engagement. Benrea acknowledged, “It helps to make things easier, but on the other hand, it makes me dependent. I don’t learn anymore because I just keep using it.” Harbe expressed a similar concern, noting, “It’s nice because it helps, but the disadvantage is you rely on it too much.”

Students recognized that technology could support procedural fluency but might limit deeper conceptual understanding. Anta explained, “Calculator or online resources are helpful for quickly solving data, gathering equations, and using formulas, but the downside is I don’t like to study or jot down information or write out steps properly.”

DISCUSSION

Theme 1 shows that students’ attitudes toward mathematics were strongly shaped by instructional modality, interaction, support, and technology use. Face-to-face learning was perceived as more supportive because it provided teacher guidance, peer interaction, immediate clarification, and clearer classroom routines. These conditions helped students feel more secure and focused, particularly because mathematics often requires step-by-step explanation and guided problem solving. This finding is consistent with studies showing that instructional context and teacher support influence students’ mathematics learning experiences and performance (Alabdulaziz & Tayfour, 2023; Sabanal et al., 2024).

Online learning, in contrast, was experienced by many students as more difficult and less supportive. Their narratives showed that online mathematics learning was affected by weak internet connectivity, reduced interaction, limited teacher presence, and fewer opportunities for collaborative learning. These conditions made students feel less emotionally secure and less engaged, particularly when they had to understand mathematical procedures independently. This finding is consistent with studies showing that online learning engagement depends on students’ perceived support, connection with teachers and peers, and access to effective digital learning conditions (Chiu, 2022). In mathematics, where immediate correction, explanation, and guided practice are often necessary, the absence of real-time support may increase students’ difficulty in sustaining attention and understanding concepts. Thus, students’ struggles in online learning should not be interpreted only as lack of motivation, but also as a reflection of environmental and technological barriers.

Technology integration emerged as both a helpful support and a possible challenge in mathematics learning. Students recognized that calculators, online resources, YouTube, GeoGebra, Symbolab, and AI-based tools helped them access explanations, check answers, visualize concepts, and complete mathematical tasks more efficiently. When used properly, technology appeared to reduce frustration and increase students’ sense of control over difficult mathematical content. However, students also acknowledged that technology could lead to dependence when used mainly to obtain answers rather than understanding processes. This concern is important because technology may support learning only when it promotes reasoning, verification, and conceptual understanding. It becomes problematic when it replaces persistence, independent thinking, and step-by-step mathematical work. Similar concerns are raised in discussions of digital mathematics learning, where technology is most effective when guided by meaningful instructional design rather than used as a substitute for thinking (Sofroniou et al., 2025; Wang et al., 2024b).

Overall, theme 1 suggests that students’ attitudes toward mathematics are not shaped by the difficulty of the subject alone, but by the quality of the learning conditions surrounding it. Face-to-face learning supported emotional reassurance, active participation, and clearer conceptual understanding; online learning often produced difficulty when interaction and guidance were limited; and technology provided useful learning support while also posing risks of overreliance. These findings imply that mathematics instruction in dynamic learning environments should intentionally combine direct teacher support, peer interaction, structured online engagement, and responsible technology use. For mathematics learning to be effective, technology should function as a scaffold for understanding and not as a shortcut for completing tasks.

Influential Factors in Mathematical Attitudes

This theme encapsulates the broader context, within and beyond the classroom, that shapes students' orientation toward mathematics.

Environmental Influences

Students experienced both encouragement and pressure from their social environment. Jolo shared, "The parental expectations, especially knowing my mom is an accountant, are quite high… I would cry because I really didn't like math. I wished there could be no math subject at all." This statement shows how family expectations can create emotional pressure, anxiety, and avoidance when students feel unable to meet perceived standards. In contrast, positive teacher influence appeared to strengthen comfort and motivation. Jeta stated, "I was influenced because she was good at teaching," while Marba recalled, "I experienced a teacher who didn't read books in front, and we enjoy sessions with him."

Peer groups also influenced students' engagement, effort, and willingness to participate in mathematics. Baer explained, "If you're in a circle of friends who are interested in math, you'll be influenced and start liking math too because you learn from them and adopt their interests." Similarly, Bjay shared, "When I see my classmates or friends learning like that, it motivates me to learn too, so I don't get left behind."

Students' beliefs about their mathematical ability improved when they received support from classmates or observed peers succeeding in mathematics. Harbe stated, "If I have a friend who excels in math and teaches me, especially since I'm a slow learner, I feel proud because I can solve something I thought was too difficult." Jolo also shared, "My classmates helped me in math... I was more encouraged to actively learn math rather than passively."

Impact of Past Experiences

Students recalled emotionally powerful experiences with former mathematics teachers, which either strengthened or weakened their interest in the subject. Baer described a negative experience, stating, "I had a teacher who was traumatic; the classroom vibes would change when she entered… she didn't entertain weaker students, only the bright ones." This statement suggests that unsupportive teacher behavior may create fear, exclusion, and avoidance among students who already struggle in mathematics. However, Baer contrasted this with a more positive senior high school experience: "The teacher in senior high was the opposite… I would get excited because learning math was fun during her sessions." Similarly, Paril shared, "My high school teachers were good, they taught well… I still carry what they taught me."

Students' previous success or failure also influenced their learning behaviors and persistence in mathematics. Nano explained that participation in mathematics competitions strengthened his confidence: "In the math challenges I've experienced, I was more advanced compared to my classmates… so I was truly confident in math." This reflects how success experiences can reinforce effort, participation, and willingness to take on mathematical tasks. In contrast, Anta stated, "Because my scores decreased, I lost interest, which is why I don't like math," showing how repeated or noticeable academic decline can weaken motivation and lead to disengagement.

Students also described how past teacher encouragement shaped their beliefs about their mathematical ability and even their academic identity. Jevil shared, "In high school, I liked my math teacher because I saw that he was very bright in math, which is why I also majored in math." This statement suggests that teachers can serve as intellectual models who influence students' academic interests and future choices. Jeta similarly recalled, "There was a time when I answered a problem quickly and my teacher commended me… that really boosted my confidence."

DISCUSSION

Theme 2 reveals that students' attitudes toward mathematics were shaped by environmental and experiential influences surrounding their learning. These influences included family expectations, teacher practices, peer relationships, classroom interactions, previous achievements, and remembered experiences of success or difficulty. The findings suggest that students' emotions, learning behaviors, and beliefs about their mathematical ability were not formed in isolation but developed through repeated social and academic encounters. This supports recent literature indicating that teacher support, parental involvement, and social learning conditions are associated with students' mathematics engagement, self-efficacy, anxiety, and performance (Wang et al., 2024a; Wang & Wei, 2024).

Environmental influences were evident in how family members, teachers, and peers shaped students' motivation and confidence in mathematics. Family expectations could encourage students to strive harder, but they could also create emotional pressure when learners felt unable to meet perceived standards. Teacher influence was also central, as supportive, competent, and engaging teachers appeared to make mathematics more approachable, while less supportive practices could contribute to discomfort or avoidance. Peer influences further shaped students' learning behaviors through modeling, encouragement, comparison, and shared academic support. These findings suggest that students' attitudes toward mathematics are strongly affected by the quality of the social environment in which learning occurs, particularly when teachers, peers, and families provide encouragement, guidance, and constructive expectations (Wang et al., 2024a; Walker, 2006; Vygotsky, 1978).

Past experiences also played an important role in shaping students' present attitudes toward mathematics. Earlier encounters with mathematics teachers, classroom climates, grades, competitions, feedback, and success or failure became lasting reference points for how students interpreted the subject (Hakim et al., 2023; Ongcoy et al., 2023). Positive experiences, such as supportive instruction, successful problem solving, teacher recognition, and participation in mathematical activities, contributed to stronger confidence and willingness to engage. In contrast, discouraging teacher behavior, declining scores, exclusionary classroom practices, and repeated difficulty contributed to anxiety, avoidance, and reduced motivation. This indicates that students' current attitudes toward mathematics are cumulative and are shaped by how they remember and interpret earlier academic experiences (Eidlin-Levy et al., 2023; Lara et al., 2025; O'Leary et al., 2017)

Overall, theme 2 shows that cultivating positive attitudes toward mathematics requires a supportive learning ecology. Students are more likely to develop confidence, persistence, and interest when teachers provide clear explanations, constructive feedback, and inclusive participation opportunities; when peers support collaborative learning rather than discouraging comparison; and when families communicate expectations in motivating rather than intimidating ways. The findings imply that mathematics instruction should not focus only on content delivery but should also attend to the emotional and social conditions that influence students' self-belief, engagement, and resilience. Supportive teacher practices, positive peer interactions, and affirming academic experiences may help students develop more positive and enduring mathematical identities.

General Attitudes Toward Mathematics

This theme illustrates students' internal perceptions, emotional tendencies, and classroom behaviors related to mathematics learning.

Emotional Responses

Several students expressed strong negative emotions toward mathematics, often rooted in repeated difficulty or discouraging experiences. Mobo stated, "I hate math. Since elementary, my grades haven't been great, just average… My level of confidence in math is low," while Harbe shared, "I've never liked math. From elementary to college, I just don't like it… I always anticipate failing." Bjay also recalled, "Back in elementary school, we had a math teacher who would punish us if we got a wrong answer," suggesting that fear-based classroom experiences may contribute to long-term anxiety and avoidance. Jazen's statement, "I can't see myself taking a math major," further reflects how negative emotional histories can influence students' academic self-concept and future choices.

The emotional difficulty students experienced also shaped their learning habits and classroom participation. Daji admitted, “I’m not participative, I don’t understand no matter how the teacher explains… my grades are okay, but maybe my teacher just pities me,” indicating a sense of helplessness and low academic agency. Anta similarly shared, “I tend to study only because there’s an exam the next day… I don’t pay much attention unless there’s a quiz,” which suggests that anxiety and low interest may lead to minimal, assessment-driven engagement rather than sustained learning.

Despite these negative experiences, some students demonstrated emotional ambivalence and the possibility of attitude change. Jeta reflected, “When I solve a difficult problem and find an answer, I say to myself that I can handle it after all. It improves my confidence,” showing that successful problem-solving can rebuild self-belief. Paril similarly noted, “Math is easy if you practice the procedures. It’s mixed emotions, I’m happy when I can solve problems,” suggesting that satisfaction emerges when students experience mastery. Peer support also softened negative emotions. Bonfra shared, “I don’t like math, but when it comes to group work it seems alright because you have someone to share the task with,” while JB remarked that “Math is difficult to understand but interesting, and it can be understood if properly discussed.” Magel’s account also illustrates emotional growth over time: “In college I no longer fear math, but during elementary, division was really difficult. It motivated me to get a medal. There were times I felt ashamed because I was made to stand up when I couldn’t answer.”

Behavioral Engagement

Students emphasized the importance of clear, step-by-step instruction in sustaining their participation in mathematics. Jolo explained, “Math is challenging, but it’s easy to understand if done step by step. Some instructors skip steps when they explain, making it hard for me to follow along.” Similarly, Paril shared, “My method is to write it down, then follow a step-by-step process to dissect the problem to get the correct answer.”

Students also demonstrated self-directed learning behaviors when faced with mathematical challenges. Jevil stated, “Assignments and tasks helped me become more independent... I research solutions on my own,” while Marba noted, “Using technology is helpful, it makes visualizing equations easier.”

The quality of instructional tasks also shaped students’ willingness to persist. Zulo shared, “Assignments that emphasize critical thinking pose more challenges for me. They make me eager to learn,” while Baer explained, “I identify what needs to be solved, then proceed step by step.”

The physical classroom environment further influenced students’ behavioral engagement. Jevil admitted, “Noise and heat may affect,” while Tumar explained, “Sometimes the classroom gets very hot, making it hard to focus on learning or listening because you’re constantly distracted by the heat.” These reflections show that engagement is affected not only by instructional strategies but also by environmental conditions that influence attention and comfort. However, Miku offered a contrasting view, stating, “The classroom environment has no impact on my study of math,” suggesting that some students may remain engaged despite unfavorable physical conditions.

DISCUSSION

Theme 3 shows that students’ general attitude toward mathematics was shaped by the interaction of emotional responses and behavioral engagement. The findings suggest that mathematics was not experienced merely as a cognitive or procedural subject but as an emotionally charged learning domain. Students’ attitudes ranged from fear, frustration, and avoidance to curiosity, satisfaction, and renewed confidence. These emotional responses were shaped by prior achievement, teacher treatment, classroom interactions, peer support, and opportunities for successful problem solving. This supports recent mathematics education literature emphasizing that emotions, motivation, and engagement are central to students’ learning and achievement in mathematics (Hanin & Gay, 2023; Schukajlow et al., 2023).

Negative emotional responses appeared to influence students’ confidence, participation, and willingness to pursue mathematics-related learning. Experiences of difficulty, shame, low scores, fear of mistakes, and discouraging classroom encounters contributed to anxiety and avoidance. These emotions affected not only how

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students felt about mathematics but also how they viewed themselves as mathematics learners. When students repeatedly experienced mathematics as difficult or intimidating, they became more likely to develop low confidence, reduced interest, and weaker academic self-concept. Recent studies similarly show that mathematics anxiety is negatively associated with achievement, self-concept, interest, and enjoyment, making emotional difficulty a significant barrier to mathematics learning (Broda et al., 2023; Möhring et al., 2024). Thus, students' emotional responses should be understood as important indicators of how they experience and interpret mathematics as a subject.

At the same time, the findings suggest that students' attitudes toward mathematics were not fixed. Positive experiences, successful problem solving, peer support, clear instruction, and opportunities to practice helped students develop confidence and renewed interest. These experiences allowed students to view mathematics as manageable rather than permanently difficult. Emotional growth occurred when students experienced mastery, received support, or understood mathematical procedures more clearly. This indicates that students' general attitudes toward mathematics may improve when the learning environment provides encouragement, constructive feedback, and opportunities for success. In this sense, confidence and interest are developed through repeated experiences where students feel capable of understanding and solving mathematical tasks (Ramazan et al., 2023; Kapasi & Pei, 2022; Dweck, 2006).

Behavioral engagement further reflected students' general attitudes toward mathematics. Students' participation was shaped by their willingness to solve problems, take notes, persist through difficulty, collaborate with peers, use learning tools, and seek additional resources. Engagement was strengthened when instruction was clear, tasks were meaningful, and the learning environment supported concentration. Conversely, poor classroom conditions, unclear instruction, and lack of support weakened participation and focus. This aligns with engagement literature, which views behavioral engagement as students' effort, attention, persistence, and participation in learning activities (Cevikbas & Kaiser, 2022). Recent evidence also indicates that classroom environment, teacher competence, facilities, and ICT resources significantly influence students' engagement and academic performance (Hanaysha et al., 2023). Overall, theme 3 suggests that improving students' attitudes toward mathematics requires both emotional support and active learning opportunities. Mathematics teachers need to create classrooms where mistakes are treated constructively, procedures are explained clearly, students are encouraged to participate, and learning tasks promote persistence, collaboration, and confidence.

Implications For Educational Practice

The findings of this study offer meaningful insights for improving mathematics instruction, particularly in contexts affected by shifting learning modalities and educational disruptions. Students' preference for face-to-face learning underscores the importance of instructional clarity, scaffolding, and immediate feedback in mathematics education. Since mathematical understanding often depends on the gradual development of procedural and conceptual knowledge, teachers need to break down complex tasks into manageable steps, model problem-solving processes clearly, and provide timely clarification. These practices are necessary not only in face-to-face classes but also in online and blended settings, where structured guidance can help reduce confusion and support students' confidence in learning mathematics.

The study also highlights the need for balanced and purposeful technology integration. Although students recognized the usefulness of calculators, online resources, and AI-powered applications in solving problems and accessing explanations, they also acknowledged that excessive reliance on these tools may weaken independent reasoning and deeper understanding. Thus, technology should be used as a scaffold for learning rather than a substitute for mathematical thinking. Teachers should guide students in using digital tools responsibly by encouraging them to verify solutions, explain procedures, and reflect on the reasoning behind answers. At the same time, the findings emphasize the importance of addressing emotional barriers such as mathematics anxiety, frustration, and low confidence. Creating emotionally supportive classrooms through positive reinforcement, growth-oriented feedback, and strong teacher–student rapport can help students manage academic stress and become more engaged in mathematics learning.

Beyond classroom instruction, the findings suggest that peer, family, and institutional support are important in strengthening students' mathematics engagement. Collaborative learning, peer tutoring, and group-based problem solving may be used to promote motivation, shared understanding, and confidence through social interaction. Schools may also involve families in mathematics-related initiatives to strengthen the connection between home and school support systems. Given the recurring effects of pandemics, natural disasters, and sudden transitions to remote learning, crisis-responsive pedagogy should also be institutionalized through teacher training in flexible instruction, hybrid learning design, and student well-being support. Overall, mathematics education should not focus solely on content mastery but should also consider students' lived experiences, learning preferences, emotional needs, and contextual realities. By adopting these insights, educators, administrators, and policymakers can help build more inclusive, resilient, and emotionally responsive mathematics learning environments, particularly in rural and crisis-affected areas such as Agusan del Sur.

Limitations and Future Research

This study provides insights into how students' attitudes toward mathematics are shaped by learning environments, social influences, and prior academic experiences; however, the findings should be viewed within limitations. Since the study was conducted in one institutional and geographical context and focused on students enrolled in mathematics-related subjects but of different majors at ADSSU, transferability to other settings may be limited. The data were also based on self-reported interviews and focus group discussions, which may be affected by selective recall or social desirability. Although the sample size was suitable for qualitative inquiry, the findings are not intended for broad generalization. Future studies may involve larger and more diverse samples, use quantitative or mixed-methods designs, and examine how learning modality, teacher support, peer influence, technology use, anxiety, engagement, and performance shape students' mathematics attitudes across different contexts.

CONCLUSION

This study provided a comprehensive exploration of how college students at ADSSU experienced and adapted to mathematics learning across face-to-face, online, and blended environments, particularly in the face of educational disruptions brought about by crises such as the COVID-19 pandemic and natural calamities. Anchored in the Affective-Behavioral-Cognitive (ABC) model of attitudes and analyzed through Braun and Clarke's thematic analysis, the findings illuminate the dynamic nature of students' emotional, behavioral, and cognitive engagements with mathematics.

Face-to-face learning was consistently preferred by students due to its ability to foster emotional reassurance, behavioral participation, and cognitive clarity. In contrast, the abrupt transition to online learning resulted in heightened anxiety, diminished motivation, and fragmented comprehension. While technology served as a valuable aid in navigating these transitions, students also reported cognitive disengagement and overreliance, signaling the need for more thoughtful, balanced integration of digital tools into mathematics instruction.

Social and environmental factors, particularly the roles of teachers, peers, and family, emerged as significant influencers of students' mathematical attitudes. Supportive classroom climates, collaborative learning, and encouragement from teachers and family were found to enhance self-efficacy and engagement, whereas negative experiences contributed to long-term avoidance, anxiety, and disengagement from mathematics.

The findings underscore the complexity and fluidity of students' attitudes toward mathematics in crisis-prone and resource-constrained contexts. They also point to the need for pedagogical approaches that are not only content-driven but also emotionally responsive, socially attuned, and adaptable to changing learning environments. As educational landscapes continue to shift in response to global and local crises, insights from phenomenological inquiry, such as those offered in this study, are vital in designing resilient, inclusive, and empowering models of mathematics education that genuinely reflect and support students' lived realities.

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