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Learner's Beliefs and Values in Learning Mathematics in the New Normal

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Abstract*: Beliefs and values in learning mathematics refer to individuals' attitudes, assumptions, and perspectives about Mathematics and its learning. These can influence how they approach mathematical tasks, perceive their ability in Mathematics, and remark on the value of Mathematics in their lives. Thus, this undertaking provides insights into the beliefs and values of the students in learning Mathematics and if these are predictors of their Mathematics performance. The randomly selected senior high school students were quantitatively surveyed. Data were analyzed using ANOVA, Pearson r, and regression analysis to prove the assumptions. The findings revealed that students placed a very high belief in the importance of Mathematics. Also, set a high value on collaboration and cooperation. They emphasized the importance of understanding key concepts, being open to new ideas and approaches when learning, and working with precision on mathematical concepts. Furthermore, female students have a higher belief in the nature and importance of Mathematics. They also have more positive social and personal values. In addition, it is determined that STEM students provide a higher social value than TVL students. Finally, the assumptions are proven that the beliefs and values of the students in learning Mathematics affect their academic achievement. Also, the relationship between beliefs and values in learning Mathematics is established. The implications and recommendations of the study were also discussed.*

Keywords—beliefs in learning Mathematics; values in learning Mathematics; senior high school; Zambales

1. INTRODUCTION

Mathematics educators are troubled because many students misunderstand mathematics and dislike mathematical activities [1]. More than that, many students seem to fear, even hate, mathematics [2]. Students' performance in mathematics, as indicated by the grades they achieved, is affected by several factors. Personological, sociological, and psychological factors have been linked to the students' Mathematics performance [3]. Psychological factors like curiosity and epistemological beliefs may directly impact the student's ability to learn Mathematics. Various studies show that knowing Mathematics may depend on beliefs [4], [5], [6], [7] and cultural values [8], [9], [10].

Studies in the United States of America investigated teacher's and student's beliefs in Mathematics [12], [13], [14], [15], [16], [17], [18], [19]. For instance, McMinn et al. [13], Shilling-Traina and Stylianides [12], Paolucci [17], and Campbell and Malkus [19] focused on identifying the beliefs in Mathematics of Pre-service teachers. At the same time, the study of Ayebo and Mrutu [14] explored the Mathematics beliefs of the students. It can be implied from these studies that it is substantial to recognize the importance of ideas in Mathematics to have a deeper understanding. A student's beliefs are formed by the student's social system and the classroom environment encountered during every learning activity. Teachers and students have similar thoughts, which suggests that teachers impact students' beliefs [20].

Meanwhile, Clarkson, Seah, and Pang [21] briefly explore notions regarding values and valuing in Mathematics. They mentioned that Mathematics is still a value-free zone for many Mathematics teachers and students today [21]. Carr [22] cited research from Germany and the United States of America about the development of values in Mathematics education. For example, Carr [22] mentioned that one study conveyed that the product of parental values in Mathematics is the formation of students' values in Mathematics [23], and another study revealed how math classroom experiences affect students' values [24].

In some ASEAN countries like Malaysia, Indonesia, and China, several undertakings also mentioned Mathematical beliefs [25], [20], [26]. Adnan et al. [25] used the Mathematical Beliefs Questionnaire (MBQ) to measure mathematical beliefs, conceptual knowledge, and mathematical experience. At the same time, Muhtarom et al. [20] and Yang et al. [26] explain teachers' beliefs' influence on students' beliefs in Mathematics. Braeken and Blomeke [27] stated that future teachers from Thailand, Malaysia, and the Philippines strongly believed that Mathematics is a fixed ability.

Several studies here in the Philippines were conducted regarding the values taught and learned in Mathematics [28], positive and negative beliefs in Mathematics [29], mathematical curiosity, and epistemological beliefs [3], and cultural factors [30] in learning Mathematics. Yet, there is a lack of studies to confirm whether students' belief in mathematics relates to their values toward Mathematics. In

the theory of Rokeach [31], one person's beliefs could be related to their values, and these factors affect learning and skill organization. Thus, this study addressed the need to examine in this post-pandemic era the student's beliefs and values in learning Mathematics to cope with the new normal education and tried to establish connections between these factors and the student's academic achievement. This undertaking is relevant since it provides the student's insights, awareness, and understanding of learning Mathematics in terms of students' beliefs and values. Mathematics teachers also be enlightened about the nature and ability of the students to understand Mathematics.

1.1 Objectives of the Study

The study aimed to ascertain the beliefs and values of senior high school students from the public secondary schools in Zone 3, Division of Zambales, in learning Mathematics in the new normal and explore its relationship to the participants' academic achievement in General Mathematics.

Specifically, it sought to determine the following:

1. Participants' age, sex, and strand.

2. Academic achievement of the respondents in General Mathematics.

3. Participant's belief in learning Mathematics in the Nature of Mathematics, Importance of Mathematics, and Ability in Mathematics.

4. Participant's values in learning Mathematics in terms of Epistemological Values, Social Values, and Personal Values.

5. Significant difference in the beliefs and values in learning Mathematics across the profile of the respondents

7. Significant relationship among the academic achievement, beliefs, and values of the respondents in learning Mathematics

8. Significant relationship between the beliefs and values of the respondents in learning Mathematics

9. Regression model from the relationship between academic achievement, beliefs, and values of the participants in learning Mathematics

1.2 Theoretical Framework

The Theory of Organization and Change by Milton Rokeach [31] was used for the study of having a good foundation and bases. Attitudes arise out of core values and beliefs we hold internally. Beliefs are assumptions and convictions we hold to be accurate based on past experiences. Values are worthy ideas based on things, concepts, and people. These factors heavily influence the ability to learn and organize knowledge and skills. To affect performance in a learning context or an organization, one needs to be aware of the critical differences between these constructs [32]. Levy [33] discussed the three books of Rokeach [31], [34], [35]. In Beliefs, Attitudes, and Values: A Theory of Organization and Change, Levy [33] mentioned that Rokeach [31] argued for the role of value concerning beliefs and attitudes. In Rokeach's second book, The Nature of Human Values, Rokeach [34] presented his value theory and RVS, an instrument to assess value and its justification and validity [33]. In Understanding Human Values, Rokeach [35] described his value theory and reviewed research works that used it. Rokeach [31] compared values, beliefs, attitudes, and behaviors. He said values underlie beliefs, attitudes, and conduct. Belief systems are evolving, impervious mental structures that can alter in response to experience [36].

Figure 1 below is the modified theory model related to the present study.

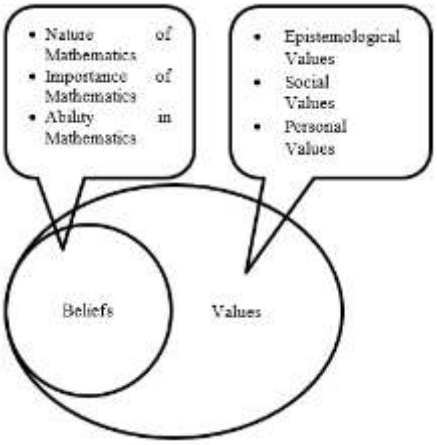

Figure 1. *Modified Theory of Organization and Change Model*

The purpose of this study is not to give empirical proof for such a sequence (i.e., value affects beliefs, attitudes, and behavior). However, the links presented in the literature among such variables are essential in establishing a value-belief-based framework.

1.3 Conceptual Framework

To help better understand the study, the researcher constructed a framework model to align the theory. Figure 2 below is the conceptual paradigm of the study showing the

relationship between the variables used in this study.

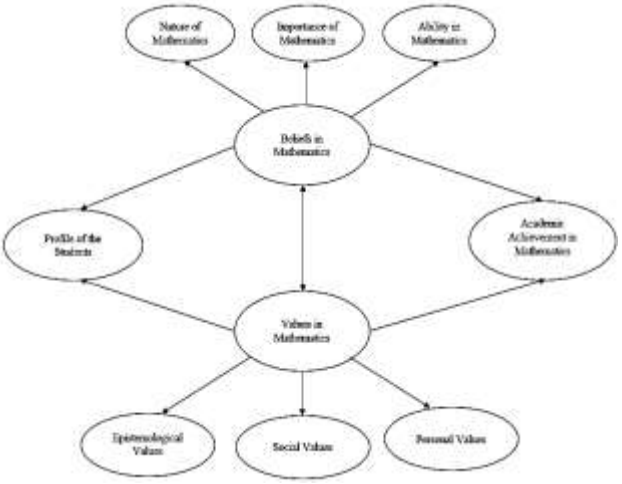

Fig 2. *Paradigm of the Study*

The first box on the left is the profile variable of the respondents as to age, sex, and grade level. It is connected to the middleboxes to show the differences across the profile. The upper box at the top is the perceived beliefs of the respondents in learning Mathematics in terms of the Nature and Importance of Mathematics and Ability in Mathematics. It is connected in the lower box to represent the relationship discussed in the Theory of Organization and Change [31]. The lower box contains the perceived values in learning Mathematics as Epistemological, Social, and Personal Values. The two middle boxes are connected to the last box at the right to show their relationship to the respondent's academic achievement in Mathematics.

1.4 Hypothesis

The fundamental concept of this study was to determine the relationship between respondents' beliefs and values in learning Mathematics and its effect on the academic achievement of the participants in Mathematics. It also ascertains differences across the profile of the respondents. Thus, the researcher tested the following null hypotheses:

Ho1: The beliefs and values of the participants in learning Mathematics do not differ significantly across the profile of the respondents.

Ho2: The relationship among the respondents' academic achievement, beliefs, and values in Mathematics does not exist.

2. METHODS

2.1 Research Design

The researcher used a quantitative approach since the study tests the hypothesis and analyzes the data through statistical tools. According to Creswell and Creswell [37], quantitative research evaluates objective ideas by studying the connection between variables. These factors can be measured, often with tools, and the resulting numeric data may be examined statistically [37].

Moreover, the study also utilized a descriptive-correlational research design to describe the beliefs and values of the participants in Mathematics through a survey questionnaire as the primary tool in gathering data and information from the senior high school students and determining its relationship to the academic achievement of the respondents. Correlational research determines the prevalence and associations among variables and forecasts events from current data and knowledge [38].

2.2 Participants and Location

The respondents of this study were composed of randomly selected Senior High School students from public secondary schools in Zone 3, Division of Zambales, enrolled during the Academic Year 2022-2023, specifically Cabangan National High School, Gov. Manuel D. Barreto National High School, San Rafael Tech.-Voc. High School, and La Paz National High School. From the population of six hundred thirty-nine (639) senior high school students, 241 randomly selected students participated in this study. The researcher computed the sample size with a 0.5 margin of error and 95% confidence.

2.3 Research Instrument

The primary tool for gathering the data and information of the participants was a survey questionnaire. The researcher adapted the survey instrument to the study of Casinillo, Camulte, Raagas, and Riña [30] for the beliefs in Mathematics and the study of Sam and Ernest [39] as the basis for values in Mathematics.

The survey questionnaire consists of four parts. The first part focuses on the profile of the participants as to age, sex, and strand. The second part deals with the academic achievement of the participants in Mathematics. The third part determines the respondent's beliefs in Mathematics, while the last part determines the respondent's values in learning Mathematics. A 4-point Likert Scale was used to describe the beliefs and values of the participants in Mathematics: 4 – very high, 3 – high, 2 – low, and 1 – very low. The instrument underwent panel validation and pilot testing to test its reliability. It has been found that the statements on the beliefs (0.903) and values (0.950) in learning Mathematics possess an excellent reliability value.

2.4 Data Collection

After a validated survey questionnaire was accepted, a permission letter was submitted to the thesis adviser, Dr. Katherine Parangat. Once it was signed, the request letter was sent to the Schools Division Superintendent, endorsed by the PMRSU Graduate School Director, Dr. Marie Fe De Guzman, for the conduct of the study. After signing the permission letter, a letter to the School Principal was sent to gather data from the respondents.

The researcher provided a printed copy of the questionnaire to the different public secondary schools with

the permission of the School Principal. The researcher allowed about three (3) weeks to distribute and gather data to ensure a hundred percent response. A consent form is included in the survey indicating the objectives and purpose of the study and that the data was treated as highly confidential.

2.5 Data Analysis

The researcher used the Statistical Package for Social Sciences v.26 (SPSS) software to analyze the data. Frequency percentages were used as descriptive statistics for age, sex, and strand. Weighted means was utilized to determine academic achievement in Mathematics and values and beliefs in learning Mathematics. Inferential statistics like the f-test and Pearson r were employed to confirm the hypothesis of this undertaking.

Also, the Likert scale was used to interpret the perceived beliefs and values in learning mathematics of the student-respondents: 4 (3.25 – 4.00) – Very High (VH); 3 (2.50 – 3.24) – High (H); 2 (1.75 – 2.49) – Low (L); and 1 (1.00 – 1.74) – Very Low (VL).

The interpretation of academic achievement is based on the DepEd grading system: 90 and above (Advanced); 85 – 89 (Proficient); 80 – 84(Approaching Proficiency); 75 – 79 (Developing); and 74 and below (Beginning).

3. RESULTS AND DISCUSSION

Student's Profile

The student respondents' profile comprises age, sex, and strand, as shown in Table 1.

Age. The data collected show that most respondents were 17 years old (61%), followed by 18-year-old respondents, 60 or 24.90% of the participants. The mean age is 17.47, meaning the participants are adolescents [40]. The result corroborates the study of Ablian and Parangat [41], and Lopez and Malay [42], where the respondents are also senior high school students. Adolescents are often characterized by their enthusiasm, energy, optimism to learn and explore new things, and tendency to take risks and challenge authority. At the same time, adolescence is also a period of increased vulnerability to mental health issues, including anxiety disorders. The physical, psychological, and social changes that occur can increase the risk of developing an anxiety disorder [40]. It is why their beliefs and values in learning Mathematics might change due to this stage of their life.

Table 1. Participant's Profile

Age	Frequency	Percent
20 years old	9	3.73
19 years old	17	7.05
18 years old	60	24.90
17 years old	147	61.00
16 years old	8	3.32
Total	**241**	**100.0**
Mean = 17.47 years old		
Sex	**Frequency**	**Percent**
Male	111	46.06
Female	130	53.94
Total	**241**	**100.0**
Strand	**Frequency**	**Percent**
Science, Technology, Engineering, and Mathematics (STEM)	73	30.29
Humanities and Social Sciences (HUMSS)	94	39.01
Accounting and Business Management (ABM)	17	7.05
Technical, Vocational, and Livelihood (TVL)	57	23.65
Total	**241**	**100.0**

Sex. As for the sex, it is evident that there is a higher number of female respondents (130 or 53.94%) than male respondents (111 or 46.06%). Male students may value mathematics as a way to demonstrate their intelligence or to gain prestige. In contrast, female students may appreciate mathematics as a way to gain practical skills or to understand the world around them. A study on students' preferences in STEM fields disclosed that male students preferred the usefulness of Mathematics for their future studies and career. In contrast, female students may choose mathematics' importance in daily life [43].

Strand. In terms of students' strand, the Humanities and Social Science (HUMSS) strand garnered the highest number of participants with a total of 94 (or 39.01%), followed by the Science, Technology, Engineering, and Mathematics (STEM) strand (73 or 30.29%). The Technical Vocational and Livelihood track attained 57 (or 23.65) participants, while there were 17 (or 7.05%) Accounting and Business Management (ABM) students. Senior high school strands vary in the curriculum type and the focus of the student's studies [44]. Generally, students have different preferences when it comes to choosing a strand. Some students prefer a strand focusing on academic subjects such as Math, Science, and English. In contrast, others prefer a strand focusing on more technical or vocational skills such as Business, Technology, and Home Economics. Some students may even select a strand combining academic and technical skills [45]. Depending on the student's educational goals, they somehow choose a career path with a limited Mathematics subject [46].

Academic Achievement in General Mathematics

The academic achievement of the student-respondents in General Mathematics is shown in Table 2 below.

Table 2. Academic Achievement in General Mathematics

Academic Performance		Frequency	Percentage
Advanced	90 & above	117	48.55
Proficient	85 - 89	78	32.37
Approaching Proficient	80 - 84	44	18.26
Developing	75 - 79	2	0.82
Beginning	74 & below	0	0.00
Total		**241**	**100.0**
Mean Grade		**89.08 (Proficient)**	

The data revealed that though there are 117 (or 48.55%) advanced students in General Mathematics, the mean grade is 89.09, considered proficient. Students with proficient levels can think logically and critically, which helps them understand concepts and solve problems. They can also apply their knowledge to real-world situations and understand the implications of their solutions. Ablian and Parangat [41] asserted that students with excellent competency could solve and answer questions and facts in mathematics. A comparable study also shows that most students have satisfactory grades [47].

Beliefs in Learning Mathematics

Table 3 provides the summary results on the participants' beliefs in learning Mathematics.

Nature of Mathematics. Among the five statements, three are considered very high, where students firmly believe that studying mathematics entails mostly remembering procedures and formulae and connecting many diverse ideas. They are also adamant in their conviction that achieving correct answers is a more powerful incentive than comprehending mathematical concepts. The finding denotes that the participants understand that learning Mathematics is about remembering and understanding key concepts, which is one way to learn the subject. Since Mathematics is the study of the world's patterns, relationships, and structures [48], it is necessary to grasp the basic ideas and formulas needed to learn more about Mathematics. Some students may be more motivated by getting the correct answers, while others may be more motivated by learning the material and gaining knowledge, or both. A survey conducted found that people have various conceptions of what mathematics is and how it should be used, including that it is a formalistic structure, a collection of rules, formulae, and procedures (scheme), a dynamic and creative production process, and a method of describing the real life [49].

Table 3. Student's Beliefs in Learning Mathematics

	Nature of Mathematics	WM	QR
1.	I believe that Mathematics consists mainly of using rules.	3.23	H
2.	I believe that learning mathematics mainly involves memorizing procedures and formulas.	3.51	VH
3.	I believe that Mathematics involves relating many different ideas.	3.33	VH
4.	I believe that getting the correct answers is more of a motivation than the satisfaction of learning the mathematics content.	3.27	VH
5.	A common difficulty with taking quizzes and Mathematics exams is that you are lost if you forget relevant formulas and rules.	3.24	H
	Overall Weighted Mean	**3.32**	**VH**
	Importance of Mathematics	**WM**	**QR**
1.	I believe that Mathematics is essential in my life.	3.65	VH
2.	I believe that I study Mathematics because I know how useful it is.	3.43	VH
3.	I believe that knowing Mathematics will help me earn a living.	3.49	VH
4.	I believe that Mathematics is worthwhile and necessary subject.	3.40	VH
5.	I believe that Mathematics is relevant in my life.	3.41	VH
	Overall Weighted Mean	**3.48**	**VH**
	Ability in Mathematics	**WM**	**QR**
1.	I have more confidence in my mathematics ability than in other academic subjects.	2.87	H
2.	If I am presented with a new mathematical situation, I can cope with it because I have a good background in Mathematics.	2.76	H
3.	I am calm if presented with a problem different from what I usually work with.	2.76	H
4.	I can use the knowledge I have gained so far in Mathematics.	3.15	H
5.	I believe I can solve problems in Mathematics.	3.02	H
	Overall Weighted Mean	**2.91**	**H**

However, it is interesting to take note that since the participants strongly believe that memorizing procedures and formulas is an essential component of learning Mathematics, they also have a high acceptance of following established rules and procedures and that there are significant consequences if one forgets or fails to use the correct formulas and regulations. It is also possible that the statement emphasizes the importance of memorization and retention in mathematics, as ignoring relevant procedures and rules can significantly affect one's ability to solve problems and complete tasks accurately. Okafor and Anaduaka [50] posited that Mathematics relies on logical and precise methods, and forgetting or not using the correct rules and formulas can lead to incorrect results or conclusions.

Importance of Mathematics. All the statements given to the respondents were marked with a very high level of belief, and the statement, Mathematics is essential in their lives, received the highest rank. It is followed by the idea that Mathematics will help earn a living. They also firmly believe they study Mathematics because it is a healthy, worthwhile, and relevant subject. The results denote that the students understand how

vital Mathematics is in their lives because it provides a foundation for understanding, solves problems in a wide range of fields, and offers a common language that can be used to describe and understand the world around us. Mathematics is fundamental in many areas, including science, engineering, finance, and everyday life [51]. It helps people understand and analyze complex systems and make informed decisions [52]. It is also essential for developing critical thinking and problem-solving skills, which are valuable in many careers [53]. Many believe studying mathematics can lead to higher-paying jobs and financial security [54], [55].

Ability in Mathematics. In terms of students' perceived ability in Mathematics, all the statements given were marked with a high level of belief, where the statements that talk about the usefulness of knowledge gained in Mathematics obtained the highest rank, followed by the views that they are capable of solving problems in this subject. Students also declared that they are particular about their ability in Mathematics compared to other academic subjects. The result is encouraging as it suggests that students have a positive attitude toward the topic, which could motivate them to put more effort into their studies. This could lead to better academic performance in Mathematics. Mathematics is a subject that requires a strong ability to think logically, analyze problems, and solve equations [56]. Therefore, it requires dedication and practice to master, but with the right skills and mindset, anyone can improve their ability in mathematics [57]. In addition, developing the ability to think logically will help the students understand the steps involved in solving math problems and make it easier to understand and remember concepts [50].

Values in Learning Mathematics

Table 4 provides the summary results on the participants' values in learning Mathematics.

Epistemological Values. The participants express a high level of all the given statements in epistemological values. The statement about working Mathematics activity with accuracy, care, and alertness acquired the highest rank, followed by the statement about time management in solving Mathematics problems. They also value the practical application of their Mathematics knowledge to solve problems. The results suggest that the students emphasize being thorough and efficient in their approach to Mathematics as they prioritize precision when working on Mathematics activities and consider time management an essential factor. In mathematics, it is vital to understand the logical reasoning behind concepts and theorems, which includes being able to provide proof or evidence for statements made [58]. It also requires a high level of precision in terms of language and notation. Thus, it is vital to communicate mathematical ideas accurately and clearly [59]. Since Mathematics is also relevant to real-world problems and situations, it is crucial to apply mathematical concepts and techniques to solve practical problems and be open to new ideas and approaches to problem-solving [60], [61].

Table 4. Student's Values in Learning Mathematics

	Epistemological Values	WM	QR
1.	I can do my Math work with accuracy, care, and alertness in thought.	2.98	H
2.	I can solve Math problems systematically.	2.78	H
3.	I can use my time correctly in solving Mathematics problems.	2.96	H
4.	I can use the practical and logical approach in Mathematics.	2.85	H
5.	I can use what I learn in Math and answer every Math problem.	2.93	H
	Overall Weighted Mean	**2.90**	**H**
	Social Values	**WM**	**QR**
1.	Mathematics teaches me to be cooperative with my classmates.	3.37	VH
2.	Mathematics teaches me to be honest in solving Math problems.	3.36	VH
3.	Mathematics teaches me to become grateful.	3.24	H
4.	Mathematics teaches me to become independent.	3.20	H
5.	Mathematics teaches me to become compassionate.	3.12	H
	Overall Weighted Mean	**3.26**	**VH**
	Personal Values	**WM**	**QR**
1.	I have become open-minded in different learnings in Mathematics.	3.24	H
2.	I became interested to learn more about Mathematics.	3.21	H
3.	I have become independent in solving Mathematics problems.	2.99	H
4.	I become diligent when solving Mathematics problems.	2.95	H
5.	I become patient in dealing with Mathematics problems.	3.01	H
	Overall Weighted Mean	**3.08**	H

Social Values. Two of the five (5) statements were rated as very high, with which the statement about being cooperative in Mathematics ranked the highest, followed by teaching them to be honest in solving Mathematics problems. The results suggest that learning mathematics can help individuals develop skills in cooperation and honesty. It is essential to work with others and communicate openly to solve mathematics problems effectively and honestly about the process and any challenges or mistakes that may arise. Additionally, it may be necessary to be honest with oneself about one's understanding and limitations to solve problems and seek help when needed effectively. In addition, it proposes that the skills learned through mathematics can be applied to other areas of life and help individuals become more cooperative and honest in their interactions with others. According to Anthony [62], the students who were perceived as "good" students placed a greater emphasis on the importance of working with others and creating a positive learning environment as they recognized the value of sharing knowledge and resources with their peers, and they demonstrated respect for others in the mathematical

community. Cardino Jr and Ortega-Dela Cruz [63] also posited that students' academic performance is significantly influenced by the extent to which they participate in cooperative learning. It is also evident in the study of Johnson et al. [64] that students who work collaboratively with their peers tend to have higher levels of achievement in math and a greater understanding of the material.

However, three of the statements acquired a high remark. The result implies that studying mathematics can help individuals develop gratitude, independence, and compassion. It also implies that studying mathematics can facilitate personal growth and the development of positive character traits. Gratitude may be cultivated through understanding and appreciating precision and logic [65]. Also, independence can be fostered through the challenge of solving problems and developing critical thinking skills [66]. Lastly, compassion can be strengthened by recognizing the universal nature of mathematical principles and their application to real-world situations [67].

Personal Values. All the statements on personal values received high remarks from the participants, with an overall weighted mean of 3.08. The statements about becoming open-minded in different learnings in Mathematics got the highest rank. This is followed by the statements that assert becoming interested in learning more in Mathematics. The participants also have a high level of value in becoming patient, independent, and diligent in dealing with Mathematics problems. The results indicate that the students valued being open to new ideas and approaches when learning and working with mathematical concepts. The high ranking of interest in learning more about Mathematics indicates that the participants are motivated to continue learning and improving their skills in this subject. Overall, this suggests that the participants value their ability to learn and grow their understanding of Mathematics. The values of patience, independence, and diligence are seen as necessary in learning and working with Mathematics, suggesting that the participants highly valued these qualities required to effectively tackle mathematical problems [68]. According to Winter [69], a curious student desires to understand and learn more about the world through the lens of mathematics.

Test of Difference on the Participant's Beliefs and Values in Learning Mathematics Across Profile

In terms of age and strand, as shown in Table 5, no statistical differences were determined in the nature and importance of Mathematics and perceived ability in Mathematics. The result corroborates some research findings that age, and strand is not an indicator of the Mathematics learning of the students [70], [41] (Mutodi & Ngirande, 2014; Ablian & Parangat, 2022)

Table 5. Test of Difference on the Beliefs in Learning Mathematics Across Student's Profiles

Grouping Variables		F-Value	Sig.	Decision (ά = 5%)
Nature of Mathematics	Age	0.628	0.643	Accept Ho (Not Sig)
	Sex	**13.613**	**0.000**	**Reject Ho (Sig)**
	Strand	0.223	0.925	Accept Ho (Not Sig)
Importance of Mathematics	Age	0.300	0.878	Accept Ho (Not Sig)
	Sex	**10.202**	**0.002**	**Reject Ho (Sig)**
	Strand	1.155	0.332	Accept Ho (Not Sig)
Ability in Mathematics	Age	2.194	0.070	Accept Ho (Not Sig)
	Sex	0.177	0.674	Accept Ho (Not Sig)
	Strand	1.652	0.162	Accept Ho (Not Sig)

However, a significant difference was determined across sex on the nature and importance of Mathematics in which female students perceived firmer beliefs than male participants. The result shows that females may have different experiences or exposures contributing to their perceptions of belief. The result corroborates the claims of Gaspard et al. [6], where gender differences were noticed, and intervention effects were more significant for females than males. In contrast, Peteros et al. [71] posited that substantial differences across gender do not exist in the self-concept of the students in Mathematics, which corresponds to the claims of Ajai and Imoko [72] that since no differences in achievement in Mathematics, it is also acceptable that both male and female students are capable of engaging in competition and working together. Though some studies exposed that male scores are better than females in Mathematics [73], [74], [75], the mathematical ability can be acquired regardless of sex [76].

In terms of age, as shown in Table 6, the respondents' epistemological, social, and personal values are the same. It is also the same with the epistemological and personal values of the participants' strand.

On the other hand, differences vary significantly across the student's sex in their social and personal values. The mean comparison revealed that female students generally have a stronger appreciation for learning Mathematics than male students. This signifies that female students tend to have a more positive outlook and outstanding commitment to Mathematics than male students. The results also substantiate the difference in social values between male and female respondents. Interestingly, while some studies show that males are more likely to prefer taking Mathematics field or subject [77], [78], both men and women have the potential to acquire mathematical ability with proper instruction and practice.

Table 6. Test of Difference on the Values in Learning Mathematics Across Student Profiles

Grouping Variables		F-Value	Sig.	Decision (ά = 5%)
Epistemological Values	Age	0.223	0.925	Accept Ho (Not Sig)
	Sex	1.762	0.186	Accept Ho (Not Sig)
	Strand	1.874	0.135	Accept Ho (Not Sig)
Social Values	Age	1.155	0.332	Accept Ho (Not Sig)
	Sex	**18.931**	**0.000**	**Reject Ho (Sig)**
	Strand	**2.843**	**0.038**	**Reject Ho (Sig)**
Personal Values	Age	1.652	0.162	Accept Ho (Not Sig)
	Sex	**5.182**	**0.024**	**Reject Ho (Sig)**
	Strand	0.839	0.473	Accept Ho (Not Sig)

Meanwhile, post hoc analysis (Tukey HSD) revealed a difference between STEM and TVL students. The students enrolled in the STEM strand (Science, Technology, Engineering, and Mathematics) have higher social values than those enrolled in the TVL strand (Technical-Vocational-Livelihood). Since Mathematics is often considered a core STEM subject, the results indicated that students received more intensive training and instruction than in other strands. The STEM students had a strong foundation in Mathematics, which may have given them an advantage over their peers in another academic track [79]. The STEM curriculum places a greater emphasis on academics, such as teamwork and problem-solving, than the TVL curriculum, which may focus more on technical skills and vocational training [80].

Test of Correlation among Academic Achievement, Beliefs, and Values of the Respondents in Learning Mathematics

As shown in Table 7, the relationship among the three variables is significant. The low correlation signifies that those beliefs somehow influence the academic achievement of the respondents. The positive result indicates that as the respondents' belief increases, the chance of getting a high grade is possible. The result corresponds to Mutodi and Ngirande's [70] findings that students' beliefs influence Mathematical performance. The correlation outcome also verifies the claims of Villavicencio and Bernardo [81] that positive emotions can help students engage more deeply with mathematics, foster a sense of motivation and engagement, and build a more positive attitude towards mathematics.

Also, since the result is significantly positive, this implies that when the values of the respondents in learning Mathematics are higher, so is their academic performance. The low correlation denotes that the participants' values somehow influence their academic achievement in Mathematics. The results prove the recommendations of Carr [22] to determine the relationship between values and academic performance outcomes. The claims of Ablian and Parangat [41] also corroborate the findings of this study that having higher self-efficacy in mathematics will also help students to be more confident and to have higher expectations for themselves, which can lead to better performance. Active learning can help improve student performance in science, engineering, and mathematics courses by providing students with the opportunity to apply what they have learned, which leads to an increased understanding of the material and helps students develop problem-solving skills [82].

Table 7. Test of Correlation among Participant's Academic Achievement, Beliefs, and Values in Learning Mathematics

Correlation			Values	Decision
Beliefs	Academic Achievement	r-value Sig. N	0.287 0.000 241	**Reject Ho (Sig)**
Values	Academic Achievement	r-value Sig. N	0.241 0.000 241	**Reject Ho (Sig)**
Beliefs	Values	r-value Sig. N	0.671 0.000 241	**Reject Ho (Sig)**

Lastly, the correlation between the beliefs and values of the participants in learning mathematics is significant and moderately positive. The positive relationship indicates that the values and beliefs of the participants are in the same direction. The moderate correlation denotes that the values depend on the student's beliefs in learning Mathematics or vice versa. The participants with certain beliefs and values about learning mathematics tend to have a positive attitude towards the subject. They could be more likely to engage in and succeed at mathematics learning. The result confirms the theory of Organization and Chance that values underlie beliefs [31]. Levy [33] also mentioned Rokeach [31] argued for the role of value concerning beliefs and attitudes. Recent studies mentioned Rokeach's theory [83], [84], yet a dearth of research confirms this relationship.

Regression Model from the Relationship among Academic Achievement, Beliefs, and Values of the Respondents in Learning Mathematics

The regression analysis revealed a significantly low positive correlation. The beliefs and values in learning Mathematics are a predictor of the academic achievement of the students. The respondents' beliefs and values account for 8.8% of the variance in academic achievement in Mathematics, which the regression model represents:

$$y = 3.03x_1 + 1.06x_2 + 76.015 \quad (1)$$

Where y denotes the dependent variable (Academic Achievement), x_1 represents the belief in learning Mathematics, and x_2 denotes the values in learning Mathematics.

When the participants have positive beliefs and values, they are more likely to have a positive attitude toward Mathematics and be more motivated to learn and succeed. Also, the result implies that beliefs and values in mathematics are two significant factors that can positively influence how a student learns and approaches mathematics. Positive emotions can lead to increased effort and persistence, better performance, improved collaboration, and greater enjoyment of mathematics. Positive emotions can also help students to stay focused and motivated and to develop interest and confidence in mathematics [81].

On the other hand, the regression analysis, as shown in Table 21, revealed that the students' values in learning Mathematics have a significant positive relationship with their beliefs in learning Mathematics. The respondents' beliefs account for 45% of the variance in values in learning Mathematics $(F = 195.339, p = 0.000)$ which is represented by the regression model:

$$y = 0.5x + 1.695 \quad (2)$$

Where y represents the dependent variable (beliefs in learning Mathematics) and x represents the predictor (values in learning Mathematics)

The respondents' values are significantly influencing their beliefs about learning mathematics. This also suggests that their thoughts play a significant role in shaping their values about Mathematics. According to Sagiv, et al. [85], values are the fundamental beliefs and principles that guide an individual's actions and decisions. It is a guiding force in a person's life and motivates them to act in a certain way.

3.1 Conclusion and Recommendations

The participants are senior high school students and mostly female adolescents with a proficient level in General Mathematics. They have a steadfast belief in the importance of Mathematics. They understand that one way to learn is to remember and understand the critical concept and have the ability to apply this knowledge. In general, the beliefs of the students in learning Mathematics are high. The students have very high values in cooperation and collaboration. They highly valued being open to new ideas and approaches when learning and working with precision on mathematical concepts. In general, students place a high value on learning Mathematics.

Statistical difference was found in the nature and importance of Mathematics, where female students have firmer beliefs than males. At the same time, no differences occur in the perceived ability of the students in Mathematics across age, sex, and strands. The sex of the students varies significantly on social and personal values, where female respondents place more positive values than males. In addition, a significant difference was found between STEM and TVL students in their social values.

The beliefs and values of the students in learning Mathematics somehow influence their academic achievement. Also, the student's beliefs and values in Mathematics are related and influence each other.

Lastly, the student's beliefs and values in Mathematics predict academic achievement. Also, their beliefs play a significant role in shaping their values about Mathematics.

Considering the findings presented thus far in the investigation, students may be encouraged to have a growth mindset to view mistakes and struggles as opportunities for growth and learning rather than setbacks. It can help students develop a more positive belief in their ability to learn mathematics. They may also be encouraged to explore ways of thinking deeply about the concepts they are learning and develop strategies to solve problems. It will help students better understand mathematics and create a more meaningful learning experience. The teachers may provide more learning experiences. Show them that there are multiple strategies to solving math problems, not just memorizing rules. Have them explain their solutions' reasoning to help them better understand. Show students how math is used in everyday life and their future careers. This can help them see math's practical value and relevance and strengthen their belief in its importance. They may also promote a more collaborative learning environment.

Encourage students to work together and share ideas, as this can help them feel more confident in their math skills and foster a sense of community and support within the classroom. Teachers and parents may also provide ongoing support and reinforcement. Offer extra help and support to students who may be struggling and recognize and praise progress and achievements. It can help students feel valued and motivated to continue learning math. In addition, school heads and administrators may promote and foster a positive and inclusive classroom culture. Create a welcoming and inclusive classroom environment where all students feel valued and supported. This can help students feel more positive about their ability to learn math and can help them feel more connected to the subject.

A follow-up study may be conducted to confirm further the relationship between values and beliefs in learning Mathematics. It is also possible to conduct this study qualitatively to have a deeper sense of view on the student's

values and beliefs. Future research may also include other predictors or factors like attitude or behavior, skills, and knowledge in broader scope for validity purposes.

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