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ACADEMIC RESILIENCE IN LEARNING MATHEMATICS: A MIXED METHOD

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ABSTRACT

The study aimed to describe the lived experiences of mathematics teacher education students in a local college regarding their academic resilience in learning mathematics. This study engaged a mixed-method design, utilizing a parallel convergent approach. The participants of the study were the mathematics teacher education students from all levels. There were 150 students who were randomly selected for quantitative and 14 for the qualitative, 14 for in-depth interview which were purposively selected. Based on the results of the study, the overall level of academic resilience in learning mathematics was determined as very high. The results from the quantitative and qualitative converged when they were being corroborated. The value indicator, rated very high, aligns with the theme of cultivating a positive attitude toward mathematics, emphasizing its importance in achieving academic goals and solving real-life problems. The struggle indicator, rated high, reflects the theme of difficulties with the basics of mathematics, highlighting challenges with analyzing and understanding word problems. Lastly, the growth indicator, rated high, corresponds with the theme of developing intrinsic motivation, underscoring the belief that everyone has the potential to succeed in mathematics. This suggests that schools may implement essential courses that applicable across various subjects. By providing regular study skills workshops, practice tests, and access to tutoring services, students will be better prepared for mathematics assessments, increasing their resiliency.

KEYWORDS: *Academic resilience, mixed methods, teacher education students, Philippines*

INTRODUCTION

Mathematics is considered as one of the most important subjects in school curricula and is a problem of poor performance in many countries around the world (Chand et al., 2021). Academic resilience or educational resilience is defined as "the heightened likelihood of success in school, and other life accomplishments despite environmental adversities brought about by early traits, conditions, and experiences". It is the student's ability to gain success despite being under depress or harsh situation compared to his other peers. In relation to mathematics subject, since many students faced long-tail under-achievement or failure, there are few studies using academic resilience to find out how some students able to gain success despite some obstacles (Ishak et al., 2020).

Internationally, in accordance to the study conducted in Sragen Regency, Indonesia, there was still a need to pay attention to students' self-regulation of mathematics and how to hold students facing various challenges in mathematics learning and it found that there were still many students feel that mathematics is a difficult and unpleasant subject so that the lack of confidence in students and the low resilience of self-regulation to challenges and difficulties required a skill to overcome problems in mathematics but the above causes are also caused by external and internal factors (Attami et al., 2020).

In the Philippines, over 50% of students scored below the lowest proficiency level in the 2018 PISA mathematics evaluation (DepEd, 2019). In Pampanga, a study found that negative academic emotions like anxiety, boredom, and hopelessness predict students' ability to cope with math challenges and their achievement. However, metacognition moderates the impact of these emotions, showing it does not significantly influence the achievement of students with high negative emotions in math (Layco, 2020).

Academic resilience in learning mathematics is crucial as it significantly impacts students' educational outcomes and future opportunities. This research investigates academic resilience among mathematics teacher education students and explores self-management factors to address this issue. Its findings can enhance educational institutions, support teachers in developing effective pedagogy, and help students overcome challenges with perseverance and resilience.

Recently, related studies have been found with regards to problems in learning mathematic due to lack of academic

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resilience. Previous studies have even raised concerns that learners' academic resilience in learning is a quite serious and rampant issue. There were studies conducted such as the studies of Chisholm-Bums et. al (2019) which focused about development of an instrument to measure academic resilience among pharmacy students. Another study of Xenofontos and Mouroutsou (2022) entitled "Resilience in mathematics education research: a systematic review of empirical studies". Another study of Neshila (2018) entitled "Academic resilience in Mathematics amongst at-risk Grade 10 learners in Namibia: A Phenomenology Study" which focused on the Academic resilience in Mathematics amongst at-risk Grade 10 learners, the respondents are not mathematics major college students. However, this study is different to the studies that have mentioned as this study specifically investigated the academic resilience in learning mathematics of mathematics teacher education students in a local college in Barangay Maniki, Kapalong, Davao del Norte using a mixed methods research approach. This study aims to address this gap by examining the impact of academic resilience on the approaches of mathematics teacher education students to facilitating learning in this context.

Research Questions

1. What is the level of academic resilience in learning mathematics among mathematics teacher education students?
2. What are the lived experiences of mathematics teacher education students with regards to their academic resilience in learning mathematics?
3. Do qualitative data align or corroborate with the quantitative?

RESEARCH METHODOLOGY

Research Design

This study utilized a mixed methods design, which involves integrating both qualitative and quantitative components within the research. Mixing in this context refers to the interconnection of qualitative and quantitative elements to provide a comprehensive understanding of the research issue. This integration is crucial at various stages of the research process to enhance the overall rigor of the study (Creswell & Plano, 2011).

Participants

The study involved mathematics teacher education students from Kapalong College of Agriculture, Sciences, and Technology, with 150 participants for the quantitative phase and 14 for the qualitative phase.

In the quantitative phase, 150 students were sampled from a total of 245 mathematics education program in a local college: 63 students from BSED-MATH1A, 54 students from BSED-MATH1B, 50 students from BSED-MATH2A, 43 students from BSED-MATH3A, and 33 students from BSED-MATH4A. A statistician determined the sample, including 39 out of 63 students from BSED-MATH1A, 34 out of 54 students from BSED-MATH1B, 31 out of 50 students from BSED-MATH2A, 26 out of 43 students from BSED-MATH3A, and 20 out of 33 students from BSED-MATH4A. These students completed surveys assessing their academic resilience in learning mathematics.

For the qualitative phase, only 14 participants from the BSED-Mathematics students are included in the qualitative phase: fourteen (14) for in-depth interview. All participants in the qualitative phase must not have participated in the data collection of the quantitative phases.

Data Collection

The data collection procedure involved several steps, with quantitative and qualitative data gathered concurrently using parallel mixed-method techniques to compare and integrate findings (Creswell & Plano Clark, 2018).

Permission to conduct the study was first secured from the Office of the President at Kapalong College of Agriculture, Sciences, and Technology. Quantitative data was collected using a construct questionnaire, namely the mathematical resilience survey questionnaire, which is derived from Kooken et al. (2015). To ensure consistency, the survey was administered to all participants on the same day to avoid mood variations.

Qualitative data collection, a one-on-one interview was conducted to gather the lived experiences of the participants with regard to the academic resilience in learning mathematics. Participants were asked about their availability and preferred interview locations beforehand. During the interviews, the researcher used prepared enabling questions and follow-up queries to gather comprehensive responses.

Data Analysis

After collecting all the necessary data, tabulation and analysis were conducted. For qualitative data, thematic analysis was employed, while statistical tools were utilized for the quantitative phase.

Descriptive statistics, such as mean was utilized to examine the average responses of the participants, and the standard deviation was used to determine the variability of responses of the respondents on the survey questionnaires in terms of academic resilience in learning mathematics.

For qualitative data, responses were recorded, organized, and reduced into themes through coding. The data was presented in narratives, tables, or figures. The researcher engaged deeply with the descriptive data, repeatedly refining and categorizing themes to describe the participants' academic resilience in learning mathematics

This iterative process involved careful reading and rereading of data to ensure accurate theme generation and final analysis (Miles et al., 2014).

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RESULTS AND DISCUSSION

Table 2. Level of Academic Resilience in Learning Mathematics

Variables and Indicators	Mean	Description
A. *Value*		
1. Value math as important subject matter that helps me improve my learning	4.55	Very High
2. Believe that math will be useful to me in solving real-life problems	4.48	Very High
3. Find math courses essential because it provides problem-solving skills that are applicable across various subjects	4.43	Very High
4. Observe that understanding math contributes greatly for achieving my academic goals	4.44	Very High
5. View that having a solid knowledge of math helps me understand more complex topics in my college journey	4.41	Very High
Category Mean	**4.46**	**Very High**
B. *Struggle*		
1. Observe that when I work on math-related tasks, I experience difficulty when tackling challenging math problems	4.14	High
2. Make mistakes while doing math but it provides valuable opportunities for growth and improvement	4.29	Very High
3. Acknowledge that experiencing struggle is a normal and expected aspect of working on mathematical problem	4.33	Very High
4. Observe that people within my peer group may encounter difficulties in math	4.17	High
5. Recognize that making mistakes is integral part of the learning process in mathematics	4.35	Very High
Category Mean	**4.25**	**High**
C. *Growth*		
1. Believe that mathematics subject is accessible to everyone	4.39	Very High
2. Believe that every student has the potential to grasp significant amount of mathematics	4.31	Very High
3. Realize that there is something that can be done to change a person's math attitude	4.19	High
4. Envision everyone's math ability is determined at birth	3.75	High
5. Believe everyone can do math	4.31	Very High
Category Mean	**4.19**	**High**
Overall Mean	**4.30**	**Very High**

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Academic Resilience among mathematics education students is very high, indicating that students consistently exhibit strong perseverance in the face of challenges. Mathematical resilience, which enables students to overcome difficulties and persist in solving complex problems, is an essential trait for success in the subject (Agustin et al., 2022). It involves a positive attitude, collaboration with peers, effective communication of mathematical ideas, and mastery of mathematical concepts (Attami et al., 2020). This resilience allows students to adapt to challenges and solve problems with flexibility and logic, ultimately contributing to their academic success.

Students also score very high in *value*, shows that academic resilience in learning mathematics is highly valued by students, who consistently recognize its importance in mastering the subject. Abel (2019) highlights that resilient students view mathematics as a valuable discipline, while Riaz and Asad (2018) emphasize the positive impact of a supportive attitude on cognitive, emotional, and educational success. Tytler (2020) further underscores the interdisciplinary relevance of mathematical literacy, reinforcing the need for educators to connect math to real-world applications and foster a positive mindset.

Struggle is high, reveals that struggles in mathematics education are perceived as significant barriers to academic resilience. This aligns with Şeyma and Gözde (2020), who describe struggle in learning math as the ability to regulate one's thoughts, motivation, and actions, fostering perseverance despite obstacles. Jenni and John (2020) further emphasize the importance of self-reflection and problem-solving skills in overcoming these challenges. Their findings suggest that institutional support and resources are key in helping students navigate difficulties and build resilience in mathematics.

Growth is another strength, which highlights that academic resilience in mathematics is strongly influenced by a growth mindset, with students recognizing the importance of persistence and effort in overcoming challenges. Pieronkiewicz and Szczygieł (2019) emphasize that teachers who encourage effort, persistence, and commitment are crucial in fostering students' mathematical resilience. They highlight the importance of a growth mindset, with students recognizing how persistence and effort help overcome challenges in mathematics. This aligns with the Mathematical Resilience (MR) model, which, according to Johnston-Wilder and Lee (2019), stresses the value of cultivating a growth mindset to strengthen students' resilience in learning mathematics.

Table 3. Lived Experiences of Mathematics Teacher Education Students on their Academic Resilience in Learning Mathematics

ISSUES PROBED	CORE IDEAS	CODE / CATEGORIES	ESSENTIAL THEMES	THEORETICAL SUPPORT
Effects of Teachers' Instruction on Learners	• Lacking proficiency of teachers in delivering the instruction and the lesson. • Having weak voice of the teacher which affects students' understanding of the lesson.	Obstruse Instruction of the Teachers	Teacher-Related Factors in Teaching	Constructivist Theory
	• Having your instructor help you understand the lesson. • Having contextualized instructions, lessons, and examples given by the teacher.	Being Scaffold by the Teacher		
Impacts of Difficulties in Learning Math Concepts Affecting	• Having problems with analyzing and comprehending mathematical problems.	Struggling with Analyzing and Understanding Word Problems	Difficulties with the Basics of Mathematics	Cognitive Load Theory

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Academic Resilience	• Struggling to grasp mathematical ideas and concepts, for it needs inferential and deep comprehension.			
	• Having a hard time finding solutions to or answering specific math problems. • Struggling to operate and perform mathematical notations and operations in major contents.	Battling with Basic Operation in Mathematics		
	• Having difficulty understanding and memorizing mathematical ideas. • Having a hard time memorizing mathematical formulas and their usage in a specific mathematical problem.	Memory Retention Difficulties		
Impacts of Taking Responsibility for Your Own Learning to Understand Math among Math Majors	• Having difficulty with numerous learning tasks or activities from the instructors. • Barely studying math concepts due to complying plenty of tasks.	Managing Multiple Assignments	Being Responsible in Learning Mathematics	Self-Regulated Learning Theory
	• Utilizing self-directed learning to understand math lessons. • Overcoming math-related setbacks through self-directed learning.	Employing Self-Directed Learning Styles		
	• Taking responsibility for their own learning especially in mathematics. • Searching for reliable sources to supplement one's own learning by gaining knowledge of math concepts.	Being Responsible for Your Own Learning		

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Effects of Cultivating a Positive Attitude Towards Mathematics	• Having academic perseverance to move forward despite of the academic struggles. • Finding resiliency in learning mathematics as a driving force to keep going.	Having Perseverance in Learning	Cultivating a Positive Attitude Towards Mathematics	Growth Mindset Theory
	• Finding it a helpful tool to think positively about learning especially in mathematics. • Thinking about positive things in life despite being challenged.	Being Optimistic and Positive-Minded		
	• Having the courage to face challenges and thinking that everything has a solution. • Having academic resilience and courage to deal with difficult math concepts. • Learning by making mistakes in dealing with Math problems.	Having Courage in Learning		
Effects of Having a Supportive Environment on Learning Math	• Having peers to strive harder and support on their academic journey. • Having friends who are knowledgeable about mathematical concepts to help them understand math concepts.	Seeking Supports from Others	Building a Supportive Learning Environment	Social Cognitive Theory

Teacher-Related Factors in Learners' Academic Resilience. Research underscores the vital role of teachers in fostering academic resilience in mathematics. Piaget's Constructivist Theory highlights the importance of engagement and problem-solving in knowledge construction. Teacher behaviors like promoting self-efficacy, a positive classroom climate, and a growth mindset significantly enhance students' resilience (Yang & Zheng, 2024). Additionally, Zhang and He (2025) found that teachers' growth mindset and supportive environments, alongside perceived parental autonomy, positively influence students' resilience and ability to overcome challenges.

Difficulties in Learning Math Concepts Affecting Academic Resilience. Difficulties in learning math concepts significantly impact academic resilience, leading to frustration, reduced confidence, and diminished motivation. Cognitive Load Theory (Sweller, 1988) highlights how information presentation can either ease or worsen these struggles. Targeted interventions and emotional support are essential to help students improve coping strategies, enhance resilience, and achieve academic success (Schukajlow et al., 2023).

Being responsible in learning mathematics. Students' responsibility in learning mathematics is essential for success and aligns with Zimmerman's (2000) Self-Regulated Learning (SRL)

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Theory, which emphasizes goal-setting, progress monitoring, and strategy adjustment. Schukajlow et al. (2023) highlight that self-regulated learners are proactive, use adaptive strategies, and manage challenges like mathematics anxiety effectively. Developing these skills fosters resilience, reduces anxiety, and enhances mathematical performance.

Cultivating a Positive Attitude Towards Mathematics. Students' beliefs about their abilities significantly impact their learning experiences, as highlighted by Dweck's (2006) Growth Mindset Theory. This theory emphasizes that students who view intelligence as malleable are more likely to embrace challenges and persist in their efforts. Research by Sisk et al. (2021) supports this, showing that fostering a growth mindset in mathematics promotes academic resilience, encouraging students to approach abstract concepts and problem-solving with perseverance rather than frustration or avoidance.

Building a Supportive Learning Environment. A supportive learning environment enhances motivation and engagement in mathematics, as Bandura's (1986) Social Cognitive Theory emphasizes the impact of self-efficacy, observational learning, and social influence. Zimmerman & Schunk (2022) observing peers succeed fosters confidence and persistence, while collaborative settings with problem-solving and positive feedback reduce math anxiety, build resilience, and improve academic success.

Table 4.Joint Display Salient Quantitative and Qualitative Findings

ASPECT OR FOCAL POINT	QUANTITATIVE FINDINGS	QUALITATIVE FINDINGS	NATURE OF DATA INTEGRATION	AXIOLOGICAL IMPLICATIONS
Academic Resilience in Learning Mathematics	Table 1 on the indicator of value specifically item 1 about value math as important subject matter that helps me improve my learning (M=4.55), item 2 about believe that math will be useful to me in solving real-life problems (M=4.48), item 3 about finds math courses essential because it provides problem-solving skills that are applicable across various subjects (M=4.43), item 5 about observe that understanding math contributes greatly for achieving my academic goals (M=4.44), item 5 about view that having a solid knowledge of math helps me understand more complex topics in my college journey (m=4.41) all rated as very high.	Table 3.3 core ideas- on the category - perseverance in learning under the theme - cultivating a positive attitude towards mathematics	Merging – converging	Perseverance in learning fosters resilience, helping students approach challenges in mathematics with a positive mindset. By cultivating persistence, they gain confidence to tackle complex problems, develop problem-solving skills, and reduce math anxiety.
	Table 2 on the indicator of struggle specifically item 1 about observe that when I work on math-related tasks, I experience difficulty when tackling challenging math problems (M=4.14),	Table 3.2 on the category - struggling with analyzing and understanding word problems under the theme - difficulties with	Merging – converging	Difficulty with word problems and basic math skills can reduce students' confidence and slow their academic progress. Lacking a strong foundation may make

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	item 4 about observe that people within my peer group may encounter difficulties in math (M=4.17), all rated as high.	the basics of mathematics		advanced topics seem daunting, leading to frustration and a reluctance to engage with math. Building essential skills and analytical thinking early supports a more positive learning journey.
	Table 3 on the indicator of growth specifically item 3 realize that there is something that can be done to change a person's math attitude (M=4.19) which rated as high, item 2 about believe that every students has the potential to grasp significant amount of mathematics (M=4.31), and item 5 about believe everyone can do math (M=4.31) which both rated as very high.	Table 3.2 core ideas- on the category - motivation as a driving force in learning math under the theme - developing intrinsic motivation from oneself	Merging – Converging	Motivation acts as a powerful force in learning math, especially when it comes from within. When students develop intrinsic motivation, they engage more deeply, find personal satisfaction in problem-solving, and persevere through challenges. This self-driven enthusiasm builds confidence and leads to a more meaningful and enjoyable learning experience in math.

Value. Students' perceptions of mathematics' value greatly influence their resilience and ability to overcome challenges. Choi et al. (2023) found that seeing mathematics as meaningful improves emotional well-being and academic outcomes, while negative emotions hinder resilience. Similarly, Eccles' Expectancy-Value Theory highlights how subjective task values, such as utility and intrinsic value, drive motivation and persistence. Vergara (2021) also emphasized that valuing mathematics strengthens resilience, helping students navigate challenges and achieve success.

Struggle. Students with academic resilience show persistence and adaptability in overcoming challenges in mathematics. Ye et al. (2024) found that struggles often lead to mental blankness and reduced confidence, hindering resilience despite adequate preparation. They stressed the need to foster a growth mindset and offer emotional support to help students manage difficulties and maintain progress.

Growth. Personal growth plays a key role in students' academic resilience in mathematics. Comparing progress to peers can lower motivation, but fostering a growth-oriented mindset, as emphasized by Noh et al. (2023), strengthens resilience. Prioritizing personal development boosts persistence, confidence, and engagement in math.

CONCLUDING REMARKS

In conclusion, the study reveals that academic resilience in learning mathematics is highly influenced by various factors such as teacher-related elements, personal struggles, and the learning environment. Both the quantitative and qualitative findings emphasize the importance of cultivating a positive attitude, taking responsibility for learning, and utilizing effective coping strategies to enhance academic resilience. Ultimately, these results highlight the significant role of academic resilience in improving students' performance and perseverance in mathematics, contributing to their overall success.

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