

# Students' Attitude towards Mathematics and its Relationship with Mathematics Achievement

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## Abstract

*This study aims to investigate the relationship between students' attitudes towards mathematics and mathematics achievement among secondary-level students at community schools in Kirtipur Municipality. A convenience sampling method was used to choose schools and random sampling method was adopted to select 100 secondary level students, comprising 50 males and 50 females from five community schools in Kirtipur Municipality. The Mathematics Attitude Scale Short Form (MAS-SF), developed by Yasar, M. (2014), was employed to evaluate individuals' attitudes towards mathematics. Additionally, mathematics test-item was administered to measure mathematical achievement. The results of this research revealed a statistically significant positive correlation between students' attitudes towards mathematics and their mathematics achievement. The findings suggest that as students' attitudes become more positive, their performance in mathematics tends to exhibit a concurrent increase. Furthermore, regression analysis revealed that variations in students' attitudes towards mathematics could account for about 26% of the variability in mathematical achievement. These outcomes highlight the significance of attitudes as a predictive factor in determining students' success in mathematics. Understanding the relationship between attitudes and achievement can assist educators, policymakers, and stakeholders in developing strategies and interventions aimed at nurturing positive attitudes and improving students' mathematical achievement.*

**Keywords:** attitude, mathematics achievement, enjoyment, usefulness, confidence, anxiety

## Introduction

Mathematics is a vital discipline that significantly contributes in the development of cognitive abilities of the students in school education. Considerable attention has been given to devote in examining students' attitude towards mathematics. Many research studies have focused on examining the relationship between students' attitude towards mathematics and their academic achievement. (Hwang & Son, 2021).

The attitude towards mathematics refers to an individual's feelings, beliefs, and behaviors regarding the subject of mathematics. It encompasses a person's overall disposition and emotional response towards learning, understanding, and engaging with mathematical concepts, problems, and activities. According to Lin and Huang (2014), attitude towards

mathematics can be referred to as positive, negative, and neutral feelings and dispositions. Some students find mathematics enjoyable and rewarding while others may feel anxious and disinterested in mathematics. Attitudes are influenced by activities, emotional responses and beliefs associated with attitude object (Zan & Martino, 2007). Attitudes towards mathematics comprise a range of emotions, thoughts, and actions that students have towards the subject. Attitude towards mathematics is determined by four factors i) enjoyment, ii) fear, anxiety and distress, iii) usefulness of mathematics in daily life and iv) perceived achievement in mathematics (Yasar, 2014). The attitudes of students towards mathematics are seen as influential characteristics that can have a major impact on their level of engagement, persistence, and achievement in the study of mathematics (Hwang & Son, 2021).

Mathematical Achievement is the competency shown by the student in the subject mathematics. Its measure is the score on an achievement test in mathematics. (Pandey, 2017). Prior studies have yielded significant data substantiating the link between students' attitudes towards mathematics and their mathematics achievement. A longitudinal study by Gunderson et al. (2018) is an illustration of this, which discovered that students who had positive attitudes towards mathematics demonstrated greater academic success over time. Students with a positive attitude towards mathematics tend to enjoy the subject, understand its value, and have confidence in it; thus, they are likely to prioritize the study of mathematics which could lead to high performance in mathematics (Hwang & Son, 2021).

The objective of this study is to examine the relationship between students' attitudes towards mathematics and their mathematical achievement. This research endeavors to provide valuable insights for educators, policymakers, and stakeholders by providing actionable insights to enhance teaching practices, curriculum design, parental involvement, policy-making, and ultimately, students' academic success and future prospects.

### **Methods**

This study employed a quantitative and correlational research design, focusing on secondary school students from community schools in Kirtipur Municipality, located in the Kathmandu district of Nepal.

A convenient sampling method was employed to choose five community schools from ten secondary community schools which are in Kirtipur Municipality. The sample size was 100. A random sampling method was used to pick 20 students from each school. The goal was to ensure representation of students from both genders in each school. Among 20, 10 males and 10 females were selected from class 10 from each school.

The Mathematics Attitude Scale Short Form (MAS-SF), created by Yasar, M. (2014) and with a Cronbach's alpha coefficient of .956 (Yasar, 2014), was employed to assess the attitudes of secondary-level students towards mathematics. Participants provided their opinion on each item using a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). A higher score on this scale reflects a positive attitude towards mathematics. The MAS-SF consists of 19 items that include four factors of attitude: enjoyment (6 items with a Cronbach Alpha of .89), mathematics anxiety (5 items with a Cronbach Alpha of .84), the usefulness of mathematics (4 items with a Cronbach Alpha of .84), and confidence in mathematics (4 items with a Cronbach Alpha of .82) (Yasar, 2014).

The mathematics test-item consists of 20 questions and was administrated to assess students' achievement in mathematics. The test specifications outlined by the curriculum development center was followed to prepare mathematics test-item.

The Microsoft Excel 2019 and IBM SPSS 25, which is the Statistical Package for Social Science version 25 were used in data processing. Following the process of data gathering, the collected data underwent a thorough cleansing and preparation in Microsoft 2019 software in order to be ready for the final analysis. Additionally, an independent T-test was employed to assess the connection between independent and dependent variables.

## Results and Discussion

An analysis of descriptive data, including frequencies, mean, and standard deviation, was conducted. The data revealed the findings as shown below.

### Frequency and mean of factors of attitude

The following is the findings derived from the analysis of factors of attitude i.e. enjoyment, anxiety, usefulness, and confidence.

**Table 1**

*Frequency and mean of factors of attitude*

	SD	D	N	A	SA	Mean	$\alpha$
<i>Factor 1: Enjoyment</i>						<b>3.29</b>	
1. I enjoy solving math problems whenever I see them.	3	3	32	46	16	3.67	
2 I feel happy when dealing with mathematics.	1	11	29	45	14	3.62	
3 I enjoy fiddling with maths in my free times.	10	30	34	15	11	2.88	.85
4 I like maths topics so much that I've started thinking about everything mathematically.	18	38	22	16	6	2.53	
5 I like to practice with math.	1	7	30	41	21	3.72	
6 I think Mathematics course is very enjoyable and fun.	8	9	40	27	16	3.35	

	SD	D	N	A	SA	Mean	$\alpha$
<i>Factor 2: Fear, Anxiety and Distress</i>						<b>2.38</b>	
7 I'm so bored in math class.	29	37	19	10	5	2.25	
8 I think maths is a very boring class.	33	37	16	11	3	2.16	
9 I study maths only to pass the course.	29	34	13	14	10	2.4	.78
10 Maths is the course I fear most.	25	25	23	21	6	2.57	
11 I am annoyed by the fact that maths is a course consisting of symbols and formulas.	18	34	28	16	4	2.53	
<i>Factor 3: The use of Mathematics in everyday life</i>						<b>3.9</b>	
12 I believe that the knowledge I get in maths class will be useful in life.	2	6	14	46	32	4.00	
13 I believe what I learn in Mathematics will work for me.	3	4	14	47	32	3.99	.77
14 I think I will need maths in my work life in the future.	3	7	21	38	31	3.89	
15 I think that maths has an important place in my daily life.	3	14	16	43	24	3.69	
<i>Factor 4: Confidence</i>						<b>3.18</b>	
16 My friends think that I am successful at Maths.	7	20	29	34	10	3.18	
17 I see myself as a successful student in Maths.	5	18	37	29	11	3.22	.78
18 I am not a model student in Maths.	14	27	28	25	6	2.98	
19 I think I am a good student in Maths.	1	19	37	31	12	3.34	

Table above shows that the mean for usefulness of mathematics is 3.9, for enjoyment 3.29, for confidence 3.18 and for anxiety 2.38. Students enjoy mathematics by practicing math ( $M=3.72$ ), solving math problems whenever they see ( $M=3.67$ ), dealing with mathematics ( $M=3.62$ ) and thinking mathematics course is enjoyable and fun ( $M=3.35$ ). Students are anxious about mathematics because mathematics subject is the most fearful subject to them ( $M=2.57$ ) and they are annoyed by symbols and formula in the subject ( $M=2.53$ ). They consider mathematics subject as the course meant only to pass ( $M=2.4$ ). The most of students believe that the knowledge they get in maths class will be useful in their lives ( $M=4.0$ ) and will work for them ( $M=3.99$ ) in future ( $M=3.89$ ). The mean of confidence is 3.18. Most students thrive that they are good in maths ( $M=3.34$ ) and see themselves as successful in mathematics ( $M=3.22$ ). This study found the Cronbach Alpha for enjoyment, anxiety, usefulness, and confidence in mathematics was .85, .78, .77 and .78 respectively which indicate good reliability of the tool.

### Factors of attitude and gender

Table 2 shows the means, standard deviations, and independent t tests for gender in the various domains of attitude towards mathematics: enjoyment, anxiety, usefulness and confidence and mathematics achievement.

**Table 2***Independent T test of gender*

		N	Mean	SD	SEM	t	df	Sig (2-tailed)
Enjoyment	Male	50	20.52	4.469	.353	3.224	98	.001
	Female	50	18.86	4.190	.369			
Anxiety	Male	50	11.35	3.827	.303	-3.323	98	.001
	Female	50	12.95	4.329	.381			
Usefulness	Male	50	15.57	3.088	.244	-.633	98	.527
	Female	50	15.34	3.230	.284			
Confidence	Male	50	12.73	3.043	.241	2.629	98	.009
	Female	50	11.83	2.661	.234			
Overall Attitude	Male	50	60.17	7.329	.579	.822	98	.412
	Female	50	58.98	7.534	.663			

***Enjoyment and gender***

The average enjoyment score among males ( $M = 20.52$ ,  $SD = 4.46$ ) is greater than that of females ( $M = 18.86$ ,  $SD = 4.19$ ). There is a significant gender difference in the enjoyment of mathematics, with males (20.52) reporting higher levels of enjoyment than females (18.86),  $t(98)=3.224$ ,  $p=.001$ . This result is consistent with the findings reported by Baidoo et al. (2022), Tapia and Marsh (2001) and Frenzel, et al. (2007). This study found males enjoy learning, understanding, and engaging with mathematical concepts, problems, and activities more than females.

***Mathematics anxiety and gender***

The study revealed that females ( $F = 12.95$ ,  $SD = 4.32$ ) showed considerably greater levels of fear and anxiety than males ( $M = 11.35$ ,  $SD = 3.82$ ),  $t(98) = -3.323$ ,  $p = .001$ . According to this study, females (12.95) displayed higher levels of anxiety in comparison to males (11.35), which is consistent with previous research findings carried out in where Rahaman et al. (2023), De La Hera et al. (2023), Jansen et al. (2016) and Yüksel-Şahin (2008) reported women showed experiencing higher levels of mathematics anxiety than men.

***Usefulness and gender***

Table 2 indicates that there is no statistically significant difference found in the usefulness of mathematics between males ( $M = 15.57$ ,  $SD = 3.23$ ) and females ( $M = 15.34$ ,  $SD = 3.04$ );  $t(98) = -.633$ ,  $p = .527$ . Although, there is no significant difference, the mean of usefulness of mathematics for male ( $M=15.57$ ) is slightly higher than that of female ( $M=15.34$ ). This finding is consistent with the study conducted by Jansen et al. (2016)

where they revealed that women expressed a lower perceived use of mathematics in daily life compared to men.

### ***Confidence and gender***

There is a significant difference found in confidence levels between males ( $M = 12.73$ ,  $SD = 3.04$ ) and females ( $M = 11.83$ ,  $SD = 2.66$ );  $t(98) = 2.629$ ,  $p = .009$ . It was notably found that males (12.73) have higher level of confidence in mathematics than in females (11.83). This finding is consistent with Perez-Felkner et al. (2017) and Anaya et al. (2022). They found within the population of high school students, male individuals display greater levels of self-confidence in the field of mathematics compared to their female counterparts..

### ***Overall attitude towards mathematics and gender***

While there is no statistically significant difference found in the overall mathematical attitude between males ( $M = 59.93$ ,  $SD = 7.32$ ) and females ( $M = 59.21$ ,  $SD = 7.53$ ),  $t(98) = .822$ ,  $p = .412$ , it can be observed that males (59.93) tend to have a more positive attitude towards mathematics compared to females (59.21). The finding is line with Mubeen et al. (2013) who found there is no gender difference in mathematics attitude among secondary school students. Both males and females show a similar reduction in attitude scores over grade levels. Prior research on attitudes towards mathematics has documented notable gender disparities that favor male (Fennema & Sherman, 1976; De La Hera et al., 2023). Contrary to the findings of Ayebo & Dingel (2021), who discovered that males had a more positive attitude towards mathematics compared to girls, Recber et al. (2018) found the opposite to be true.

### **Mathematics achievement and gender**

**Table 3**

*Mathematics achievement and gender*

		N	Mean	SD	SEM	t	df	Sig (2-tailed)
Achievement	Male	50	41.46	25.265	2.648	1.393	98	.166
	Female	50	35.85	20.417	2.753			

There is no statistically significant difference in mathematics achievement between males ( $M=41.46$ ,  $SD=25.26$ ) and females ( $M=35.85$ ,  $SD=20.41$ );  $t(98)=1.393$ ,  $p=.166$ . Male students achieved a mean score that was almost six points higher than that of female students in the total mathematics assessment. However, this difference was not statistically significant. The similar non-significant finding can be seen in the prior research carried out by Kaiser and Zhu, (2022), Recber et al. (2018) and Ajisuksmo and Saputri (2017); they did not find any significant difference on mathematics achievement

between male and female either. ERO (2020) resulted statistically significant difference between the achievement of boys and girls in Mathematics in Nepal. The achievement of boys was above the national average in Maths whereas girls performed below the national average in grade 10 in Nepal (ERO, 2020). In contrast, Shakya (2012) found girls had more mathematics achievement than boys in Newari community in Kirtipur. This might have been influenced by cultural factors.

### Correlation between factors of attitude and mathematics achievement

Table 4 displays the association between achievement in mathematics and the factors of mathematics attitudes.

**Table 4**

*Correlation between factors of attitude and achievement*

	Achievement	Enjoyment	Anxiety	Usefulness	Confidence	Overall Attitude
Achievement	-	.427**	-.322**	.293**	.241**	.406**
Enjoyment	.	-	-.553**	.542**	.348**	.712**
Anxiety			-	-.348**	-.166*	.026
Usefulness				-	.299**	.721**
Confidence					-	.651**
Overall Attitude						-

\*\* . The correlation is significant at the 0.01 level (2-tailed).

The findings indicate that there is a considerable positive correlation between mathematics achievement and enjoyment ( $r = .427$ ,  $p < .01$ ), utility of mathematics ( $r = .293$ ,  $p < .01$ ), and confidence ( $r = .241$ ,  $p < .01$ ). The findings is aligning with the research conducted by, Mazana, et al., (2019) that found enjoyment significantly predict the student's achievement; Abin & et al. (2020) that found when students perceived mathematics to be useful, they tend to more likely to achieve well in mathematics; Kunhertanti and Santosa (2018), that found the positive correlation between confidence and achievement in mathematics. However, there is a moderately negative correlation between mathematics achievement and anxiety ( $r = -.322$ ,  $p < .01$ ). This finding is supported by Zhang et al. (2019) who found a similar correlation ( $r = -.32$ ) between mathematics anxiety and achievement. The results further revealed strong correlation between overall attitude and its factors such as enjoyment ( $r = .712$ ), usefulness ( $r = .721$ ), and confidence ( $r = .651$ ). Nevertheless, there is no substantial correlation between anxiety ( $r = .026$ ) and attitude. The variables such as enjoyment, usefulness and confidence significantly influenced students' attitude formation, with a rise in these variables resulting in more favorable attitudes among students.

### Attitudes towards mathematics as predictors of mathematics achievement

A regression analysis is conducted to examine the relationship between mathematics attitudes, the predictor variable, and mathematics achievement, the dependent variable. The table below demonstrates that attitude towards mathematics has a significant impact on mathematical achievement.

**Table 5**

*Regression analysis on attitudes towards mathematics as predictors of mathematics achievement*

Variable	B	SE	95% CI		$\beta$	F	P
			LL	UL			
Constant	26.48	14.87	.489	1.518			
Attitude	.93	.25	1.434	2.970	.304	14.71	.000
R <sup>2</sup>	.26						

Note N=100

The statistical analysis showed that mathematics attitude is a significant predictor of mathematics achievement,  $F(2, 98) = 14.71, p < 0.01$ . This means that having a positive attitude towards mathematics can have a considerable impact on mathematics achievement ( $\beta = 0.34, p < 0.01$ ). Furthermore, the coefficient of determination ( $R^2$ ) of .26 indicates that the model accounts for 26% of the variability in mathematics achievement. It means attitude towards mathematics contributes 26% in mathematics achievement. This result is supported by Ajisuksmo and Saputri (2017) which similar in predicting the contribution of attitude towards mathematics on mathematics achievement for 25.5%.

The positive correlation observed implies that as students' attitudes become more positive, their mathematical achievement tends to increase concurrently. This outcome aligns with prior research by Hwang and Son (2021) that has suggested a linkage between attitude towards mathematics and mathematics achievement. By having a positive attitude towards mathematics, the students will feel the importance of mathematics so as to improve their mathematics achievement and students who have negative attitudes tend to pay less attention in mathematics (Ajisuksmo & Saputri, 2017). Achievement in mathematics tends to result in more pleasant emotional perceptions of mathematics, and conversely, more positive attitudes towards mathematics lead to greater academic performance (Hwang & Son, 2021).

The results of this study support the findings of earlier studies that have shown a favorable correlation between students' attitudes towards mathematics and their achievement in mathematics (e.g., Dowker & Sheridan, 2022).

## Conclusion and Recommendations

In conclusion, the findings of this research shed light on students' attitudes towards mathematics and their corresponding achievements in the subject. The mean scores indicate that students perceive mathematics as useful with a generally positive outlook on its application in their lives and future endeavors. This suggests a recognition among students of the practical value of mathematical knowledge. The aspect of enjoyment in mathematics reveals mixed sentiments, as students report varying degrees of pleasure in practicing math solving problems on the fly engaging with mathematical concepts and viewing the mathematics course as enjoyable and fun. This nuanced perspective suggests that while some students find joy in specific activities, others may not perceive the subject as inherently enjoyable. However, the prevalence of anxiety towards mathematics is notable. Students express fearfulness toward the subject, irritation with symbols and formulas, and a perception of mathematics as a course merely meant for passing. These findings highlight the existence of apprehension and challenges associated with the subject, possibly influencing students' overall attitude and performance. On the positive side, students exhibit a moderate level of confidence in mathematics. Many students perceive themselves as proficient in math and envision success in the subject. This self-assurance may contribute positively to their overall mathematics achievement.

Importantly, the statistical analysis demonstrated a significant relationship between students' attitudes towards mathematics and their mathematics achievement. The regression analysis revealed that a positive attitude towards mathematics serves as a substantial predictor of mathematics achievement, emphasizing the influential role of psychological factors in academic performance. The coefficient of determination ( $R^2$ ) of .26 indicated that the model, incorporating attitudes towards mathematics, accounted for 26% of the variability observed in mathematics achievement among the students.

These findings underscore the importance of cultivating positive attitudes towards mathematics within educational settings. Strategies aimed at promoting the practical relevance, enjoyment, and confidence in mathematical skills may contribute not only to enhanced academic achievement but also to a more positive and engaged learning experience for students. Educational stakeholders, including teachers and policymakers, may consider implementing interventions that address students' anxieties, foster a sense of enjoyment, and emphasize the real-world applicability of mathematical concepts. As we navigate the landscape of mathematics education, understanding and addressing students' attitudes emerge as pivotal factors in unlocking their full potential and promoting success in the field.

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