

An Investigating on Attitudes Towards Mathematics and Their Relationship to Achievement among Basic School Students

Maheshwor Pokhrel¹, Lekhnath Sharma², Narendra Narayan Jha³, Tribhuvan Sharma⁴,
Bhadra Raj Tripathi⁵, and *Madhav Prasad Poudel⁶

^{1,3,4,5} Prithivi Naryan Campus, Tribhuvan University, Kaski, Nepal

²Central Department of Mathematics Education, Tribhuvan University, Kritipur, Nepal.

⁶ School of Engineering, Pokhara University, Kaski Nepal

*Corresponding author: pdmadav@gmail.com

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Abstract:

Attitudes toward mathematics are influenced by certain factors like school type, gender, self-confidence, impact of learning and achievement. This study aims to explore the students' attitudes toward mathematics and their relationship with achievement. It is a quantitative survey design. The data are collected from 110 students of public and private schools and were obtained and analyzed with validated attitude scales and achievement tests. The result showed the unfavorable attitudes towards mathematics in both school types, with males reporting slightly higher confidence. Private school students performed significantly better than public school, though no significant gender differences were observed in achievement.

Keywords: Mathematics attitudes, Achievement, Confidence, School type, Gender.

Introduction

Mathematics is the principal discipline which constitute a major domain in science and technology. Mathematics is regarded as a key subject throughout the world (Pokhrel et al., 2024). Not only in science, is mathematics essential for everyday life since the ancient period (Poudel, 2023). Thus mathematics is regarded as the queen of all sciences. (Burton, 2003). Though mathematics is studied at each level, it is still regarded as a tough subject (Yadav, 2017). Mathematics has the power to alter the capacity of achieving skills, knowledge and attitude that is reflected in everyday life (Kusmaryono, 2014).

Even though mathematics exists in every paces of study, many students are indifferent towards mathematics (Pokhrel, 2023). Students' mathematics performance is the prime concern aspect in mathematics education. Attitudes is an internal intrinsic factor and student's performance depend on their attitude (Pontian, 2019; Pokhrel & Sharma, 2024). Attitude refers to the degree of positive or negative affect associated with psychological objects such as symbols or ideas (Yadav et al., 2018). McLeod (1992) conceptualizes the effects in mathematics education by emphasizing on its impact in learning. Turnstone (1946) defines psychological objects are those objects in which people can express differing positive or negative feelings. Furthermore, Attitudes are essential in shaping students'

engagement, as they encompass evaluative responses that influence behavior, belief, and emotion (Mohamed, 2010; Allport, 1935). They argued that positive attitudes toward mathematics arise when students perceive mathematics as meaningful, and negative attitudes may lead to avoidance and anxiety. The factors like students' interest, attitudes, and teaching methods plays a vital role in creating the indifference towards learning mathematics (Jumadi & Kanafish, 2013). Concerning this issue, this study explores the student's attitude toward mathematics.

Literature Review

Many studies are done to observe the student's attitude toward mathematics. Lamb and Fullarton (2002) identified that school, classroom, and personal factors significantly impact students' achievement. These factors include classroom dynamics, school characteristics, students' beliefs, attitudes, and home influences like socioeconomic status and parental background (Poudel, 2020). Mohamed and Waheed (2011) observed that students generally hold an average positive view of mathematics regardless of the gender differences. Pontian (2019) emphasized that attitudes toward mathematics are key to effective learning and teaching because they shape the students' engagement with the subject. These studies highlight that students' perceptions and attitudes are critical in shaping their mathematics learning. Schoenfeld (1992) explored students' and parents' perspectives on mathematics, highlighting common misconceptions, assuming mathematics problems has a correct solution, rules are rigid and are to be memorized. The only geniuses can excel in mathematics. Similarly, parents viewed mathematics as difficult, fixed, and primarily about arithmetic and accuracy, suggesting that only students with innate ability should be expected to succeed. Similarly, Mohamed (2011) found that students' personal confidence and perceived usefulness of mathematics moderately affected their attitudes. Joshi (2017) points the barriers like lack of confidence, mathematics anxiety, home environment, and teacher quality as challenges affecting students' attitudes. Pandit (2007) explored attitudes toward mathematics and found positive attitudes overall, with differences noted between urban and rural students. Mohamed (2011), Mariade and Lourds et al. (2012), Joshi (2017), and Pandit (2007) emphasizes that students' attitudes toward mathematics are influenced by confidence, motivation, social support, and educational resources.

Langat (2011) found that students' attitudes significantly impact on their mathematics achievement. Most students showed a positive attitude, but perceptions of their abilities and past performance influences motivation and outcomes. This study underscores that attitudes, along with self-belief, play a crucial role in learning mathematics. Waheed (2011) investigated secondary students' attitudes toward mathematics in a school in Maldives and inferred that students generally has a positive attitude toward mathematics, regardless of the gender differences. Several studies highlight on the significant role of students' attitudes towards mathematics in influencing their academic performance (Mohd et al., 2011; Bramlett & Herron, 2009). Positive attitudes are linked with better achievement and problem-solving abilities (Nicolaidou & Philippou, 2003). Lawsha and Hussain (2011) found that male students exhibits a more positive attitude for mathematics in comparison to female students, with private school students performing better than those in government schools. Similarly, Rabha (2021) identified a positive correlation between attitudes and performance, noting that male students outperformed females, and private schools fostered more favorable attitudes. Studies by Basavayya (1995) and Mahanta & Islam (2012) showed gender differences in attitude, with boys

demonstrating more positive dispositions, positively correlated with higher achievements in mathematics. Farooq and Shah (2008) found that a positive attitude directly influences participation and success in mathematics. Davadas and Lay (2017) emphasized that attitude is a crucial factor for influencing students' mathematical achievement, noting its permanence and evaluative nature. These studies emphasized on the need to enhance students' attitudes towards mathematics and to explore the factors that affects attitudes and performance (Graziano & Raulin, 2000). The findings support the research objective of exploring how gender, school environment, and attitude impact on mathematics learning and performance. These evidence suggests that fostering a positive attitude, particularly through innovative teaching strategies and supportive environments, is essential for improving student outcomes in mathematics.

Based on literature review of exploring students' attitudes on mathematics, it is evident that multiple factors shape the attitudes and impacting achievement among the students. No significant study has been conducted to explore the attitudes toward mathematics and linkage it with achievement in the basic school level. So this study aims to investigate the students' attitudes, and achievement toward mathematics on the basis of school type and gender and its relationship.

Objective of the Study

Based on the weak achievement in mathematics within the above process, the objective of this study is to explore students' attitudes toward mathematics and its relationship with achievement.

Research Questions

Considering the objective of the study, the research is based on the following research questions.

1. What is the student's attitude toward mathematics?
2. Is there any difference in attitude towards mathematics among the students in public and private schools in Nepal?
3. Does the gender make any difference in attitudes toward mathematics?
4. Does the relationship exist between attitudes and mathematics achievement?

Delimitations of the study

The delimitation of the study are as follows;

1. The sample constitute of a public and private school from Pokhara metropolitan city; one and two.
2. The measure of attitude toward mathematics modifying from ERO (2019) and Alreshidi (2016) attitudes scale.
3. The concept of achievement tests is derived from Mullis et al. (2011), Alreshidi (2016), and Lindquist et al. (2019).

Methodology

This research was a quantitative survey design following a positivist research paradigm. Result analysis was in SPSS software based on descriptive and inferential statistic.

1. Methods

The study utilizes a quantitative research design. A survey design is an effective method for gathering data from a small population. This approach allows for efficient data collection, timely administration, and reliable comparisons (Fowler, 2013; Creswell, 2013). A standardized instrument, including an attitude scale and achievement test, was employed to ensure consistent and dependable analysis of responses, despite the limited sample size (Babbie, 2016; Auliana et al., 2022). Consequently, this design is well-suited for examining students' attitudes toward mathematics and their correlation with mathematics achievement in wards 1 and 2 of Pokhara Metropolitan City. Data was collected from primary sources using the attitude scale and achievement test, both developed by the researcher. Secondary sources included reviews of related literature, books, journal articles, research papers, forums, dissertations, and online documents.

2. Population and Sample

The population for the research includes all students of grade eight enrolled in basic schools located in Ward No. 1 and Ward No. 2 of Pokhara Metropolitan city, Nepal. A multi-stage sampling method was employed to select the sample students. In the first stage, schools were selected purposively. According to Creswell (2013), purposive sampling involves intentionally selecting individuals or sites to gain a deeper understanding of the central phenomenon. Within the two wards, there are six public schools and eight private schools. One school from each category (public and private) was selected based on the comparability of their student demographics, achievement levels, and the availability of infrastructure and academic facilities. All grade eight students from the selected schools were included in the survey sample, resulting in a total sample size of 110 students, with 56 from the private school and 54 from the public school.

3. Research Tools:

The attitude test questionnaire comprises the components ; liking mathematics, place value of mathematics, and confidence in mathematics. A Likert scale is employed for the questionnaire. This study utilizes a modified version of the ERO (2019) and Alreshidi (2016) attitude scale. The questionnaire is based on a five-point Likert scale with options: Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D), and Strongly Disagree (SD), with scores ranging from 5 to 1, respectively. A mean score of 3 is the threshold. The scores above 3 indicate a positive (favorable), a score of 3 indicates neutrality, and scores below 3 indicate a negative (unfavorable) attitude (Alreshidi, 2016). Additionally, the researcher developed a 30-item multiple-choice achievement test with a total score of 60 points. The test assesses knowledge, application, and reasoning domains, with 10 items allocated to each domain. The concept of the achievement test is adapted from Mullis et al. (2011), Alreshidi (2016), and Lindquist et al. (2019). The validity of the tests is established through expert review (face validity), and reliability is assessed using the Cronbach's alpha method.

4. Reliability and Validity of Tool

The reliability and validity of the attitude scale and achievement test were established through expert judgment for face validity and the Cronbach's alpha method for internal consistency. The prepared tools were reviewed by three experts, who provided feedback and suggestions. Their remarks were

carefully incorporated into the revised instruments. The revised attitude scale and achievement test were then piloted among the students, and the internal consistency of the sub-scales was assessed to determine reliability. A Cronbach’s alpha with a range between 0.70 to 0.90 is considered to be acceptable (Alreshidi, 2016). In this study, the Cronbach’s alpha values for the attitude scale and achievement test were 0.82 and 0.72, respectively, both falling within the acceptable range.

Analysis and interpretation

The data obtained from attitude scale and achievement test was analyzed by using SPSS and the result was inferred based on the research questions.

1. Demography of the Respondent

Table 1 *Population distribution*

Demography			
School	Private	Public	Total
No of students	56	54	110
Gender	Male	Female	
	56	54	110

2. Attitude related to “like mathematics.”

The mean weight was used to address the research questions for analysis. If the obtained mean weight is equal to or greater than three, students hold positive attitude toward “like mathematics.”

Table- 2 *Attitude related to like mathematics in public and private schools.*

Statement	School Type	Mean weightage	Remarks
Enjoy mathematics learning (QL1)	Public	2.45	Unfavorable
	Private	2.12	
Mathematics is not interesting (QL2)	Public	2.86	Unfavorable
	Private	2.81	
Favouring mathematics(QL3)	Public	2.62	Unfavorable
	Private	2.2	
Learn interesting lessons in mathematics. (QL4)	Public	2.44	Unfavorable
	Private	2.42	
Total like mathematics	Public	2.43	Unfavorable

		Private	2.48	
Component	T value	Sig. (2-tailed)	p value	Significance
QL1	1.251	0.213		Not significant
QL2	0.521	0.601		Not significant
QL3	0.896	0.332		Not significant
QL4	0.240	0.711		Not significant
Total like mathematics	0.197	0.857		Not significant

The analysis of students' attitudes toward “like mathematics” in public and private schools shows an overall unfavorable view of the subject in both settings. Mean weights were used to interpret attitudes, with scores below 3.0 indicating a negative or unfavorable attitude. Since both school student's attitude related like mathematics be unfavorable (negative) and no significant difference student's attitude related to like mathematics of public and private school students.

3. Attitude toward place value of mathematics

Table 3: Attitude related to place value in learning mathematics in public and private schools

S.n.	Statement	School Type	Mean weight	Remarks
1	Mathematics will help me in my daily life. (QP5)	Public	2.53	Unfavorable
		Private	2.02	Unfavorable
2	Mathematics is also needed to learn other subjects. (QP6)	Public	2.43	Unfavorable
		Private	2.47	Unfavorable
3	Improve mathematics to get further study. (QP7)	Public	2.37	Unfavorable
		Private	1.39	Unfavorable
4	Improve in mathematics to get the better job. (QP8)	Public	2.36	Unfavorable
		Private	2.22	Unfavorable
5	Total attitude toward place value of mathematics of private school	Public	2.22	Unfavorable
		Private	2.40	

Statement	T value	Sig.(2-tailed)(p value)	Significance
QP5	1.978	0.050	Not significant
QP6	1.983	0.050	Not significant
QP7	2.795	0.006*	significant
QP8	2.720	0.008*	significant
Total place value of mathematics	2.778	0.006*	significant

The analysis of students' attitudes toward the “place value” of mathematics revealed an overall unfavorable attitude on both public and private schools. These results highlight the need to emphasize the practical, academic, and career-related benefits of mathematics in education to foster a more positive student attitude. The analysis of students' attitudes toward the place value of mathematics for learning, comparing public and private school students. For QP5 and QP6 showing statistically significant differences, with public school students having a more favorable view regarding the importance of mathematics for further study and career aspirations. The total attitude score reinforces a significant overall difference, with public school students perceiving mathematics more positively than private school students.

4. Attitude related to confidence to ward mathematics

Table 4 *Attitude related to confidence toward learning mathematics of private and public school*

s. n.	Statement		School type	Mean weight	Remarks
1	I normally do better in mathematics.	QC9	Public	2.42	Unfavorable
			Private	2.35	Unfavorable
2	Mathematics is comparative difficult to me than my friends.	QC10	Public	2.21	Unfavorable
			Private	2.16	Unfavorable
3	I am weak at mathematics.	QC11	Public	3.33	Unfavorable
			Private	2.47	Unfavorable
4	I learn new concepts in mathematics faster.	QC12	Public	2.51	Unfavorable
			Private	2.39	Unfavorable
5	Total attitudes related to confidence toward learning mathematics		Public	2.40	Unfavorable
			Private	2.12	Unfavorable

Statement	T value	Sig. (2-tailed)	Significance
QC9	0.822	0.410	Not significant
QC10	1.511	0.132	Not significant
QC11	1.555	0.044*	significant
QC12	0.112	0.913	Not significant
Total confidence	-0.539	0.552	Not significant

The analysis of students' confidence toward learning mathematics in both public and private schools reveals an overall negative attitude. The t-test results for confidence in learning mathematics reveal no significant differences between public and private school students for most statements. However, QC11 ("I am just not good at mathematics") shows a significant difference ($p = 0.048$), with public school students feeling less confident. QC12 ("I quickly grasp new concepts in mathematics") and the overall confidence score ($p = 0.552$) show no significant differences.

5. Analysis of attitudes toward learning mathematics (Do the students have different attitudes toward mathematics?)

Here is a summary of 12 statement in 3 components on place value and confidence in mathematics. Moreover, 3 components are integrated to attitude toward mathematic.

Table 5 Analysis of attitudes toward learning mathematic.

S. n.	School	Mean	S.D.	Std. Error Mean	Remarks	P value	Significance
Like	private	2.49	0.866	0.116	Unfavorable	0.857	Not significant
	public	2.46	0.707	0.096	Unfavorable		
Place	private	2.60	1.230	0.164	Unfavorable	0.006*	significant
	public	2.02	0.911	0.124	Unfavorable		
confidence	public	2.02	0.582	0.078	Unfavorable	0.552	Not significant
	private	2.42	0.760	0.103	Unfavorable		
whole attitudes	private	2.50	0.582	0.078	Unfavorable	0.117	Not Significant
	public	2.33	0.537	0.073	Unfavorable		

The analysis of attitudes in learning mathematics, based on three components like, place value, and confidence shows that both public and private school students have unfavorable attitudes. The overall total attitude scores also showed no significant difference, confirming a generally unfavorable attitude toward mathematics in both groups. In general, students in both public and private

schools hold negative attitudes toward mathematics and total attitude scores also showed no significant difference between private and public school students.

6. Analysis of attitudes toward mathematics of male and female students of both school (Does the gender make any difference in attitudes toward mathematics? Interpretation in gender basis:

Table 6. Analysis of attitudes toward mathematics on gender of both schools.

Component	Gender	N	Mean	Std. Deviation	Remarks
Like mathematics	Male	56	2.51	0.958	Unfavorable
	Female	54	2.44	0.568	Unfavorable
Place value of mathematics	Male	56	2.52	0.752	Unfavorable
	Female	54	2.40	0.582	Unfavorable
Confidence in mathematics	Male	56	2.59	1.240	Unfavorable
	Female	54	2.03	0.903	Unfavorable
Total attitudes toward mathematics	Male	56	2.54	0.653	Unfavorable
	Female	54	2.29	0.426	Unfavorable

Component	T value	Sig.(2-tailed)p value	Significance
Like mathematics	0.479	0.633	0.072
Place value of mathematics	0.895	0.373	0.115
Confidence toward mathematics	2.684	0.008	0.557
Whole attitudes toward mathematics	2.350	0.021	0.248

The analysis of attitudes toward mathematics based on gender shows that both male and female students have generally unfavorable attitudes in all components. For the "like mathematics" component, male students (M = 2.51) rated slightly higher than female students (M = 2.44), but both scores are unfavorable. In terms of "place value of mathematics," male students (M = 2.52) also scored higher than females (M = 2.40), reflecting a similar trend. However, for "confidence toward mathematics," male students (M = 2.59) had a significantly higher score than female students (M = 2.03), indicating that males perceive themselves as more confident in mathematics. The overall total attitude toward mathematics showed male students (M = 2.54) with a higher score compared to females (M = 2.29), indicating that males have a slightly more favorable overall attitude and is still unfavorable. The t-test analysis for gender-based attitudes toward mathematics reveals that there is no significant

difference between female and male students in "liking mathematics" ($p = 0.633$) and "place value of mathematics" ($p = 0.373$). However, a significant difference is observed in "confidence toward mathematics" ($p = 0.008$), with male students ($M = 2.59$) displaying significantly higher confidence than female students ($M = 2.03$). Similarly, there is a significant difference in "overall attitudes toward mathematics" ($p = 0.021$), with male students ($M = 2.54$) showing more favorable attitudes than female students ($M = 2.29$). Thus, while both genders show unfavorable attitudes, males exhibit higher confidence and slightly more positive views toward mathematics.

7. Analysis of achievement in mathematics among public and private school (Is there any difference in achievement in mathematics by studying in public and private school?)

The mathematics achievement test based on the domains of knowing, applying, and reasoning, to eighth-grade students from both public and private schools sample is given below.

Table 7. Analysis of mathematics achievement in public and private school

	School	N	Mean achievement
Mathematic achievement test	Private	56	31.54
	Public	54	20.65
	T value	Sig. (2-tailed) p value	Significance
Mathematic achievement test	8.234	0.000	

On comparing the mathematics achievement of eighth-grade students from private and public schools, the data showed that the private school students have a higher mean achievement score compared to the public school students. The t-test showed a value of $t = 8.234$ and a p-value $p = 0.000$. Since the p-value is less than 0.05, there is statistically significant difference between the two groups. In general, the analysis indicates that there is a significant difference in mathematics achievement between private and public school students, with private school students outperforming their public school.

8. Analysis of mathematics achievement in male and female students (Does the gender make any difference in achievement mathematics?)

Table 8 Analysis of mathematics achievement in male and female students

	School	N	Mean achievement	S.D.	Std. Error Mean
Mathematic achievement test	Male	56	26.52	9.410	1.257
	Female	54	23.81	7.869	1.071

		T value	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Mathematic test	achievement	0.1.631	0.106	2.703	1.657

On comparing the mathematics in terms of gender, male students (Mean = 26.52) outperformed female students (Mean = 23.81), with male students showing a higher standard deviation (9.410) compared to females (7.869), indicating more variation in male scores. The t-test results yielded a t-value of 1.631 and a p-value of 0.106, which is greater than 0.05, indicating no statistically significant difference between the two groups. The mean difference was 2.703, suggesting that males scored, on average, 2.703 points higher, but this difference is not significant in the context of the study.

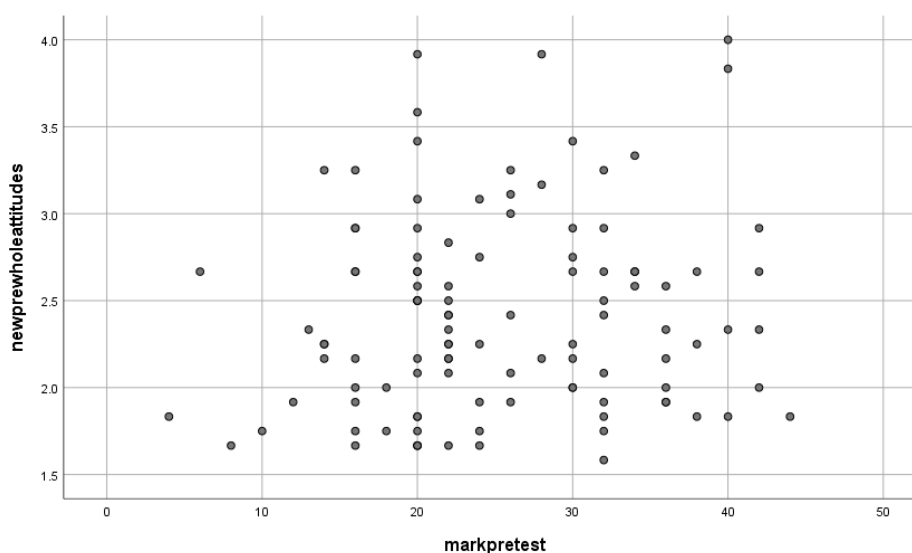
9. Relationship between attitudes and achievement toward mathematics

This study also aims to explore the relationship between achievement and attitudes of the students. The summary of the relationship between attitude and mathematics achievement is given below.

Table 9. Relationship between attitudes and achievement toward mathematics.

		Achievement	Attitudes
Achievements	Pearson correlation	1	0.367
	Sig(2.tailed)		0.218
	N	110	110
Attitudes	Pearson Correlation	0.367	1
	Sig. (2-tailed)	0.218	
	N	110	110

Scatter diagram



The study examines the relationship between students' achievement and attitudes toward mathematics. The Pearson correlation coefficient is 0.367, indicating positive correlation between achievement and attitudes. However, the p-value of two tailed test is 0.218, which is greater than the significance threshold of 0.05. This indicates a moderate positive association between students' attitudes and their achievement in mathematics. The evidence is not strong enough to conclude that one directly influences the other in a statistically meaningful way. The moderate value indicates that the relationship may exist between the two factors but other factors may also influence the result. Therefore, further study is needed to explore the underlying causes.

Results and Discussion

Some important results obtained from the study are as follows:

1. The study of variable “like mathematics” in both public and private schools shows an overall unfavorable condition for attitude toward mathematics, with no significant difference between the two groups.
2. Students in both public and private schools show an overall unfavorable result on attitude toward the “value of mathematics”, with public school students perceiving it slightly positively for academic and career relevance. Students from both groups show an unfavorable attitude, with private school students perceiving it more negatively than public students; the difference is statistically significant.
3. Both public and private school students exhibit low confidence in learning mathematics, with minimal differences between groups, underscoring the need to enhance self-efficacy in math education. Confidence levels in both schools are unfavorable, with no significant difference between the groups.
4. The total attitude score is unfavorable for both schools, with no significant difference, indicating a generally negative attitude of mathematics across both groups.
5. Both male and female students hold an unfavorable attitude toward “liking mathematics”, with no significant gender difference
6. Both Male and female students have an unfavorable view for the “place value of mathematics”, with no significant difference between genders.
7. Both genders report low confidence in mathematics, but male students score significantly higher in confidence than female students, showing a significant difference.
8. The overall attitude is unfavorable for both male and female students, with males showing significantly difference and positive attitude than females.
9. The result of mathematics achievement shows that private school students significantly difference than public school students. However, no significant difference was found between male and female students.
10. The analysis reveals a moderate positive correlation between students' achievement and attitudes toward mathematics, but the p-value of 0.218 indicates that the correlation is not statistically significant, suggesting that the relationship between attitudes and achievement is not strong enough to draw conclusive evidence.

Conclusion

This research is based on quantitative research design (survey) to find students attitudes toward mathematics at basic school. The findings of this study highlight on key insights into students' attitudes and achievements in mathematics. Both public and private school students exhibited unfavorable attitudes toward liking mathematics, with no significant difference between the two groups. The students from both school types showed negative perceptions on the “value of mathematics”. The public school students viewed mathematics as the career and hence took positively. There was no significant difference in confidence levels between public and private school students, with both groups reporting low self-efficacy in learning mathematics. Similarly, the total attitude score for both groups remained unfavorable, and no significant difference was found between public and private school students in this regard. Gender-wise analysis revealed that both gender shared unfavorable attitudes toward “liking mathematics” and its value. Regarding overall attitude, males showed positive attitudes than the females. On the academic front, private school students significantly outperformed public school students in mathematics achievement, whereas no significant gender-based achievement gap was observed. Despite a moderate positive correlation between attitudes and achievement, the lack of statistical significance suggests that other factors may be influencing this relationship. These findings underline the need for interventions to improve students' attitudes, confidence, and performance in mathematics, particularly focusing on boosting self-efficacy across both school types and genders.

Implication and Suggestion:

The government of Nepal spends nearly 11% of the total budget on education. But the outcome is not as expected. The result is degrading day by day. This can be improved not only by the change in curriculum but through the change in the teaching methodology. This study provides positive insights to all teachers, policymakers, and curriculum planners to be aware of how student perceive attitudes toward mathematics. Moreover, it also helps the teachers to rethink the teaching learning strategy. This study recommends different researches that can be carried out in other research design in different area or educational level.

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Conflicts of Interest:

The author declares no conflict of interest.

Declaration:

For the study, the permission was taken from the department of mathematics education, Tribhuvan University, local government body, concerned teachers and students about the survey and also has to permission to publish the report on the basis of this study. No unlawful works is done and no violation of personal rights is entertained during the study.

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