Interplay Of Mathematics Self-Efficacy, Anxiety, Creativity Beliefs, And Learning Styles Among College Students: Implications For Curriculum Alignment

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Abstract

Mathematics is essential for various fields, but many students struggle with it, leading to low achievement and negative attitudes. This study examined the interplay of Mathematics Self-Efficacy, Anxiety, Creativity Beliefs, and Learning Styles among college students of Northwest Samar State University, Philippines, and its implications for curriculum alignment. Using a descriptive quantitative correlational research design, standardized scales, and statistical techniques were employed to measure and analyze the variables. Participants were 72 Bachelor of Elementary Education students of Northwest Samar State University. Descriptive and inferential statistics, including tests of normality, were utilized. Findings revealed moderate levels of Mathematics Self-Efficacy, anxiety, and mathematical creativity, indicating a moderate proficiency and enjoyment in exploring unconventional approaches and recognizing patterns. Collaborative and experiential learning were preferred, emphasizing hands-on activities and meaningful discussions. Respondents generally perceived a positive alignment of the mathematics curriculum, with positive results in specific aspects. Sex and high school grade did not significantly influence the variables. Higher Mathematics Self-Efficacy correlated with greater mathematical creativity and preferred learning styles. Positive curriculum alignment perceptions were associated with higher creativity and preferred learning styles. However, the correlation between Mathematics Self-Efficacy and anxiety was weak. The study's implications inform policy and curriculum development to enhance mathematics instruction. By understanding the interplay of these variables, educators can tailor instruction to improve self-efficacy, creativity, and learning styles in mathematics. This research contributes to effective teaching strategies and curriculum design.

Keywords: Self-Efficacy, Anxiety, Creativity, Learning Styles, Curriculum Alignment, Mathematics education,

Introduction

In today's rapidly changing global landscape, mathematics education plays a critical role in preparing college students for future challenges and opportunities

(UNESCO, 2015). The exploration of the relationship between mathematics self-efficacy, anxiety, creativity beliefs, and learning styles among college students holds significant implications for curriculum alignment. This research aligns with the objectives and initiatives of the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the global agenda for quality education (UNESCO, 2015).

Mathematics is a fundamental subject in education, serving as a building block for various fields such as science, technology, engineering, and finance. However, many students experience difficulties in learning mathematics, leading to low achievement and negative attitudes towards the subject (UNESCO, 2015). Understanding the factors that influence students' mathematical performance and attitudes is crucial for developing effective instructional strategies and curriculum alignment. UNESCO emphasizes the importance of mathematics education in equipping individuals with the necessary skills to succeed in a knowledge-based society (UNESCO, 2015). Mathematics self-efficacy, which refers to an individual's belief in their ability to perform mathematical tasks, is a crucial factor in determining students' engagement and achievement in the subject (Pajares & Miller, 2014). By understanding the factors that influence mathematics self-efficacy, such as anxiety, creativity beliefs, and learning styles, educators can develop targeted interventions and instructional approaches that boost students' confidence and competence in mathematics (Pajares & Miller, 2014).

Curriculum alignment is a key focus of UNESCO's efforts to enhance the effectiveness of education systems worldwide (UNESCO, 2015). By exploring the relationship between mathematics self-efficacy, anxiety, creativity beliefs, and learning styles, this research contributes to the development of aligned and student-centered mathematics curricula. Understanding how these psychological factors interact can inform curriculum designers about the importance of incorporating strategies that address anxiety, foster creativity, and cater to diverse learning styles (Runco & Bahleda, 2016). The findings from this research can guide educators and policymakers in creating inclusive, relevant, and engaging mathematics curricula that promote deep understanding, critical thinking, and a positive attitude towards mathematics among college students globally, in line with UNESCO's vision of quality education for sustainable development (UNESCO, 2015). By examining the interrelationships between mathematics self-efficacy, anxiety, creativity beliefs, and learning styles, this research aims to provide valuable insights into the complex dynamics that influence students' mathematical learning experiences. These findings will have implications for curriculum alignment, instructional design, and the development of interventions to support students in overcoming challenges and fostering a positive attitude towards mathematics (Pajares & Miller, 2014; Runco & Bahleda, 2016).

The Interplay of Mathematics Self-Efficacy, Anxiety, Creativity and Learning Styles

Research has shown that mathematics self-efficacy plays a crucial role in students' academic achievement in mathematics. Students with high self-efficacy beliefs are more likely to approach mathematical tasks with confidence, persistence, and a positive attitude. A study by Cerdán and Ponsoda (2015) found a positive correlation between mathematics self-efficacy and academic performance among Spanish university students. Similarly, in a study conducted by Aydin and Eryilmaz (2016) in Turkey, it was observed that higher mathematics self-efficacy was associated with better mathematics achievement. On the other hand, mathematics anxiety has been identified as a significant barrier to learning and performance in mathematics (Ramirez et al., 2018). Students with high levels of mathematics anxiety tend to experience negative emotions, avoidance behaviors, and decreased motivation in relation to mathematics. A study by Putwain et al. (2015) conducted in the United Kingdom found that mathematics anxiety negatively predicted mathematics performance among college students. Similarly, a study by Primi et al. (2015) in Brazil revealed a negative relationship between mathematics anxiety and mathematics achievement. The role of creativity beliefs in mathematics education has gained attention in recent years. Research has shown that students' beliefs about their creative abilities in mathematics can impact their problem-solving strategies and engagement with the subject (Pampaka et al., 2017). A study by Leikin et al. (2017) conducted in Israel found a positive relationship between students' creativity beliefs and their mathematical creativity. Additionally, a study by Choi and Lee (2018) in South Korea demonstrated that students with higher creativity beliefs in mathematics were more likely to engage in divergent thinking and exhibit higher levels of mathematical achievement. Learning styles are another factor that can influence students' engagement and understanding of mathematics. Research suggests that matching instructional strategies to students' preferred learning styles can enhance their learning experiences (Rohaan & Schoonenboom, 2017). A study by Alghazo and Khader (2016) conducted in Jordan found that students' preferred learning styles significantly influenced their academic achievement in mathematics. Similarly, a study by Ibrahim et al. (2018) in Malaysia revealed that students with visual learning style preferences performed better in mathematics compared to students with other learning style preferences.

Why Prepare future teachers who are Mathematically Proficient?

Preparing future teachers who are mathematically proficient is essential for enhancing student achievement, fostering positive attitudes toward mathematics, promoting critical thinking skills, and effectively utilizing instructional strategies and technology. By investing in the mathematical competence of future teachers, education systems can better equip them to meet the diverse needs of their students and contribute to improving mathematics education. Firstly, mathematically proficient teachers are better equipped to effectively teach and communicate mathematical concepts to their students. Research has consistently shown a positive relationship between teachers' content knowledge and students' achievement in mathematics (Hill et al., 2016). A study by Hill and Ball (2015) found that elementary teachers'

mathematical knowledge significantly predicted their students' mathematics achievement. When teachers have a deep understanding of mathematical concepts, they can provide clear explanations, anticipate students' misconceptions, and provide appropriate instructional strategies to support student learning. Secondly, mathematically proficient teachers serve as role models and inspire students to develop a positive attitude and interest in mathematics. A study by Beishuizen and Anghileri (2019) revealed that teacher enthusiasm and confidence in mathematics positively influenced students' motivation and engagement. When teachers demonstrate their own mathematical proficiency and enthusiasm, students are more likely to view mathematics as an interesting and valuable subject. This can contribute to improved student attitudes, increased participation, and higher achievement in mathematics.

Furthermore, mathematically proficient teachers are better equipped to promote critical thinking and problem-solving skills among their students. In a rapidly changing world, these skills are highly valued and essential for success in various fields. A study by Desimone et al. (2015) highlighted the importance of teachers' content knowledge in fostering students' mathematical reasoning and problem-solving abilities. When teachers possess deep mathematical knowledge, they can challenge students with complex problems, facilitate mathematical discussions, and provide meaningful feedback that promotes higher-order thinking skills. Additionally, mathematically proficient teachers can effectively implement innovative instructional strategies and integrate technology to enhance student learning experiences. Research by Kyriakides et al. (2018) emphasized the significance of teachers' mathematical competence in utilizing technology tools and resources to support mathematical learning. When teachers are proficient in mathematics, they can leverage technology to engage students, provide interactive learning experiences, and facilitate personalized instruction.

Challenges of Philippine State Universities in Preparing Proficient Mathematics Teachers

The challenges faced by Philippine state universities in preparing proficient mathematics teachers include the shortage of qualified mathematics teacher educators, the need for curriculum alignment, limited opportunities for authentic field experiences, and the integration of technology in teacher education. Addressing these challenges requires sustained efforts in faculty development, curriculum review and revision, enhanced field experiences, and the integration of technology in mathematics teacher education programs. By addressing these challenges, state universities can better equip future mathematics teachers with the necessary knowledge, skills, and dispositions to become proficient educators in the field of mathematics. The preparation of proficient mathematics teachers in Philippine state universities faces several challenges. One major challenge is the limited availability of qualified mathematics education faculty who possess both strong content knowledge and pedagogical expertise. A study by Manrique and Zubieta (2016) highlighted the

shortage of qualified mathematics teacher educators in the Philippines. This shortage can impede the delivery of high-quality mathematics teacher education programs and hinder the development of future teachers' mathematical proficiency.

Another challenge is the need to align mathematics teacher education programs with the evolving demands of the K-12 curriculum and changing educational landscape. The implementation of the K-12 program in the Philippines has necessitated revisions in mathematics curricula and instructional approaches. A study by Galan et al. (2019) emphasized the importance of curriculum alignment and the need for mathematics teacher education programs to provide prospective teachers with the necessary knowledge and skills to effectively teach the revised curriculum. Ensuring that mathematics teacher education programs remain relevant and responsive to educational reforms is crucial for preparing proficient mathematics teachers. Furthermore, there is a need to address the limited opportunities for pre-service teachers to engage in authentic and meaningful field experiences. Research by Sarmiento and Pangilinan (2015) identified the lack of exposure to real classroom settings as a challenge in the preparation of future mathematics teachers in the Philippines. Providing pre-service teachers with opportunities to observe and participate in actual classrooms, under the guidance of experienced mentors, can enhance their pedagogical skills and deepen their understanding of effective mathematics instruction. Additionally, the integration of technology in mathematics teacher education poses both challenges and opportunities. While technology can enhance teaching and learning experiences, there is a need to ensure that future teachers are equipped with the necessary technological skills and knowledge to effectively integrate technology in their mathematics classrooms. A study by Del Rosario et al. (2018) emphasized the importance of providing pre-service teachers with opportunities to develop their technological proficiency and pedagogical content knowledge in the context of technology-enhanced mathematics instruction.

This present study on the interplay of mathematics self-efficacy, anxiety, creativity beliefs, and learning styles among college students contributes to addressing the challenges faced by Philippine state universities in preparing proficient mathematics teachers. It provides insights into effective instructional strategies, interventions, and the importance of incorporating authentic field experiences in mathematics teacher education programs. By integrating the findings of this study into curriculum alignment efforts, state universities can enhance the preparation of future mathematics teachers and promote their proficiency in teaching mathematics.

Research Gap

Research exploring the relationship between mathematics self-efficacy, anxiety, creativity beliefs, and learning styles among first-year pre-service mathematics students has been conducted in various contexts. However, there is a research gap specifically within the Philippine context, which requires examination to address the unique challenges and cultural considerations present in the

Philippine education system. Understanding this research gap is crucial for developing targeted interventions and curriculum alignment strategies. Specifically, there is a need to investigate mathematics self-efficacy among college students in the Philippines, as there is a lack of research focusing on the self-efficacy beliefs of Filipino college students. Examining the levels and factors influencing mathematics self-efficacy in this context can provide insights into the challenges and strengths of Filipino college students and guide the development of interventions to enhance their confidence and performance in mathematics. Additionally, there is a research gap in exploring the impact of anxiety on mathematics learning among college students in the Philippines. Mathematics anxiety is recognized as a significant barrier to learning and achievement in mathematics globally. However, the levels and effects of mathematics anxiety among Filipino college students and its association with mathematics self-efficacy, creativity beliefs, and learning styles require investigation. Understanding the relationship between anxiety and these psychological factors can inform the development of targeted interventions and support strategies to alleviate mathematics anxiety and foster a positive learning environment in the Philippine context.

Moreover, there is a research gap in examining the relationship between creativity beliefs, learning styles, and mathematics performance among college students in the Philippines. Although creativity and individual learning styles are recognized as influential factors in mathematical thinking and problem-solving, their specific impact on mathematics learning experiences among Filipino college students is underexplored. Investigating this relationship within the Philippine context can provide valuable insights into leveraging creativity beliefs and learning styles to enhance mathematics education and curriculum alignment strategies. Addressing these research gaps within the Philippine context is essential for developing a comprehensive understanding of the interplay between mathematics self-efficacy, anxiety, creativity beliefs, and learning styles among college students. These insights can inform curriculum designers, educators, and policymakers in tailoring mathematics education to meet the specific needs and challenges faced by Filipino college students. Ultimately, this research can contribute to promoting mathematical achievement, fostering positive attitudes towards the subject, and supporting the overall educational success of Filipino college students.

Practical Gap and Context of the Study

The Northwest Samar State University (NwSSU) in the Philippines faces the challenge of enhancing students' mathematical achievement and cultivating positive attitudes towards mathematics, particularly among first-year BEED students who will become future teachers in the basic education curriculum. Despite the significance of mathematics in various academic disciplines and professions, many college students in the Philippines exhibit low levels of mathematics self-efficacy, high mathematics anxiety, and limited engagement in creative problem-solving approaches. Additionally, there is a need to investigate the relationship between students' learning styles and their mathematical

performance within the specific context of NwSSU. This study aims to address the problem by examining the levels of mathematics self-efficacy, anxiety, creativity beliefs, and preferred learning styles among NwSSU college students. It seeks to explore the interrelationships among these factors, providing insights into the unique challenges faced by NwSSU college students in mathematics education. The findings will contribute to the development of curriculum alignment strategies tailored to their specific needs, enabling NwSSU to better support its students. Furthermore, the study aims to explore the implications of these identified relationships for curriculum alignment at NwSSU. By examining the context of NwSSU, the research endeavors to understand how mathematics self-efficacy, anxiety, creativity beliefs, and learning styles may impact students' mathematical achievement and attitudes towards the subject. The study's outcomes will inform curriculum designers, educators, and policymakers at NwSSU in designing targeted interventions and instructional strategies that align with the distinctive characteristics and needs of their students. Ultimately, the research aims to foster a positive learning environment and improve mathematics education outcomes at NwSSU, addressing the challenges faced by the university in preparing proficient mathematics teachers.

Objectives of the Study

This study aimed to explore the relationship between Mathematics Self-Efficacy, Anxiety, Creativity Beliefs, and Learning Styles among college students and its implications for curriculum alignment. The specific objectives of the study were as follows: (1) Assess the level of Mathematics Self-Efficacy, Anxiety, Creativity Beliefs, and Learning Styles among the respondents; (2) Evaluate students' perception of Mathematics Curriculum Alignment; (3) Examine the differences in Math General Weighted Average (GWA) in Senior High School, Mathematics Self-Efficacy, Anxiety, Creativity, and Learning Styles when grouped according to sex; (3) Determine the relationship between Mathematics Self-Efficacy (MSE), Mathematics Anxiety (MA), Mathematical Creativity, Learning Styles, and Curriculum Alignment.

Null Hypotheses

This study tested the following hypotheses in null form, in the context of Filipino university students: (1) There is no significant relationship between Mathematics Self-Efficacy, Anxiety, Creativity Beliefs, Learning Styles, and Mathematics Curriculum Alignment among college students; (2) There are no significant differences in Math General Weighted Average (GWA) in Senior High School, Mathematics Self-Efficacy, Anxiety, Creativity, and Learning Styles when grouped according to sex; and (3) There is no significant relationship between Mathematics Self-Efficacy (MSE), Mathematics Anxiety (MA), Mathematical Creativity, Learning Styles, and Curriculum Alignment.

METHOD

Research Design

The study employed a descriptive quantitative correlational research design to examine the relationship between Mathematics Self-Efficacy, Anxiety, Creativity Beliefs, and Learning Styles. This design allowed for the measurement and analysis of these variables using standardized scales and statistical techniques. By utilizing quantitative methods, the study aimed to assess the levels of Mathematics Self-Efficacy, Anxiety, Creativity Beliefs, and Learning Styles among the participants. Statistical analyses, such as correlation analysis or regression analysis, were performed to explore the relationships between these variables. Previous studies, conducted by Pajares and Miller (1994) and Runco and Bahleda (1986), have demonstrated the effectiveness of quantitative methods in investigating the relationships between these constructs. The research design focused solely on the quantitative aspect, omitting the qualitative component that involves thematic analysis of students' responses. This decision was made to concentrate on the numerical assessment and analysis of the variables of interest. By using standardized scales and statistical techniques, the study aimed to gather quantitative data that can be statistically analyzed to identify correlations and potential relationships among the variables. This approach provides a systematic and structured means of examining the interplay between Mathematics Self-Efficacy, Anxiety, Creativity Beliefs, and Learning Styles.

Sampling Characteristics

The study included a sample of seventy-two (72) students enrolled in the Bachelor of Elementary Education program at Northwest Samar State University, Philippines. The purpose of the study was to examine the relationship between Mathematics Self-Efficacy, Anxiety, Creativity Beliefs, and Learning Styles among these students. The sampling characteristics, as presented in Table 1, provide an overview of the respondents' profiles in terms of sex, age, grade, and awards received. The selection of first-year college students in the Bachelor of Elementary Education program at Northwest Samar State University, Philippines enhances the study's relevance and applicability. It allows for a targeted exploration of the relationship between Mathematics Self-Efficacy, Anxiety, Creativity Beliefs, and Learning Styles in a critical stage of students' academic journey, while considering the specific context of elementary education and the local educational system. The findings can contribute to the development of evidence-based strategies and interventions that support the learning and professional development of future elementary school teachers provided by Philippine universities.

Table 1. Profile of the Respondents

Profile Variables	Categories	Frequency (N=72)	Percentage
Sex	Male	10	14
	Female	62	86
Age	18-22	62	86
	23-27	4	6

	28-32	3	4
	Mean Age= 20.17 (SD=2.70)		
Grade	80-85	23	32
	86-90	37	51
	91-95	12	17
	Mean Grade= 87.060 (SD=3.614)		
Awards Recvieded	With Highest Honor	1	1
	With Honor	38	53
	None	33	46

The sample consisted of 10 male students (14%) and 62 female students (86%). The majority of the students fell within the age range of 18-22, comprising 62 participants (86%), while a smaller proportion of students were in the age ranges of 23-27 (4%) and 28-32 (4%). The average age of the participants was 20.17 years with a standard deviation of 2.70. In terms of academic performance, the participants' grades were categorized into three ranges: 80-85, 86-90, and 91-95. Among the respondents, 32% obtained grades within the range of 80-85, 51% achieved grades within the range of 86-90, and 17% received grades within the range of 91-95. The mean grade of the participants was 87.060 with a standard deviation of 3.614. Regarding awards received, only one participant (1%) received the highest honor, 38 participants (53%) received honors, and 33 participants (46%) did not receive any awards. These sampling characteristics provide insights into the demographics and academic profiles of the participants in the study. The predominantly female composition of the sample aligns with the general trend of more females pursuing degrees in education-related fields (OECD, 2019). The distribution of age reflects a majority of younger participants, which is expected for a college student population. The variation in academic performance indicates a range of achievement levels among the participants. Previous research has shown that academic achievement can influence students' self-efficacy, anxiety, and creativity beliefs (Bandura, 1997; Karwowski & Beghetto, 2018). The presence of award recipients suggests recognition for exceptional academic performance among a subset of participants. It is worth noting that the sample size of 72 participants may limit the generalizability of the findings. Additionally, the specific context of a single state university in the Philippines may restrict the generalizability of the results to other populations or educational settings.

Research Instruments

The study utilized four research instruments to assess various constructs related to mathematics anxiety and learning. These instruments were tested for their validity and reliability using a sample of 30 students who were not part of the study. Testing the validity and reliability of these research instruments helps to establish their credibility and ensures that they are appropriate and reliable tools for measuring the intended constructs of interest in the study.

These research instruments were applicable and effective in quantitatively assessing variables such as mathematics self-efficacy, anxiety, creativity, learning styles, and curriculum alignment among college students. They provided robust measures, demonstrating reliability and validity, and their implementation offered valuable insights into the relationships between these variables. The findings have important implications for improving mathematics education and enhancing curriculum alignment to better meet the needs and interests of students.

A. Mathematics Self-Efficacy and Anxiety Questionnaire (MSEAQ)

This tool was adopted from Diana K. May (2009) called the Mathematics Self-Efficacy and Anxiety Questionnaire (MSEAQ), was designed to assess each construct as a subscale of the questionnaire. Relationships among students' questionnaire responses and individual characteristics such as gender, high school mathematics preparation, and grades in college mathematics courses were examined. The Mathematics Self-Efficacy and Anxiety Questionnaire (MSEAQ) is a 29-item self-report measure of both mathematics self-efficacy and mathematics anxiety. The questionnaire was developed to assess college students' mathematics self-efficacy and mathematics anxiety, and was designed to be reliable, valid, and efficient to administer. The MSEAQ has been found to be reliable, relatively valid, and efficient to administer. The construct validity of the MSEAQ was established previously using correlations to compare the MSEAQ study reported a Cronbach's alpha of .93 for the anxiety subscale and .96 for the total scale. This tool was used in the study and was answered by thru students through online google drive link.

B. Mathematics Creativity Questionnaire (MCQ)

The Mathematics Creativity Questionnaire is a research instrument designed to assess the mathematical creativity of students. It consists of ten items that aim to capture various components of mathematical creativity, such as problem-solving, originality, and flexibility. The questionnaire likely requires students to generate multiple solutions and explain their thinking. According to the study conducted using this questionnaire, higher scores on the mathematical creativity assessment were associated with better performance on a problem-solving task. This suggests that the questionnaire has concurrent validity, as it aligns with students' actual problem-solving abilities. Additionally, the study reported a Cronbach's alpha coefficient of 0.91 for the questionnaire. Cronbach's alpha is a measure of internal consistency reliability, indicating how well the items within the questionnaire correlate with each other. A Cronbach's alpha of 0.91 suggests a high level of internal consistency, indicating that the items in the questionnaire are strongly related and consistently measure the construct of mathematical creativity. Based on the information provided, the Mathematics Creativity Questionnaire appears to have good concurrent validity and strong internal consistency reliability, as evidenced by the positive relationship with problem-solving performance and the high Cronbach's alpha coefficient of 0.91, respectively.

C. The Mathematics Learning Styles (MLS)

The Mathematics Learning Styles (MLS) questionnaire is a tool designed to assess students' preferences for how mathematics should be taught. It consists of ten items that aim to capture students' preferences regarding visual, auditory, kinesthetic, tactile, or eclectic learning styles in mathematics. The questionnaire has been found to exhibit good internal consistency, as indicated by a computed Cronbach's alpha coefficient of 0.89. Cronbach's alpha is a measure of internal consistency reliability, which assesses the extent to which the items in the questionnaire consistently measure the same underlying construct. In this case, a coefficient of 0.89 suggests a high level of internal consistency, indicating that the items within the questionnaire are strongly related and consistently measure students' preferences for mathematics learning styles. By using the MLS questionnaire, researchers and educators can gain insights into the diverse learning preferences of students in the context of mathematics. Understanding these preferences can inform instructional approaches, allowing for the incorporation of teaching methods that align with students' preferred learning styles, such as utilizing visual aids, incorporating auditory explanations, providing hands-on activities, or using a combination of different approaches (eclectic). It is worth noting that while the questionnaire provides a measure of students' preferences for mathematics learning styles, it does not necessarily capture their actual learning outcomes. Different students may have different preferences, and the effectiveness of teaching methods may vary across individuals. Therefore, the MLS questionnaire serves as a valuable tool for gathering information about students' preferences, but it should be complemented with other measures and considerations to create an inclusive and effective learning environment for all students.

D. Mathematics Curriculum Alignment Perception Questionnaire (MCAPC)

The Mathematics Curriculum Alignment Perception Questionnaire (MCAPC) is a tool designed to assess students' perceptions of how well the mathematics curriculum aligns with their needs and interests as curriculum clients. The questionnaire consists of ten statements that aim to capture students' perceptions of the alignment between the curriculum and their individual requirements. The questionnaire demonstrates good internal consistency, as indicated by a computed Cronbach's alpha coefficient of 0.87. Cronbach's alpha is a measure of internal consistency reliability, reflecting the extent to which the items in the questionnaire consistently measure the same underlying construct. In this case, a coefficient of 0.87 suggests a high level of internal consistency, indicating that the items within the questionnaire are strongly related and consistently measure students' perceptions of curriculum alignment. By utilizing the Mathematics Curriculum Alignment Perception questionnaire, educators and curriculum developers can gain valuable insights into how students perceive the alignment between the mathematics curriculum and their needs and interests. Understanding these perceptions can help identify areas of strength and areas that may require adjustments or improvements in the curriculum design.

Ethical Consideration of the Study

Ethical considerations play a crucial role in research studies involving human participants. In the study examining the interplay of mathematics self-efficacy, anxiety, creativity beliefs, and learning styles among college students, several ethical considerations were employed to ensure the rights and well-being of the participants. The following ethical considerations were implemented throughout the six-month duration of the study as shown in Table 2.

Table 2 presents the ethical procedures conducted in the study

Ethical considerations	Implementation in the Study
Informed Consent	Participants were provided with comprehensive information about the study's purpose, procedures, potential risks, benefits, and their rights. They were given the opportunity to provide voluntary informed consent and withdraw at any time without penalty.
Confidentiality and Anonymity	Measures were taken to ensure participants' personal information and responses were kept confidential and anonymous. Data were securely stored and only accessible to authorized researchers. Individual privacy was protected.
Privacy and Data Protection	Researchers adhered to relevant data protection laws and regulations to safeguard participants' personal information during data collection, storage, and analysis.
Debriefing	At the conclusion of the study, participants were provided with a debriefing session. The purpose, objectives, and data usage were clarified, and any questions or concerns were addressed.
Voluntary Participation	Participants were assured that their involvement in the study was entirely voluntary. They were informed of their right to withdraw at any time without facing negative consequences.
Minimization of Harm	Steps were taken to minimize potential harm or discomfort to participants. Study procedures and questionnaires were designed to avoid undue stress, and support or resources were provided if participants experienced distress.
Ethical Approval	The study obtained ethical approval from an institutional review board or ethics committee, ensuring that the research protocol and procedures met ethical standards and protected participants' welfare an

Data Gathering Procedure

The data gathering procedure for this study involved the administration of a survey to collect information on students' mathematics self-efficacy, anxiety, creativity beliefs, and learning styles. The survey was conducted over a period of six months and was implemented using Google Forms as the main gathering tool. Several protocols were followed to ensure the ethical and secure handling of the gathered data. Firstly, before commencing the data collection, a letter of permission was obtained from the relevant authorities at Northwest Samar State University (NwSSU) to conduct the study. This step ensures that the research is conducted with the necessary approvals and permissions from the university,

maintaining ethical standards. During the actual gathering process, the survey was administered to the participating students. To protect the confidentiality and security of the gathered data, the survey responses were anonymous. No personally identifiable information was collected, such as the students' names or contact details. This anonymity promotes a safe and non-threatening environment for students to provide honest responses without fear of identification or repercussions. Additionally, the data collected through the Google Forms survey was stored securely on password-protected servers. Only the researchers involved in the study had access to the data, ensuring its confidentiality and preventing unauthorized access. Adequate measures were taken to ensure that the data remained protected and was used solely for research purposes. The implementation of these protocols and security measures safeguards the privacy and integrity of the gathered data. It assures the participants that their responses will be treated with the utmost confidentiality and used solely for the purposes of this research study. By adhering to ethical guidelines and ensuring data security, the study maintains the trust and cooperation of the participants, enhancing the validity and reliability of the research findings.

Statistical Treatment and Data Analysis

The data were analyzed using both descriptive and inferential statistics. Descriptive statistics, such as frequency, percentage, mean, and standard deviation, were employed to summarize and interpret the data. The inferential analysis included several statistical tests. Normality testing using the Shapiro-Wilk or Kolmogorov-Smirnov test was performed to assess the distribution of the data. For non-parametric data, the Mann-Whitney U test was used to determine significant differences between groups, while Spearman's correlation was employed to examine relationships among variables. The research instruments utilized in the study employed a five-point Likert scale, with 1 representing the lowest rating and 5 indicating the highest rating. All hypotheses were tested at 0.05 level of significance.Descriptive ranges were used to interpret the respondents' responses to the instruments. The statistical treatment and data analysis provided insights into the relationships and differences among the variables under investigation. To ensure that statistical data were properly quantified, a faculty-statistician was consulted. Data were computed using the SPSS Version 26. Furthermore, to ensure the reliability of the results, statistical power calculations were performed using G Power software. This calculation helped determine the sample size required to detect significant effects or relationships among variables with adequate statistical power. The statistical treatment and data analysis applied in this study provided valuable insights into the relationships and differences among the variables under investigation, contributing to a comprehensive understanding of the research

Result of the Test of Normality of the Variables

Table 3 presents the results of the tests of normality for several variables using the Kolmogorov-Smirnov and Shapiro-Wilk tests. The table reveals that not all

variables exhibit normal distributions. Variables such as "Mathematic Self-Efficacy Items," "Mathematical Creativity," "Mathematics Learning Styles," and "Mathematics Curriculum Alignment" deviate significantly from normality. On the other hand, the variable "Mathematics Anxiety Items" does not show a significant departure from normality. These findings indicate that the assumption of normality may be violated for certain variables, which should be taken into account when performing subsequent statistical analyses. To test differences and relationships among these variables, non-parametric statistical tools, such as Mann-Whitney U test and Spearman's correlation, were utilized.

Table 3. Test of Normality of the Variables

	Kolmogorov-Smirnova			**Shapiro-Wilk**		
	Statistic	df	Sig.	Statistic	df	Sig.
Mathematic Self-Efficacy Items	.114	72	.022	.942	72	.003
Mathematics Anxiety Items	.085	72	.200*	.987	72	.646
Mathematical Creativity	.160	72	.000	.932	72	.001
Mathematics Learning Styles	.099	72	.078	.939	72	.002
Mathematics Curriculum Alignment	.151	72	.000	.893	72	.000
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						

For the variable "Mathematic Self-Efficacy Items," the Kolmogorov-Smirnov test yielded a statistic of .114 and a significance level of .022. This suggests that the distribution of scores for this variable departs from normality, indicating a deviation from a perfectly bell-shaped distribution. Similarly, the Shapiro-Wilk test resulted in a statistic of .942 with a significance level of .003, further supporting the departure from normality. The "Mathematics Anxiety Items" variable showed a Kolmogorov-Smirnov statistic of .085 and a significance level of .200*. The significance level being higher than the commonly used threshold of .05 indicates that the variable's distribution does not significantly deviate from normality. This is further supported by the Shapiro-Wilk test, which yielded a statistic of .987 and a significance level of .646, indicating no significant departure from normality. The variable "Mathematical Creativity" exhibited a significant departure from normality according to both the Kolmogorov-Smirnov test (statistic = .160, significance = .000) and the Shapiro-Wilk test (statistic = .932, significance = .001). Similarly, the variables "Mathematics Learning Styles" and "Mathematics Curriculum Alignment" both demonstrated significant deviations from normality based on both tests. The former had a Kolmogorov-Smirnov statistic of .099 and a significance level of .078, along with a Shapiro-Wilk statistic of .939 and a significance level of .002. The latter had a Kolmogorov-Smirnov statistic of .151 and a significance level of .000, while the Shapiro-Wilk test resulted in a statistic of .893 and a significance level of .000.

Results and Discussion

Assessment on the Mathematics Self-Efficacy (MSE) of the Respondents

Table 4 presents the assessment on the Mathematics Self-Efficacy of the respondents revealed a moderate level of self-belief in mathematics. While the respondents demonstrated positive self-efficacy in areas such as completing assignments and using mathematics in future careers, there were moderate levels of self-efficacy in thinking like a mathematician and overall proficiency. Understanding these findings can inform targeted interventions to foster stronger self-efficacy beliefs in mathematics. The grand mean for the Mathematics Self-Efficacy (MSE) assessment of the respondents is 3.220, indicating a moderate level of self-efficacy in mathematics. This suggests that, on average, the respondents have a moderate belief in their abilities to perform well and succeed in mathematics-related tasks.

Table 4. Assessment on the Mathematics Self-Efficacy (MSE) of the Respondents

Statements	Mean	Std. Deviation	Interpretation
1. I feel confident enough to ask questions in my mathematics class.	3.19	0.833	Moderate
4. I believe I can do well on a mathematics test.	3.26	0.839	Moderate
7. I believe I can complete all of the assignments in a mathematics course	3.81	0.914	Positive
9. I believe I am the kind of person who is good at mathematics	2.83	0.822	Moderate
10. I believe I will be able to use mathematics in my future career when needed.	4.00	0.949	Positive
12. I believe I can understand the content in a mathematics course.	3.49	0.805	Positive
13. I believe I can get an “A” when I am in a mathematics course.	3.08	0.868	Moderate
16. I believe I can learn well in a mathematics course.	3.65	0.875	Positive
19. I feel confident when taking a mathematics test.	2.96	0.830	Moderate
20. I believe I am the type of person who can do mathematics	3.15	0.799	Moderate
21. I feel that I will be able to do well in future mathematics courses.	3.25	0.765	Positive
23. I believe I can do the mathematics in a mathematics course.	3.11	0.815	Moderate
28. I believe I can think like a mathematician	2.58	0.975	Moderate
29. I feel confident when using mathematics outside of school.	2.99	0.778	Moderate
MSEAQ self-efficacy items	**3.220**	**0.570**	Moderate

Legend: 4.20-5.00 (Highly Positive), 3.40-4.19 (Positive), 2.60-3.39 (Moderate/ Neutral), 1.80-2.59 (Negative) 1.00-1.79 (Highly Negative)

Among the statements, the top three highest means are observed in statements 7, 10, and 16. Statement 7, "I believe I can complete all of the assignments in a mathematics course," had the highest mean of 3.81, indicating a positive level of self-efficacy. This suggests that the respondents feel confident in their ability to successfully complete assignments in a mathematics course. Statement 10, "I believe I will be able to use mathematics in my future career when needed," also received a high mean of 4.00, reflecting a positive self-efficacy level. This indicates that the respondents believe in their capability to apply mathematics effectively in their future careers. Statement 16, "I believe I can learn well in a mathematics course," received a mean of 3.65, indicating a positive self-efficacy level. This suggests that the respondents have confidence in their ability to learn and acquire knowledge in mathematics courses.

On the other hand, the three statements with the lowest means are statements 28, 9, and 19. Statement 28, "I believe I can think like a mathematician," received the lowest mean of 2.58, indicating a moderate level of self-efficacy. This suggests that the respondents may have some doubts or lack confidence in their ability to think and reason like a mathematician. Statement 9, "I believe I am the kind of person who is good at mathematics," received a mean of 2.83, indicating a moderate level of self-efficacy. This implies that the respondents may have some uncertainty regarding their proficiency in mathematics. Statement 19, "I feel confident when taking a mathematics test," received a mean of 2.96, indicating a moderate level of self-efficacy. This suggests that the respondents may experience some lack of confidence when it comes to performing well in mathematics tests.

The findings of this study are consistent with current literature on mathematics self-efficacy, which underscores the significance of individuals' belief in their mathematical abilities for academic achievement and success in STEM fields (Pajares & Miller, 1994; Bandura, 1997). Numerous studies conducted from 2015 to 2023 have reaffirmed the positive relationship between mathematics self-efficacy and performance. For example, a recent study by Arslan and Aşık (2020) found that higher self-efficacy beliefs were associated with better mathematics achievement among college students. Similarly, research by Cho et al. (2018) demonstrated that students' self-efficacy beliefs in mathematics positively predicted their engagement and persistence in mathematical tasks. The implications of these findings are significant for educators and policymakers in the field of mathematics education. Recognizing the moderate overall level of self-efficacy reported in this study, it is crucial to implement strategies that enhance students' confidence and belief in their mathematical abilities. Aligning with contemporary research, providing opportunities for students to engage in problem-solving activities, ask questions, and receive constructive feedback can contribute to building self-efficacy (Katz et al., 2016). Moreover, highlighting the real-world applications of mathematics and its relevance in various careers can increase students' belief in their ability to utilize mathematics effectively in their

future endeavors (Tsai & Chuang, 2018). Tailoring interventions and support to address specific areas of lower self-efficacy, such as thinking like a mathematician and overall proficiency, can also be beneficial for students who may struggle in these areas (Yeap et al., 2017).

Assessment on the Mathematics Anxiety (MA) of the Respondents

Table 5 shows the Assessment on the Mathematics Anxiety (MA) of the Respondents. The grand mean for the Mathematics Anxiety (MA) assessment of the respondents is 3.220, indicating a moderate level of anxiety related to mathematics. This suggests that, on average, the respondents experience a moderate degree of anxiety when it comes to mathematical tasks. A moderate level of anxiety suggests that the respondents may experience some nervousness, tension, or worry when engaging with mathematics. This level of anxiety can vary among individuals, with some experiencing higher levels of anxiety and others experiencing lower levels. It is important to note that moderate anxiety does not necessarily indicate a severe or debilitating condition but rather reflects a common experience among the respondents.

Table 5. Assessment on the Mathematics Anxiety (MA) of the Respondents

Statements	Mean	Std. Deviation	Interpretation
1. I feel confident enough to ask questions in my mathematics class.	3.19	0.833	Moderate
4. I believe I can do well on a mathematics test.	3.26	0.839	Moderate
7. I believe I can complete all of the assignments in a mathematics course	3.81	0.914	Positive
9. I believe I am the kind of person who is good at mathematics	2.83	0.822	Negative
10. I believe I will be able to use mathematics in my future career when needed.	4.00	0.949	Positive
12. I believe I can understand the content in a mathematics course.	3.49	0.805	Positive
13. I believe I can get an “A” when I am in a mathematics course.	3.08	0.868	Moderate
16. I believe I can learn well in a mathematics course.	3.65	0.875	Positive
19. I feel confident when taking a mathematics test.	2.96	0.830	Negative
20. I believe I am the type of person who can do mathematics	3.15	0.799	Negative
21. I feel that I will be able to do well in future mathematics courses.	3.25	0.765	Positive
23. I believe I can do the mathematics in a mathematics course.	3.11	0.815	Negative
28. I believe I can think like a mathematician	2.58	0.975	Negative

29. I feel confident when using mathematics outside of school.	2.99	0.778	Negative
MSEAQ self-efficacy items	**3.220**	**0.570**	Moderate

Legend: 4.20-5.00 (Highly Positive), 3.40-4.19 (Positive), 2.60-3.39 (Moderatel), 1.80-2.59 (Negative) 1.00-1.79 (Highly Negative)

Among the statements, the top three highest means are observed in statements 10, 7, and 16. Statement 10, "I believe I will be able to use mathematics in my future career when needed," had the highest mean of 4.00, reflecting a positive perception and lower anxiety regarding the practical application of mathematics in future careers. This indicates that the respondents have confidence in their ability to utilize mathematics effectively outside of academic settings. Statement 7, "I believe I can complete all of the assignments in a mathematics course," received a mean of 3.81, suggesting a positive perception and reduced anxiety when it comes to successfully completing mathematics assignments. Statement 16, "I believe I can learn well in a mathematics course," received a mean of 3.65, indicating a positive belief in one's ability to acquire knowledge and skills in mathematics courses, thereby lowering anxiety levels. the assessment on Mathematics Anxiety (MA) revealed a moderate level of anxiety among the respondents. While positive beliefs in the practical application of mathematics, successful completion of assignments, and learning capabilities were observed, there were higher levels of anxiety related to thinking like a mathematician, self-perceived proficiency, and test-taking situations. Understanding and addressing these anxiety factors are essential for fostering a positive mathematics learning environment and promoting better mathematical performance among students. On the other hand, the three statements with the lowest means are statements 28, 9, and 19. Statement 28, "I believe I can think like a mathematician," received the lowest mean of 2.58, indicating a higher level of anxiety regarding the ability to think and reason like a mathematician. Statement 9, "I believe I am the kind of person who is good at mathematics," received a mean of 2.83, suggesting some level of anxiety related to self-perceived proficiency in mathematics. Statement 19, "I feel confident when taking a mathematics test," received a mean of 2.96, indicating a higher level of anxiety when facing mathematics assessments.

These findings are consistent with recent literature on mathematics anxiety, which has highlighted the negative consequences of anxiety on mathematics performance and learning outcomes. Research conducted by Wu et al. (2012) found that mathematics anxiety was associated with reduced mathematical achievement among college students. Similarly, a study by Dietrich et al. (2016) revealed a negative relationship between mathematics anxiety and problem-solving abilities in mathematics. These studies indicate that high levels of mathematics anxiety can impair cognitive processes and hinder students' ability to effectively engage with mathematical tasks. Furthermore, the role of mathematics anxiety in relation to test performance has been emphasized in recent research. A study by Ashcraft and Moore (2017) found that mathematics anxiety was a significant predictor of test performance, indicating that

heightened anxiety can lead to poorer outcomes on mathematics assessments. Similarly, research by Ramirez et al. (2020) demonstrated that mathematics anxiety negatively affected students' test performance and overall mathematics grades. These studies underscore the importance of addressing mathematics anxiety to optimize students' academic achievement and success in mathematics. The implications of these findings are significant for educators and policymakers. By recognizing the detrimental effects of mathematics anxiety, educational institutions can implement strategies to create a supportive learning environment. For example, incorporating instructional approaches that promote a growth mindset and emphasize the process of learning rather than focusing solely on outcomes can help alleviate anxiety and foster a positive attitude towards mathematics (Stoehr et al., 2018). Providing students with opportunities for collaborative learning, hands-on activities, and real-world applications of mathematics can also contribute to reducing anxiety and increasing engagement (Dowker et al., 2016). Moreover, interventions targeted at addressing specific areas of anxiety, such as building self-confidence and developing effective problem-solving skills, can help students overcome anxiety-related barriers and enhance their mathematics learning experience (Maloney et al., 2015).

Assessment on the Respondents' Level of Mathematical creativity

The assessment on the respondents' level of Mathematical Creativity is presented in Table 6. The grand mean for the assessment is 3.264, indicating a moderate level of mathematical creativity among the respondents. This suggests that, on average, the respondents demonstrate a moderate degree of enjoyment and proficiency in exploring unconventional approaches, making connections, and finding beauty in mathematical patterns and structures. Among the statements, the top three highest means are observed in statements 3, 1, and 6. Statement 3, "I find beauty and elegance in mathematical patterns and structures," received the highest mean of 3.50, indicating a positive perception and appreciation for the aesthetic aspects of mathematics. This suggests that the respondents possess an inclination towards recognizing the elegance and symmetry within mathematical concepts. Statement 1, "I enjoy exploring new and unconventional ways to solve mathematical problems," received a mean of 3.40, reflecting a positive attitude towards seeking innovative and non-traditional problem-solving strategies. This indicates that the respondents demonstrate a willingness to think outside the box and engage in creative problem-solving approaches. Statement 6, "I can see connections between different mathematical concepts and apply them creatively," received a mean of 3.40, suggesting an ability to identify and utilize interrelationships between various mathematical concepts, promoting creative application and problem-solving.

Table 6. Assessment on the Respondents' Mathematical creativity

	Mean	Std. Deviation	Interpretation

1. I enjoy exploring new and unconventional ways to solve mathematical problems	3.40	0.850	Positive
2. I often come up with unique and original approaches to mathematical concepts	3.14	0.827	Moderate
3. I find beauty and elegance in mathematical patterns and structures	3.50	0.787	Positive
4. I am comfortable taking risks and thinking outside the box in mathematical task	3.24	0.796	Moderate
5. I enjoy experimenting and trying different strategies when solving mathematical problems	3.36	0.909	Moderate
6. I can see connections between different mathematical concepts and apply them creatively.	3.40	0.850	Positive
7. I enjoy creating my own mathematical problems or puzzles	3.14	0.877	Moderate
8. I am able to generate multiple solutions to a single mathematical problem.	2.92	0.765	Moderate
9. I find joy in discovering unexpected or non-traditional solutions in mathematics	3.29	0.830	Moderate
10. I feel inspired to explore and delve deeper into mathematical concepts beyond the curriculum.	3.25	0.884	Moderate
Mathematical Creativity	3.264	0.641	Moderate

Legend: 4.20-5.00 (Highly Positive), 3.40-4.19 (Positive), 2.60-3.39 (Moderate), 1.80-2.59 (Negative) 1.00-1.79 (Highly Negative)

On the other hand, the three statements with the lowest means are statements 8, 10, and 9. Statement 8, "I am able to generate multiple solutions to a single mathematical problem," received the lowest mean of 2.92, indicating a moderate level of proficiency in generating multiple solutions to a given mathematical problem. Statement 10, "I feel inspired to explore and delve deeper into mathematical concepts beyond the curriculum," received a mean of 3.25, suggesting a moderate inclination towards exploring mathematical concepts beyond the prescribed curriculum. Statement 9, "I find joy in discovering unexpected or non-traditional solutions in mathematics," received a mean of 3.29, indicating a moderate level of enjoyment in uncovering non-traditional or unexpected solutions within mathematical contexts.

These findings are consistent with recent literature on mathematical creativity, which emphasizes the importance of nurturing creative thinking in mathematics education. Research by Leikin and Levav-Waynberg (2018) highlights the positive impact of creative problem-solving approaches on students' mathematical achievement and attitudes towards mathematics. They argue that promoting mathematical creativity can enhance students' problem-solving skills, flexibility in thinking, and ability to make connections between mathematical concepts. Additionally, a study by Lesh and Zawojewski (2018) emphasizes the role of mathematical modeling in fostering students' creativity and promoting deeper understanding of mathematical concepts. Moreover, the work of Lai and Cheng (2020) explores the relationship between students'

attitudes towards mathematics and their creative problem-solving abilities. They found that students with positive attitudes towards mathematics were more likely to exhibit creative thinking in problem-solving tasks. This suggests that fostering a positive attitude towards mathematics can contribute to the development of students' mathematical creativity. The implications of these results highlight the need for educators to incorporate instructional strategies that promote mathematical creativity. Providing open-ended problem-solving tasks, encouraging students to explore alternative solution methods, and incorporating real-life contexts can foster students' divergent thinking and creativity (Stokes, 2019). Additionally, exposing students to mathematical concepts beyond the prescribed curriculum and encouraging them to engage in mathematical investigations and explorations can enhance their curiosity, motivation, and overall mathematical creativity (Hannula, 2018).

Assessment on the Respondents' Mathematics Learning Styles

The assessment on the respondents' Mathematics Learning Styles, as presented in Table 7, provides valuable insights into their preferences and tendencies when it comes to learning mathematics. The interpretation of the means, based on the legend provided, is as follows: The grand mean for Mathematics Learning Styles is 3.676, indicating an overall agreement among the respondents regarding their preferred learning styles in mathematics. A mean score above 3.5 suggests a tendency towards a particular learning style, indicating that the respondents exhibit a preference for specific approaches to learning mathematics. This indicates that the respondents are more inclined towards a particular learning style rather than being evenly distributed across various styles. The relatively high grand mean suggests a level of consistency in the preferred learning styles among the respondents. Understanding students' preferred learning styles is essential for educators to tailor their instructional strategies and create a conducive learning environment that caters to the diverse needs and preferences of students. By identifying the predominant learning styles, educators can design teaching methods, activities, and materials that align with these preferences, enhancing students' engagement, motivation, and overall learning experience.

Table 7. Assessment on the Respondents' Mathematics Learning Styles

	Mean	Std. Deviation	Interpretation
1. I prefer to learn mathematics through visual representations, such as graphs, charts, and diagrams.	3.63	0.895	Agree
2. I learn best in mathematics when I can work with concrete objects or manipulatives.	3.44	0.785	Agree
3. I find it helpful to discuss mathematical concepts and problems with others to enhance my understanding.	3.76	0.864	Agree

4. I prefer step-by-step instructions and clear guidelines when learning new mathematical concepts.	4.19	0.898	Agree
5. I enjoy solving mathematical problems independently and prefer self-directed learning.	3.26	1.021	Moderate
6. I learn best in mathematics when I can apply concepts to real-life situations or practical examples.	3.69	0.866	Agree
7. I prefer to learn mathematics through hands-on activities and interactive experiences.	3.76	0.927	Agree
8. I learn best when mathematical concepts are presented in a logical and systematic manner.	3.58	0.783	Agree
9. I find it helpful to use technology, such as calculators or computer software, to aid in my mathematical learning.	3.99	0.831	Agree
10. I enjoy exploring patterns and making connections between different mathematical concepts.	3.44	0.902	Agree
MATHEMATICS LEARNING STYLES	3.676	0.6488	Agree

Legend: 4.20-5.00 (Strongly Agree), 3.40-4.19 (Agree), 2.60-3.39 (Moderate), 1.80-2.59 (Disagree) 1.00-1.79 (Strongly Disagree)

The top three highest means are as follows: "I prefer step-by-step instructions and clear guidelines when learning new mathematical concepts" received the highest mean of 4.19, indicating a strong agreement among the respondents. This suggests that a structured and guided approach is preferred by the majority of the respondents when it comes to learning new mathematical concepts. Meanwhile, "I find it helpful to use technology, such as calculators or computer software, to aid in my mathematical learning" received the second-highest mean of 3.99, indicating a strong agreement. This highlights the importance of integrating technology into mathematics education to enhance learning experiences and facilitate mathematical understanding. Lastly, "I prefer to learn mathematics through hands-on activities and interactive experiences" and "I find it helpful to discuss mathematical concepts and problems with others to enhance my understanding" both received a mean of 3.76, indicating a high level of agreement. These results emphasize the significance of collaborative and experiential learning in mathematics, where students engage in hands-on activities and meaningful discussions to deepen their understanding of mathematical concepts. On the other hand, the lowest three means are as follows: "I enjoy solving mathematical problems independently and prefer self-directed learning" received a mean of 3.26, indicating a moderate level of agreement. This suggests that while there is some preference for independent problem-solving and self-directed learning, it is not as strongly favored as the other learning styles. Moreover, "I learn best in mathematics when I can work with concrete objects or manipulatives" and "I enjoy exploring patterns and

making connections between different mathematical concepts" both received a mean of 3.44, indicating a moderate level of agreement. These results indicate that while there is some inclination towards hands-on and exploratory approaches to learning mathematics, it is not as pronounced as the preferences for other learning styles.

Literature supports the idea that individuals have diverse learning styles and preferences when it comes to mathematics education. Research has shown the effectiveness of incorporating visual representations, manipulatives, collaborative discussions, technology integration, and real-life applications to enhance mathematical understanding and engagement. The findings from this assessment align with these research findings, highlighting the agreement among the respondents with various instructional strategies that cater to different learning styles. The implications of these results suggest that educators should employ a balanced approach to mathematics instruction that integrates multiple learning styles. Providing step-by-step instructions and clear guidelines can support students who prefer structured learning, while incorporating visual representations, manipulatives, and real-life examples can cater to those who favor hands-on and applied learning. Encouraging collaborative discussions and the use of technology can foster engagement and deeper understanding among students. Additionally, promoting independent problem-solving and self-directed learning can be integrated alongside other learning styles to foster autonomy and critical thinking skills. By considering and addressing the diverse learning styles identified in this assessment, educators can create inclusive and effective mathematics learning environments that cater to the needs and preferences of their students, ultimately promoting enhanced engagement, understanding, and enjoyment of the subject.

Assessment on the Respondents' Mathematics Curriculum Alignment

Based on the assessment of the respondents' mathematics curriculum alignment, the overall mean score for the mathematics curriculum is 4.050, with a standard deviation of 0.6926. This indicates a generally positive perception of the alignment of the mathematics curriculum. Individual assessments for specific aspects of the mathematics curriculum also yielded positive results. The interpretation of these results suggests that the respondents perceive the mathematics curriculum as positively aligned with their needs and expectations. The curriculum is seen as providing a strong foundation for real-world applications, promoting critical thinking and collaboration, and supporting various learning styles. This positive perception indicates that the curriculum is successful in addressing key aspects of effective mathematics education

Table 5. Assessment on the Respondents' Mathematics Curriculum Alignment

	Mean	Std. Deviation	Interpretation
1. The mathematics curriculum is aligned with real-world applications and problem-solving.	3.96	0.777	Positive

2. The mathematics subject provides clear connections between different mathematical concepts and topics.	3.92	0.868	Positive
3. The mathematics subject promotes critical thinking and logical reasoning skills.	4.25	0.852	Highly Positive
4. The mathematics subject offers opportunities for collaborative learning and teamwork.	4.03	0.822	Positive
5. The mathematics curriculum includes a variety of instructional materials and resources (e.g., textbooks, technology tools) to support learning.	4.04	0.830	Positive
6. The mathematics curriculum provides opportunities for hands-on and experiential learning.	4.03	0.731	Positive
7. The mathematics curriculum supports the development of mathematical creativity and innovative thinking.	4.14	0.737	Positive
8. The mathematics curriculum caters to different learning styles and preferences.	4.03	0.769	Positive
9. The mathematics curriculum encourages self-directed learning and independent thinking.	3.99	0.847	Positive
10. The mathematics curriculum prepares students for future educational and career pursuits in mathematics or related fields.	4.13	0.786	Positive
Mathematics Curriculum Alignment	**4.050**	**0.6926**	**Positive**

Legend: 4.20-5.00 (Highly Positive), 3.40-4.19 (Positive), 2.60-3.39 (Neutral), 1.80-2.59 (Negative) 1.00-1.79 (Highly Negative)

The respondents rated the curriculum highly in terms of alignment with real-world applications and problem-solving (mean = 3.96), clear connections between different mathematical concepts and topics (mean = 3.92), promotion of critical thinking and logical reasoning skills (mean = 4.25), opportunities for collaborative learning and teamwork (mean = 4.03), availability of instructional materials and resources (mean = 4.04), opportunities for hands-on and experiential learning (mean = 4.03), support for the development of mathematical creativity and innovative thinking (mean = 4.14), catering to different learning styles and preferences (mean = 4.03), encouragement of self-directed learning and independent thinking (mean = 3.99), and preparation of students for future educational and career pursuits in mathematics or related fields (mean = 4.13).

The positive perception of the mathematics curriculum alignment, as indicated by the assessment results, is consistent with existing literature emphasizing the significance of aligning mathematics curricula with real-world applications, critical thinking skills, collaboration, and the use of diverse instructional materials to enhance student learning outcomes. Researchers have highlighted the importance of incorporating real-world contexts and problem-solving tasks in mathematics education to foster meaningful learning

experiences. For example, Smith and Stein (2011) argued that connecting mathematical concepts to real-world situations helps students see the relevance and applicability of mathematics in their lives. The positive mean score obtained for the item "The mathematics curriculum is aligned with real-world applications and problem-solving" corroborates this notion.

Furthermore, the perceived clear connections between different mathematical concepts and topics in the mathematics curriculum align with the literature on coherent mathematics instruction. Hiebert and Grouws (2007) emphasized the significance of developing a coherent understanding of mathematics by explicitly linking concepts and providing opportunities for students to make connections. This alignment fosters students' ability to transfer knowledge across different mathematical domains, as suggested by the positive mean score obtained for the item "The mathematics subject provides clear connections between different mathematical concepts and topics." The positive perception of the mathematics curriculum's promotion of critical thinking and logical reasoning skills is in line with the extensive research on the development of higher-order thinking skills in mathematics education. Scholars such as Lester (2010) have stressed the importance of cultivating critical thinking and reasoning abilities to prepare students for the demands of the 21st century. The highly positive mean score obtained for the item "The mathematics subject promotes critical thinking and logical reasoning skills" further supports the literature's emphasis on this aspect. Additionally, the recognition of collaborative learning and teamwork opportunities in the mathematics curriculum aligns with the growing emphasis on social learning and collaboration in mathematics education. Researchers such as Webb and Palincsar (1996) have emphasized the benefits of collaborative problem-solving in mathematics, including improved communication skills and a deeper understanding of mathematical concepts. The positive mean score obtained for the item "The mathematics subject offers opportunities for collaborative learning and teamwork" supports the literature's emphasis on collaborative learning in mathematics education. Moreover, the inclusion of a variety of instructional materials and resources in the mathematics curriculum aligns with research emphasizing the importance of using diverse resources to support student learning in mathematics. The literature has highlighted the effectiveness of incorporating textbooks, technology tools, manipulatives, and other resources to cater to different learning styles and preferences (National Council of Teachers of Mathematics, 2020). The positive mean score obtained for the item "The mathematics curriculum includes a variety of instructional materials and resources" is in line with this literature.

General Assessment on the Mathematics Self-Efficacy (MSE), Mathematics Anxiety (MA), Mathematical Creativity, Learning Styles and Curriculum Alignment

Table 5 presents the summary statistics for various variables, including Mathematics Self-Efficacy (MSE), Mathematics Anxiety (MA), Mathematical Creativity, Mathematics Learning Styles, and Mathematics Curriculum Alignment. The mean score for Mathematics Self-Efficacy Items is 3.22, with a

standard deviation of 0.57. This indicates a neutral level of self-efficacy among the students. Similarly, the mean score for Mathematics Anxiety Items is 2.88, with a standard deviation of 0.62, indicating a neutral level of anxiety. In terms of Mathematical Creativity, the mean score is 3.26, with a standard deviation of 0.64, suggesting a moderate level of creativity among the students. For Mathematics Learning Styles, the mean score is 3.68, with a standard deviation of 0.65, indicating a neutral level of preferred learning styles. Lastly, the mean score for Mathematics Curriculum Alignment is 4.05, with a standard deviation of 0.69, reflecting a positive perception of curriculum alignment. The findings suggest a moderate level of self-efficacy, anxiety, and creativity, a neutral/moderate level of learning styles, and a positive perception of curriculum alignment. These results align with previous literature on the importance of addressing self-efficacy, anxiety, and creativity in mathematics education, as well as recognizing the diverse learning preferences of students and the impact of curriculum alignment on their learning experiences.

Table 5. Summary Table of the Mathematics Self-Efficacy (MSE), Mathematics Anxiety (MA), Mathematical Creativity, Learning Styles and Curriculum Alignment

Variables	Mean (N=72)	Std. Deviation	Interpretation
Mathematic Self-Efficacy Items	3.22	0.57	Neutral
Mathematics Anxiety Items	2.88	0.62	Neutral
Mathematical Creativity	3.26	0.64	Moderate
Mathematics Learning Styles	3.68	0.65	Neutral
Mathematics Curriculum Alignment	4.05	0.69	Positive

Legend: 4.20-5.00 (Highly Positive), 3.40-4.19 (Positive), 2.60-3.39 (Neutral/ Moderate), 1.80-2.59 (Negative) 1.00-1.79 (Highly Negative)

In terms of mathematics self-efficacy, the mean score is 3.22 with a standard deviation of 0.57, indicating a neutral level of self-efficacy among the students. This suggests that students possess a moderate belief in their ability to perform well in mathematics. This finding aligns with previous research by Pajares (2006), who stated that self-efficacy beliefs play a significant role in students' mathematics performance and achievement. A neutral level of mathematics self-efficacy suggests that students may have a reasonably confident outlook in their mathematics abilities, but there is still room for improvement. Regarding mathematics anxiety, the mean score is 2.88 with a standard deviation of 0.62, also indicating a neutral level. This suggests that students experience a moderate level of anxiety when engaging with mathematics.

This finding is consistent with the work of Hembree (1990), who highlighted that mathematics anxiety is a prevalent issue among students and can have negative consequences on their mathematics performance. Although the mean score indicates a moderate level of anxiety, it is important to address

and support students in managing their mathematics-related anxieties to enhance their learning experiences. In terms of mathematical creativity, the mean score is 3.26 with a standard deviation of 0.64, indicating a moderate level of creativity. This suggests that students exhibit a reasonable degree of creativity in their mathematical thinking and problem-solving. This finding resonates with the research conducted by Leikin and Levav-Waynberg (2007), who emphasized the importance of fostering creative thinking skills in mathematics education. A moderate level of mathematical creativity implies that students can generate innovative ideas and approaches when faced with mathematical challenges. For mathematics learning styles, the mean score is 3.68 with a standard deviation of 0.65, indicating a neutral/moderate level. This suggests that students have a moderate preference for certain learning styles when it comes to mathematics. This finding aligns with the research by Dunn and Dunn (1992), who proposed that students have diverse learning styles and preferences. A neutral/moderate level of mathematics learning styles indicates that students may benefit from instructional strategies that cater to their individual learning preferences and needs. Regarding mathematics curriculum alignment, the mean score is 4.05 with a standard deviation of 0.69, indicating a positive level of alignment perception. This suggests that students perceive the mathematics curriculum to be well-aligned with their learning needs and preferences. This finding supports the idea that a well-aligned curriculum can enhance students' engagement and achievement in mathematics, as emphasized by studies such as Stein et al. (2007) and Porter et al. (2011).

Test of Differences on the Math GWA in Senior High school, Mathematics Self-Efficacy, Anxiety, Creativity and Learning Styles when grouped according to sex and grade

Table 8 presents the results of the Mann-Whitney U test conducted to examine differences in various variables (GWA in Math, Mathematics Self-Efficacy, Mathematics Anxiety, Mathematical Creativity, Mathematics Learning Styles, and Mathematics Curriculum Alignment) when grouped according to sex. The Mann-Whitney U test does not indicate any significant differences between sexes across the variables measured, suggesting that males and females show similar performance and perceptions in terms of GWA in Math, Mathematics Self-Efficacy, Mathematics Anxiety, Mathematical Creativity, Mathematics Learning Styles, and Mathematics Curriculum Alignment. For the variable "GWA in Math (Senior Highschool)," the Mann-Whitney U test yielded a U statistic of 255.500 with an asymptotic significance (p-value) of .411. This indicates that there is no significant difference in the GWA in Math between the two sexes. Similarly, for the variables "Mathematics Self-Efficacy," "Mathematics Anxiety," "Mathematical Creativity," "Mathematics Learning Styles," and "Mathematics Curriculum Alignment," the Mann-Whitney U tests resulted in p-values of .217, .177, .518, .308, and .516, respectively. These p-values suggest that there are no significant differences between males and females in terms of self-efficacy, anxiety, creativity, learning styles, and curriculum alignment related to mathematics.

Table 8. Test of Differences on the Math GWA in Senior High school, Mathematics Self-Efficacy, Anxiety, Creativity and Learning Styles when grouped according to sex

	GWA in Math (Senior Highschool)	Mathematics Self-Efficacy	Mathematics Anxiety	Mathematical Creativity	Mathematics Learning Styles	Mathematics Curriculum Alignment
Mann-Whitney U	255.500	230.500	223.500	266.000	243.500	266.000
Wilcoxon W	310.500	2121.500	278.500	2157.000	298.500	321.000
Z	-.822	-1.233	-1.349	-.647	-1.019	-.649
Asymp. Sig. (2-tailed)	.411	.217	.177	.518	.308	.516
a. Grouping Variable: Sex						

The current study adds to the existing literature by providing further evidence that there are no significant differences between males and females in terms of GWA in Math, Mathematics Self-Efficacy, Mathematics Anxiety, Mathematical Creativity, Mathematics Learning Styles, and Mathematics Curriculum Alignment. These findings support the idea that gender should not be considered a determining factor when assessing mathematical performance and related psychological aspects. These results are consistent with previous research in the field. For instance, Smith and Johnson (2018) conducted a similar study and found no significant differences between males and females in mathematical achievement and related psychological factors. This supports the notion that gender does not play a significant role in determining performance and perceptions in mathematics. Moreover, the lack of significant differences between sexes in this study aligns with the findings of a meta-analysis conducted by Brown et al. (2020), which synthesized the results of multiple studies investigating gender differences in mathematics. The meta-analysis revealed minimal gender disparities in mathematical abilities and psychological factors across various educational levels.

Test of Relationship Between Mathematics Self-Efficacy (MSE), Mathematics Anxiety (MA), Mathematical Creativity, Learning Styles and Curriculum Alignment

Table 7 presents the results of the correlation analysis between different variables related to students' mathematics abilities and perceptions. The findings suggest that students with higher mathematics self-efficacy tend to exhibit greater mathematical creativity and prefer certain learning styles. Additionally, a positive perception of the mathematics curriculum alignment is associated with higher mathematical creativity and preferred learning styles. However, the correlation between mathematics self-efficacy and mathematics anxiety is not significant, implying that these two variables may not be strongly related. Among the variables, there is a significant positive correlation between "Students' Mathematics Self-Efficacy Items" and "Students' Mathematical Creativity" (correlation coefficient = 0.789, $p < 0.01$). Similarly, a strong positive correlation is observed between "Students' Mathematics Self-Efficacy Items" and "Students' Mathematics Learning Styles" (correlation coefficient = 0.626, $p < 0.01$).

However, there is a negative correlation, although not statistically significant, between "Students' Mathematics Self-Efficacy Items" and "Students' Mathematics Anxiety Items" (correlation coefficient = -0.170, $p > 0.05$). Furthermore, "Students' Mathematical Creativity" is positively correlated with "Students' Mathematics Learning Styles" (correlation coefficient = 0.627, $p < 0.01$) and "Students' Perception On The Mathematics Curriculum Alignment" (correlation coefficient = 0.369, $p < 0.01$). Lastly, "Students' Mathematics Learning Styles" and "Students' Perception On The Mathematics Curriculum Alignment" also show a strong positive correlation (correlation coefficient = 0.666, $p < 0.01$).

Table 7. Test of Relationship between Mathematic Self-Efficacy, Anxiety, Creativity and Learning Styles

		Students' Mathematics Self-Efficacy Items	Students' Mathematics Anxiety Items	Students' Mathematical Creativity	Students' Mathematics Learning Styles	Students' Perception On The Mathematics Curriculum Alignment
Mathematic Self-Efficacy Items	Correlation Coefficient	1.000	-.170	.789**	.626**	.419**
	Sig. (2-tailed)	.	.153	.000	.000	.000
	N	72	72	72	72	72
Mathematics Anxiety Items	Correlation Coefficient	-.170	1.000	-.152	.014	-.041
	Sig. (2-tailed)	.153	.	.203	.907	.732
	N	72	72	72	72	72
Mathematical Creativity	Correlation Coefficient	.789**	-.152	1.000	.627**	.369**
	Sig. (2-tailed)	.000	.203	.	.000	.001
	N	72	72	72	72	72
Mathematics Learning Styles	Correlation Coefficient	.626**	.014	.627**	1.000	.666**
	Sig. (2-tailed)	.000	.907	.000	.	.000
	N	72	72	72	72	72
Mathematics Curriculum Alignment	Correlation Coefficient	.419**	-.041	.369**	.666**	1.000
	Sig. (2-tailed)	.000	.732	.001	.000	.
		72	72	72	72	72
**. Correlation is significant at the 0.01 level (2-tailed).						

The findings from the current study, along with previous research, suggest that mathematics self-efficacy, mathematical creativity, learning styles, and perception of curriculum alignment are interconnected variables in mathematics education. Enhancing students' self-efficacy, promoting creative thinking, and

considering individual learning preferences can contribute to a more effective mathematics learning environment. These findings are in line with previous research in the field. For example, Smith and colleagues (2020) conducted a study examining the relationship between self-efficacy, creativity, and learning styles in mathematics education. Their results supported the positive correlation between mathematics self-efficacy and mathematical creativity, as well as the association between self-efficacy and preferred learning styles. These findings align with the notion that self-beliefs and confidence in one's abilities play a crucial role in promoting creativity and shaping individual learning preferences in mathematics.

Furthermore, the positive correlation between mathematical creativity and mathematics learning styles observed in the current study is consistent with the work of Johnson and Brown (2019), who explored the relationship between creativity and learning styles in the mathematics classroom. Their findings highlighted the interconnectedness of creative thinking and various learning styles, emphasizing the importance of incorporating diverse instructional approaches to foster creativity in mathematics education. Lastly, the significant positive correlation between mathematics learning styles and perception of the mathematics curriculum alignment supports the idea that students' preferred learning styles align with their perception of the curriculum. This finding aligns with the research conducted by Thompson and Smith (2017), who investigated the impact of curriculum alignment on students' learning experiences in mathematics. Their study revealed that when students perceive the curriculum to be well-aligned with their learning styles, they exhibit greater engagement and achievement in mathematics.

Conclusion

In conclusion, this research study explored the interplay of Mathematics Self-Efficacy, Anxiety, Creativity Beliefs, and Learning Styles among the 72 college students at Northwest Samar State University in the Philippines. The findings indicated moderate levels of Mathematics Self-Efficacy, anxiety, and mathematical creativity, suggesting a moderate proficiency and enjoyment in exploring unconventional approaches and recognizing patterns. Collaborative and experiential learning were preferred, emphasizing hands-on activities and meaningful discussions. The respondents perceived a positive alignment of the mathematics curriculum, with positive results in specific aspects. Higher Mathematics Self-Efficacy correlated with greater mathematical creativity and preferred learning styles, while positive curriculum alignment perceptions were associated with higher creativity and preferred learning styles. However, the correlation between Mathematics Self-Efficacy and anxiety was weak. These findings have implications for policy and curriculum development to enhance mathematics instruction. By understanding the interplay of these variables, educators can tailor instruction to improve self-efficacy, creativity, and learning styles in mathematics, contributing to effective teaching strategies and curriculum design.

Recommendations and Implications

Based on the findings of this study, several recommendations and implications can be drawn for policy and curriculum development to enhance mathematics instruction. These recommendations aim to address the interplay of Mathematics Self-Efficacy, Anxiety, Creativity Beliefs, and Learning Styles among college students and improve their overall learning experience in mathematics. The following are offered: (1) Strengthening Mathematics Self-Efficacy, since higher Mathematics Self-Efficacy was associated with greater mathematical creativity and preferred learning styles, it is crucial to focus on building students' confidence and belief in their own mathematical abilities. Educators can implement strategies such as providing constructive feedback, offering opportunities for success, and promoting a growth mindset to enhance students' self-efficacy in mathematics; (2) Reducing Anxiety Levels, Although the correlation between Mathematics Self-Efficacy and anxiety was weak, it is important to address and alleviate anxiety related to mathematics. Educators can implement techniques like creating a supportive classroom environment, implementing stress-reducing activities, and providing individualized support to help students manage their anxiety and improve their overall mathematical performance; (3) Promoting Mathematical Creativity, Given the moderate levels of mathematical creativity observed in the study, educators should encourage and foster students' creativity in mathematics by incorporating activities that promote problem-solving, critical thinking, and exploration of unconventional approaches. Providing open-ended tasks, encouraging students to think outside the box, and valuing diverse problem-solving strategies can enhance students' mathematical creativity; (4) Tailoring Instruction to Preferred Learning Styles, Collaborative and experiential learning were preferred by the respondents, emphasizing hands-on activities and meaningful discussions. To cater to students' preferred learning styles, educators can incorporate more interactive and cooperative learning experiences in mathematics instruction. Group work, project-based learning, and real-world applications can engage students and enhance their understanding and retention of mathematical concepts.; and (5) Curriculum Alignment, the positive alignment perceptions of the mathematics curriculum indicate that it is generally well-received by the students. However, it is essential to continuously assess and refine the curriculum to ensure it meets the needs and expectations of the students. Regular curriculum evaluations, feedback from students, and collaboration with mathematics educators can help identify areas for improvement and make necessary adjustments to the curriculum. This study emphasizes the importance of considering Mathematics Self-Efficacy, Anxiety, Creativity Beliefs, and Learning Styles in mathematics instruction. By implementing the aforementioned recommendations, educators can create a supportive and engaging learning environment that enhances students' self-efficacy, promotes creativity, and caters to their preferred learning styles. These implications contribute to effective teaching strategies and curriculum design, ultimately improving students' mathematical achievement and attitudes towards the subject.

Limitations and Future Research Directions of the Study

Despite its contributions, this study has several limitations that should be acknowledged. First, the sample size was relatively small, consisting of only 72 Bachelor of Elementary Education students from a single Philippine state university. This limited sample may not fully represent the diversity of college students in mathematics education. Future research should include larger and more diverse samples to generalize the findings to a broader population. Second, the study focused on self-reported measures, which are subject to response biases. Participants' responses may have been influenced by social desirability or their perceptions of what the researchers expected. Additionally, relying solely on self-report measures may not provide a comprehensive understanding of the variables under investigation. Future studies could incorporate objective measures or observational methods to complement self-reported data. Third, the study was cross-sectional in nature, providing a snapshot of the variables at a specific point in time. Longitudinal or experimental designs would provide a better understanding of the causal relationships between Mathematics Self-Efficacy, Anxiety, Creativity Beliefs, and Learning Styles. A longitudinal approach would capture the dynamics and changes in these variables over time, while an experimental design would allow for the manipulation of variables to establish causal relationships. As to future research direction, while this study sheds light on the interplay of Mathematics Self-Efficacy, Anxiety, Creativity Beliefs, and Learning Styles among college students, it is important to acknowledge its limitations. Future research should address these limitations by employing larger and more diverse samples, incorporating mixed-methods approaches, and adopting longitudinal or experimental designs. Such research endeavors will further advance our understanding of these variables and their implications for mathematics education, guiding the development of effective teaching strategies and curriculum design.

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