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# Examining the relationship between motivation levels and academic achievement in mathematics: A quantitative analysis of Kuzhugchen Middle Secondary School

Kencho [1] and Shekhar Nath Mishra [1]

[1]Kuzhugchen Middle Secondary School, Thimphu, Bhutan

## Abstract

Performance in mathematics has been declining over the years in Bhutan. There are many studies on motivation and mathematics. However, fewer papers are available in the Bhutanese context. Thus, of the many factors, this study investigated the impact of motivation on the academic performance of the students in the Kuzhugchen Middle Secondary School, Thimphu Dzongkhag (district). Out of 142 students, data were collected from 108 students (54 males and 54 females) selected using a proportionate random sampling. The t-test results revealed that there is a significant difference between academic performance and gender and no significant difference between motivation and gender. We also found a significantly small and positive correlation between the expectancy scale and academic performance, a moderate and negative correlation between the affect scale and academic performance, and no correlation between the value scale and academic performance. The findings of this study call for teachers, parents and other stakeholders to investigate the factors affecting mathematics performance and intervene accordingly. Furthermore, similar studies in other parts of the country, especially in rural areas, are recommended for new insights into motivation and academic performance.

***Keywords***
Academic performance
Affect scale
Expectancy scale
Motivation
Value scale

Corresponding author:
t.shekharnath@education.gov.bt

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## Introduction

Science and mathematics are often perceived as fundamental forces behind economic development (Katzner, 2003). However, students' attitudes, interests, and motivation towards mathematics learning decline throughout their years of schooling, especially during secondary school years (Nurhayati & Purwanto, 2021). Studies by Singh et al. (2002) and Hannula (2006) revealed negative attitudes of students towards mathematics learning. Further, Hannula (2006) found that scientific attitudes between gender, ethnicity and across educational levels were found to be low, thereby affecting performance in Science and Mathematics. The study by Peters et al. (2020) on self-concept focusing on skills, ability, enjoyment, and interest revealed a moderate level of self-concept towards learning mathematics. However, the study revealed a significant relationship between self-concept and the respondents' academic performance in mathematics. Poor performance by students in mathematics was partially attributed to inadequate preparation by teachers, emphasis on lower rather than higher thinking skills, inconsistent use of homework, failure to engage students in their learning, lack of progress of girls, lack of students' interest and confidence in mathematics and students' lower educational aspiration (Ampadu et al., 2017).

In Bhutan, too, the emphasis is laid on improving the quality of education, especially in science and mathematics. The Royal Government of Bhutan (RGoB) has developed and implemented several policies such as the New Approach to Primary Education (NAPE, 1990), the School Performance Management System (2013), the School Self-Assessment and Improvement Plan (2013), Education Policy Guidelines and Instructions (EPGI, 2012), Bhutan Education Blueprint (2014-2024), and Education Road Map (2030), towards improving quality of education, especially mathematics and science. Despite the policies in place, there is widespread public concern over a perceived decline in the quality of education. The focus is more on science and mathematics as these subjects tend to fetch better opportunities for students if they perform well. While access to education has expanded significantly in recent years in Bhutan, the quality of learning is a major challenge (Royal Education Council & Discovery Centre for Education and Enterprise, I, 2009). A report by the Royal Education Council (2009) concluded that:

> Student learning outcomes are below the minimum expectations of their grade levels, unable to perform basic numeracy and literacy tasks;
>
> Employers perceived graduates as lacking the academic preparation and professional skills to succeed in entry-level jobs. The results of the National Education Assessment (NEA) for Class X conducted in 2013 revealed that only slightly over half of the Class X students achieved the minimum competency level in mathematics, while a little less than half achieved the minimum competency level in English. A smaller number of students achieved proficiency levels in both subjects. (BCSEA, 2014)

The results of the PISA-D preliminary assessment survey encompassing reading, mathematics and science, conducted in 2017, showed a low level of expertise (BCSEA, 2017). In a study conducted by BCSEA (2019) incorporating the three domains, it was revealed that reading literacy, mathematical literacy and scientific literacy were 45.34%, 38.84% and 45.10%, respectively. Although the report was labelled good in comparison with other countries, it was not meant to be used for the whole country. According to BCSEA (2019), the results of the Competency-Based Assessment Test (CBAT) in primary schools revealed below-average performance (Dzongkha 36.89%; English 33.70%; and Mathematics 32.04%). The report highlighted that performance in mathematics is a cause of concern.

Going by the reports and concerns shared by various sections of society, the Mathematics Department of Kuzhugchen Middle Secondary School initiated and introduced several activities to promote mathematics, such as strategic plans like maintaining a mathematics dictionary, mathematics word wall, group teaching, appreciating by praising, rewarding in cash and kind, and acknowledging the high achievers in test and examinations. In order to arouse learner motivation, activities such as setting goals, providing specific feedback on tasks, clearing doubts, providing practice materials, real-world problem situations, and adopting and adapting the 21st-century teaching-learning pedagogy are widely used to improve academic learning and student performance in mathematics.

Keeping in mind the practices in place and the academic learning and low student performance in mathematics, this study was conducted in Kuzhugchen Middle Secondary School under Thimphu Dzongkhag, Bhutan. The study was felt necessary as the individual student's performance in mathematics was found to decline over the years since 2018. Interestingly, students in lower grades tend to perform better compared to students in higher grades. Therefore, this study was designed to diagnose and inform relevant use of new approaches for teaching mathematics. The study focussed on (1) academic achievement based on gender; (2) motivation in learning mathematics based on gender; (3) academic achievement about value scale (intrinsic, extrinsic and task value) of motivation; (4) academic achievement about expectancy scale (control beliefs of learning and self-efficacy) of motivation; and (5) academic achievement about affect scale (text anxiety) of motivation.

Accordingly, the proposed four hypotheses of the study are as follows:

**$H_{01}$**- There is no significant relation between the academic performance of male and female students

**$H_{02}$**- There is no significant relation between the motivation in learning mathematics of male and female students.

**$H_{03}$**- There is no significant relation between academic performance in mathematics and the value scale of motivation among students.

**$H_{04}$**- There is no significant relation between academic performance in mathematics and the expectancy scale of motivation among students.

**$H_{05}$**- There is no significant relation between academic performance in mathematics and the scale of motivation among students.

## Literature review

It has been repeatedly proven that there is a high correlation between academic success in mathematics and motivation levels. Key discoveries from the literature include higher levels of motivation positively correlated with improved academic performance in mathematics (Schukajlow, 2023). As seen by this association, motivation appears to be a key component in predicting academic performance in maths. Mathematical accomplishment is highly correlated with intrinsic motivation (Dorit, 2023), which is the desire to do something because it is fascinating or rewarding in and of itself (Maghfiroh et al., 2023). Students are more inclined to put in effort and persevere in their learning when they find math assignments personally important or interesting, which produces higher results (Zivkovic et al., 2023). According to Hettinger et al. (2023), significant determinants of academic accomplishment in mathematics have been found to include self-efficacy beliefs or people's confidence in their capacity to succeed in certain activities or domains. Mathematically proficient students are more likely to establish demanding objectives, put out effort, and persevere through setbacks, all of which contribute to higher performance (Almagro & Edig, 2024; Dorit, 2023 ). Further, students' motivation and academic progress in mathematics are influenced by their accomplishment goal orientations, regardless of whether they prioritise mastering the subject matter or just outperforming their peers (McKellar et al., 2024). People who have a mastery orientation driven by a desire to learn and grow tend to do better than people who have a performance orientation, who are more focused on impressing colleagues or proving their ability (Jinhua et al., 2024).

In addition, students' motivation and academic achievement in mathematics are greatly influenced by the role that teachers play and the environment in the classroom (Anna et al., 2024). Teachers who are supportive and offer chances for active involvement, feedback, and encouragement can raise students' motivation levels and foster a deeper comprehension of mathematical ideas (Rutherford et al., 2022). Encouraging classroom environments that encourage cooperation, curiosity, and taking calculated risks also boost students' enthusiasm and arithmetic performance (Fuqoha et al., 2018). Further, test anxiety on maths examinations has been shown to have a detrimental effect on performance, resulting in a two-way connection where worry can both cause and result in subpar maths performance (Awofala et al., 2020). Due to the perceived relevance and cognitive demands of maths assessments, test anxiety is especially noticeable in this domain (Adamma et al., 2018). Its growth is influenced by several factors, including perfectionism, fear of failing, and cultural prejudices (Hyde & Mertz, 2009). Exam anxiety has a detrimental impact on students' well-being in addition to their academic success (Schukajlow, 2023; Adamma et al., 2018). Test anxiety may be reduced, and maths performance can be enhanced with the use of effective therapies and coping mechanisms, such as breathing exercises and creating supportive surroundings.

Although motivation is necessary for academic success in mathematics, socioeconomic variables, including family history, resource accessibility, and sociocultural norms, also have an impact on it (Karakose et al., 2023; Kizilgunes et al., 2009; Ayotola & Adedeji, 2009). Equity concerns in maths education must be addressed to guarantee that all students have the chance to achieve (Gbollie & Keamu, 2017). Inequalities in educational opportunities and support systems can have a significant influence on students' motivation levels and performance results (Almalki, 2019).

## Methodology

### Research Design

Creswell (2012) stressed that quantitative research might produce objective measurements, improve generalisability by using bigger sample sizes, use rigorous statistical analysis, make replication easier, and accomplish efficiency in data collecting and processing. For the purpose of drawing strong findings that are applicable outside of the particular research setting, numerical data and statistical connections are given priority (Plano-Clark, 2010).

This research used a quantitative survey study as it is widely used in educational research. Quantitative research is a type of research that explains phenomena through a collection of numerical data (Creswell, 1994). A similar approach was adopted by other studies to examine the cause-and-effect relationship among graduate students' academic performance (Gal et al., 2007; Gay et al., 2006).

### Sample size and sampling techniques

This study was conducted in Kuzhugchen Middle Secondary School (KzMSS) because of the familiarity of the setting. It made sense to address regional issues as there were chances for cooperation. Besides, there were resources and logistical considerations to make, and there was a bearing on instructional strategies and student results. By using their intimate knowledge, this strategy allowed them to make a significant contribution to the educational community. The population size for this study included 142 students from classes seven to ten as they grew up and matured to understand what motivates them in learning. The minimum required sample size was determined using Yamane's formula (Yamane, 1967), as shown in Equation 1.

$$n=\frac{N}{1+N(e)^2} \qquad (1)$$

$$n=\frac{142}{1+142(0.05)^2}$$

$$n=104.79»105$$

Where n = sample size
N = population size
e = level of precision or sampling of error (5%)

The proportionate stratified random sampling was applied to select 108 (54 male and 54 female) students from a population size of 142 from all the classes, as shown in Table 1.

**Table 1**

*Population and Sample Size*

| Population | | | | Sample | | |
|---|---|---|---|---|---|---|
| Classes | Boys | Girls | Total | Boys | Girls | Total |
| VIIA | 17 | 12 | 29 | 13 | 9 | 22 |
| VIII A | 9 | 9 | 18 | 7 | 7 | 14 |
| VIII B | 9 | 9 | 18 | 7 | 7 | 14 |
| IX A | 15 | 17 | 32 | 11 | 13 | 24 |
| X A | 8 | 15 | 23 | 6 | 11 | 17 |
| X B | 13 | 9 | 22 | 10 | 7 | 17 |
| Total | 71 | 71 | 142 | 54 | 54 | 108 |

**Data collection procedure**

**Research Instrument**

Survey questionnaires through Google Forms were used for collecting data with administrative approval from the KzMSS administration and consensus to participate from individual participants. The study objectives were explained to the students through the class WeChat, Messenger, and Telegram forums. Due to the school closure because of the pandemic, the Google Form was used to avoid gathering students.

The data collection instrument (Mathematics motivation scale) for this study was adapted from previously validated studies (Pintrich et al., 1991; Karadeniz et al., 2008; Liu & Lin, 2010). The mathematics motivation scale consisted of three subscales (value, expectancy, and affect) with 29 items. The value component contained three elements: Intrinsic goal orientation (4 items), extrinsic goal orientation (5 items), and task value (5 items). Intrinsic goal orientation emphasises the inner motives such as curiosity, self-development, or satisfaction on why students participate in a task. Extrinsic goal orientation is concerned about the outer reasons like money, grades, or praise from others on why students participate in a task. Task value denoted the students' insight or awareness about the material or task in terms of usefulness, importance, or applicability.

The component of expectancy consisted of two elements: Control beliefs (4 items) and self-efficacy for learning and performance (5 items). Control beliefs refer to students' belief

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that their hard work will lead to positive results. Self-efficacy for learning and performance refers to the judgment about one's ability to complete the task and the confidence in one's skills to accomplish the mission. The affective component contains one element: test anxiety (6 items). Test anxiety refers to the negative emotion related to taking an exam. The reliability test using Cronbach alpha for the component of value, expectancy and effect were 0.82, 0.74 and 0.77, respectively, and the overall reliability was 0.80. Higher values of the Cronbach alpha coefficient, ranging from 0 to 1, denoted increased internal consistency between the scale's items (Camila et al., 2023). For research purposes, a Cronbach's alpha of 0.70 or above is usually regarded as appropriate; however, the cutoff point may change according to the situation.

**Table 2**

*Variables of the Study* (n=108)

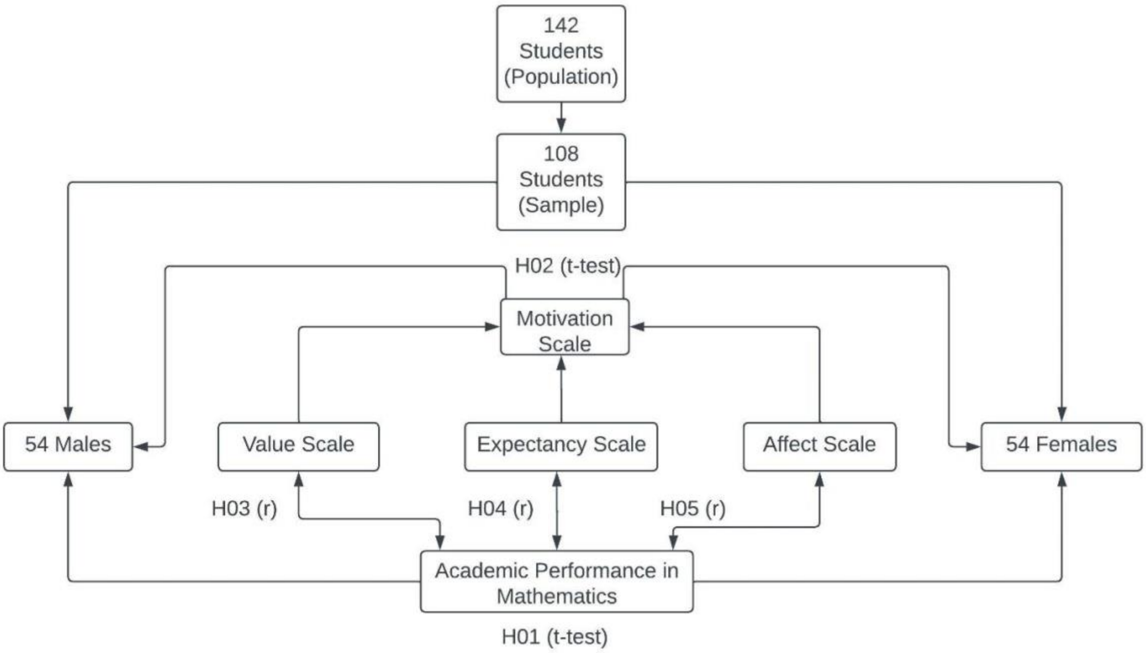
| Item No. | Items (Mathematics Motivation Scale) | M | SD |
|---|---|---|---|
| | **Value: Intrinsic goal orientation** | | |
| 1 | In math class, I would like to have some challenging materials and they will make me learn more. | 3.68 | 0.91 |
| 2 | I would like to have curiosity-initials material in math class even if they are quite difficult. | 3.54 | 0.74 |
| 3 | My biggest wish is to understand the content of the learning material used in the math class. | 4.14 | 0.83 |
| 4 | Learning math can improve my thinking logic. | 4.36 | 0.73 |
| | **Value: Extrinsic goal orientation** | | |
| 5 | My most wanting is to get the best grades in math class. | 4.25 | 0.84 |
| 6 | I hope I can get a higher grade in math than any other classmates. | 3.58 | 0.86 |
| 7 | I want to get higher scores in math class because I want to demonstrate my capability to my classmates. | 3.54 | 0.90 |
| 8 | My best wish is to attend an ideal university via learning math. | 3.33 | 0.97 |
| 9 | I want to get other people's recognition so I want higher scores in math class. | 3.49 | 0.91 |
| | **Value: Task value** | | |
| 10 | The skills I learn from the math class can be applied in other classes | 4.04 | 0.76 |
| 11 | I am interested in the learning materials used in math class. | 3.83 | 0.84 |
| 12 | I feel the learning materials used in math class are useful. | 4.02 | 0.77 |
| 13 | I like every topic and content taught in math class. | 3.52 | 0.77 |
| 14 | What I learn in math class can be applied in my daily life. | 4.05 | 0.74 |
| | **Expectancy: Control beliefs for learning** | | |
| 15 | If I have the correct learning pattern to learn math, I will learn better in the class. | 3.93 | 0.73 |
| 16 | If I study hard enough, I can understand the content of the learning materials used in math class. | 4.18 | 0.75 |
| 17 | If I pay full attention in math class, I can get better grades. | 4.18 | 0.80 |
| 18 | If I have enough time to do practice in math, I will have better performance. | 4.14 | 0.85 |
| | **Expectancy: Self-efficacy** | | |
| 19 | I believe that I will have excellent math grades in math class. | 3.30 | 0.79 |
| 20 | I believe that I can understand the most difficult part in the math materials on my own. | 2.56 | 0.92 |
| 21 | I believe that I can master every topic in math class. | 2.66 | 0.94 |
| 22 | As for math, I am competent to teach my classmates. | 3.03 | 0.83 |
| 23 | Math is not difficult for me. | 2.61 | 0.92 |
| | **Affect: Test anxiety** | | |
| 24 | In taking the math exam, I will have negative thoughts that I am inferior to other classmates. | 2.62 | 0.90 |
| 25 | In taking the math exam, I would think about the consequences of failing the exam. | 3.08 | 1.02 |
| 26 | When taking the math exam, I feel nervous and worried. | 3.49 | .97 |
| 27 | In taking the math exam, my heart beats faster. | 3.31 | 1.01 |
| 28 | In taking the math exam, I am totally blank and cannot remember what I have learned before. | 3.00 | 1.07 |
| 29 | Before taking the math exam, I am too wary to take a good sleep. | 2.94 | 1.17 |

## Data Analysis

Data were analysed using the Statistical Package for Social Science (SPSS) version 23. Descriptive statistics were performed, including mean, standard deviation, frequency, and percentage as shown in the conceptual framework (Figure 1), two sample independent t-tests were also employed to compare (1) academic achievement based on gender and (2) motivation in learning mathematics based on gender. Pearson's correlation was used to determine the relationship between (3) academic achievement and value scale (intrinsic, extrinsic and task value) of motivation; (4) academic achievement and expectancy scale (control beliefs of learning and self-efficacy) of motivation; and (5) academic achievement and affect scale (text anxiety) of motivation.

**Figure 1**

*Conceptual Framework of the Relationship Between Motivation and Mathematics Performance*




## RESULTS

### Test of Normality

The motivation score was tested for normality, and it was found that there were no outliers in the data, as assessed by examination of the box plot and was normally distributed, as assessed by Kolmogorov-Smirnov and Shapiro-Wilk test ($p>0.05$).

**Table 3**

*Test of Normality for Motivation Scale*

| | Kolmogorov-Smirnov | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | Df | Sig. | Statistic | df | Sig. |
| Motivation Score | .077 | 108 | 0.138 | 0.992 | 108 | 0.742 |

Similarly, the academic performance marks were also tested for normality, and it showed outliers in the data, as assessed by examination of the box plot and was not normally distributed, as assessed by Kolmogorov-Smirnov and Shapiro-Wilk test ($p < 0.05$) as shown in Table 4.

**Table 4**

*Test of Normality for Academic Marks*

| | Kolmogorov-Smirnov | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | Df | Sig. | Statistic | df | Sig. |
| Marks | .107 | 108 | .004 | .944 | 108 | .000 |

To make the data of academic marks normal, square root transformation has been applied as data showed positive skewness and further tested for normality. Following transformation, the data demonstrated normality as determined by the Shapiro-Wilk and Kolmogorov-Smirnov tests ($p > 0.05$), as indicated in Table 5, and a box plot analysis revealed no outliers.

**Table 5**

*Test of Normality for Transformed Marks*

| | Kolmogorov-Smirnov | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | Df | Sig. |
| Transformed Marks | .062 | 108 | .200* | .979 | 108 | .087 |

**Demographic characteristics of students**

Table 6 shows the detailed profiles of the sampled students. The survey comprised a total of 108 students (50% male and 50% female). The ages of the students range from 12 to 20 years, with the mean age being 15.05 years and a standard deviation of 1.45. The majority (74.00%) of the respondents were within the age group of 14-16 years. While comparing the age of male ($M$ =15.00; $SD$ = 1.35) and female ($M$ = 15.10; $SD$ = 1.56), there was no significant difference, $t(98) = -0.341$, $p = 0.734$. The average academic mark was 42.85 ($SD$ = 20.01) and motivation score was 101.44 ($SD$ = 12.33)

**Table 6**

*Demographic Characteristics of Students* (N = 108)

| **Variable** | **Min** | **Max** | ***M*** | ***SD*** |
|---|---|---|---|---|
| Age | 12.00 | 20.00 | 15.12 | 1.42 |
| Academic marks | 11.50 | 95.00 | 42.16 | 19.55 |
| Motivation | 78.00 | 126.00 | 102.33 | 9.98 |

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### Academic performance between male and female students

A two-sample independent t-test was applied to find out if there were differences in academic performance between male and female students. There were no outliers in the data, as assessed by inspection of the box plot. Transformed academic marks for each level of gender were normally distributed, as examined by Shapiro-Wilk's test ($p > 0.05$), and there was homogeneity of variances, as depicted by Levene's test for equality of variances ($p = 0.471$, $p > 0.05$). The mean academic performance for male students was higher by 0.58 compared to that of female students (Table 7). Thus, there was a significant difference $t(108)=2.050$, $p = 0.043$, $d=0.38$) in academic performance between male and female students at a 5% significance level. Therefore, the null hypothesis (H01) was rejected, and it was concluded that academic performance is not the same for male and female students.

**Table 7**

*Academic Performance Between Male and Female Students*

| Categories | M | SD | df | T | P |
|---|---|---|---|---|---|
| Male | 6.61 | 1.52 | 106 | 2.050 | 0.043 |
| Female | 6.03 | 1.39 | | | |

### Motivation between male and female students

The two-sample independent t-test was applied to find if there were differences in motivation in learning mathematics between male and female students. There were no outliers in the data, as assessed by inspection of the box plot. Motivation scores for each level of gender were normally distributed, as examined by Shapiro-Wilk's test ($p > 0.05$), and there was homogeneity of variances, as depicted by Levene's test for equality of variances ($p = 0.152$, $p > 0.05$). The mean of motivation in learning mathematics was slightly higher for female ($M= 0.08$) students compared to that of male students (Table 8). However, there was no significant difference $t(108)=-0.038$, $p=0.969$, $d=0.007$) in motivation in terms of learning mathematics between male and female students at a 5% significance level. Therefore, we cannot reject the null hypothesis (H02). Thus, motivation in learning mathematics is the same for both male and female students.

**Table 8**

*Academic Performance Between Male and Female Students*

| Categories | M | SD | Df | T | P |
|---|---|---|---|---|---|
| Male | 102.29 | 8.83 | 106 | -0.038 | 0.969 |
| Female | 102.37 | 11.10 | | | |

### Correlation between value factor of motivation and academic performance

Pearson's correlation was applied to determine the association between value factor and academic performance, as shown in Table 9. Initial analyses showed the relationship to be linear, with both variables normally distributed, as showed by Shapiro-Wilk's test ($p > 0.05$), and there were no outliers. There was no statistically significant correlation between value scale and academic performance, where $r = 0.169$ $p=0.080$. Thus, we accept the null hypothesis

(H03) and conclude that there is no association between the value scale of motivation and academic performance.

**Table 9**

*Value Factor of Motivation and Academic Performance*

| Pearson's Correlation | Value factor | Academic performance |
|---|---|---|
| Value factor | 1 | 0.169 |
| Academic performance | | 1 |

**Correlation between expectancy factor of motivation and academic performance**

Pearson's correlation was performed to determine the association between the expectancy factor and academic performance, as shown in Table 10. Initial analyses showed the relationship to be linear, with both variables normally distributed, as showed by Shapiro-Wilk's test ($p > 0.05$), there were outliers that made no difference. There was a small significant positive correlation between these two variables, where $r = 0.210$, $p = 0.029$. Thus, we reject the null hypothesis (H04) and conclude that there is an association between the expectancy scale of motivation and academic performance.

**Table 10**

*Expectancy Factor of Motivation and Academic Performance*

| **Pearson's Correlation** | **Expectancy factor** | **Academic performance** |
|---|---|---|
| Expectancy Scale | 1 | 0.210* |
| Academic performance | | 1 |

*. Correlation is significant at the 0.05 level (2-tailed)

**Correlation between affect factor of motivation and academic performance**

Pearson's correlation was executed to determine the association between the expectancy factor and academic performance (Table 11). Initial analyses showed the relationship to be linear, with both variables normally distributed, as showed by Shapiro-Wilk's test ($p > 0.05$), there were outliers that made no difference. There was a moderate significant negative correlation between these two variables, where $r = -0.427$, $p = 0.000$. Thus, we reject the null hypothesis (H05) and conclude that there is an association between the effect scale of motivation and academic performance.

**Table 11**

*Affect Factor of Motivation and Academic Performance*

| **Pearson's Correlation** | **Affect factor** | **Academic performance** |
|---|---|---|
| Affect factor | 1 | -0.427** |
| Academic performance | | 1 |

*. Correlation is significant at the 0.01 level (2-tailed)

## Discussion

This study attempted to (1) compare academic achievement between male and female students; (2) compare motivation in learning mathematics between male and female students; (3) determine a correlation between academic achievement and value scale; (4) determine a correlation between academic achievement and expectancy scale; and (5) determine a correlation between academic achievements and affect scale.

In line with studies by Awofala et al. (2020), Devine et al. (2012), and Doolittle and Cleary (1987), the results showed a significant difference between academic achievement in mathematics of male and female students. However, other studies (Lindberg et al., 2010; Hidi, 2000; Adamma et al., 2018; Hyde & Mertz, 2009) claim that there is no significant difference between academic achievement in terms of gender. Mathematics is viewed as a tough subject by both genders, and the reason students fail in a particular grade is also because of mathematics. Here at KzMSS, most of the parents are uneducated and unable to guide the students, especially in subjects like mathematics and science.

The results showed no significant difference between motivation in learning mathematics of male and female students. Although some studies (Githua & Mwangi, 2003; Skaalvik & Skaalvik, 2007; Meece et al., 2006; Liu & Lin, 2010) suggest a significant difference between motivation and gender, other studies (Awofala et al., 2020; Rodriguez et al., 2020; Sivrikaya, 2019) are in favour of findings of this study. Not having significant results could be due to both boys and girls being provided with equal educational rights. The school provides the same level of opportunities and incentives for learning mathematics.

Another important finding of this study is that there was no correlation between academic achievement and value scale. This is in contrast to the findings from other studies (Almalki, 2019; Ngwira et al., 2017; Erbas & Bas, 2015; Chyung et al., 2010; Ocak &Yamac, 2013; Patrick et al., 2000). Nevertheless, the findings of Gbollie and Keamu (2017) and Herges et al. (2017) are in line with the findings of this study.

Further, the results showed that there was a positive correlation between academic achievement and the expectancy scale. Many studies (Fuqoha et al., 2018; Mazana et al., 2018; Kizilgunes et al., 2009; Ayotola & Adedeji, 2009) support this finding. However, a study by Pajares and Graham (1999) is in contrast with the findings of this study.

In addition, the results from this study also revealed a negative correlation between academic achievement and affect factors. Research carried out by Schleepen and Van Mier (2016), Namkung (2019), and Kesici and Ahmet (2009) supports this finding.

## Conclusion

Data from 108 students (54 male and 54 female) were analysed to (1) compare academic achievement between male and female students; (2) compare motivation in learning mathematics between male and female students; (3) determine the correlation between academic achievement and value scale; (4) determine the correlation between academic achievement and expectancy scale; and (5) determine the correlation between academic achievement and affect scale. The results showed a significant difference between academic performance and gender. However, there was no significant difference between motivation and gender. The results also showed a significantly small and positive correlation between the expectancy scale and academic performance, a moderate and negative correlation between the affect scale and academic performance, and no correlation between the value scale and academic performance. The current findings have important implications for teachers, parents and relevant stakeholders in knowing the effect of motivation and working towards building it. However, the findings are limited to students of only one middle secondary school in Thimphu. Results may not be generalised to other schools. Therefore, future studies could focus on other parts of the country or focus on factors other than motivation that affect mathematics learning and performance.

**Limitation**

Some limitations of the study are as follows:

1. The area of the study was limited to only one middle secondary school.
2. The accuracy of the participants' data as the survey questions were administered individually, and there are chances of misinterpreting the statements.
3. The study adopted only a quantitative method. Future studies may employ mixed methods to better understand the factors affecting mathematics learning in Bhutan.
4. Motivation is a broad concept that differs from person to person, and the factors causing it also differ, so an accurate measure of motivation is difficult.

The findings of the study suggest instructors and parents provide more support to help female students solve the problems they face and improve their achievement in mathematics.

**Recommendations**

Conclusions that emanate from this study are essential in understanding the effects of motivation and working to enhance it. Therefore, it has major implications for educators, parents, and other relevant stakeholders. Teachers are encouraged to design interesting lesson plans and make the lesson appealing to the students to motivate them in mathematics. It is also suggested that teachers take measures to eliminate the myth that mathematics is a challenging subject and is only for boys or brilliant students. The study also highlights the importance of guiding students by the parents, and teachers on how to cope with test and examination stress since it is closely related to poor performance. This again means that both teachers and parents need to give more support to female students to help them overcome the challenges in mathematics, leading to an increase in achievement in the area.

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**Conflict of Interest**

The authors declare no conflict of interest.

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## About Author

**Shekhar Nath Mishra**, Senior Teacher I at Kuzhugchen Middle Secondary School, Bhutan, holds a Master's in Education and Sustainable Development. Specialising in Chemistry and Biology, he integrates teaching with research on pedagogy, climate change, and education. An avid reader and writer, he is dedicated to promoting sustainable practices and inspiring transformative learning through innovative approaches.

**Kencho** is a Vice Principal I at Kuzhugchen Middle Secondary School. He has specialised in education management and policy implementation. With a strong academic background, Kencho integrates research with leadership to enhance educational practices. Passionate about fostering growth and efficiency, Kencho's work focuses on advancing education policy and ensuring impactful outcomes through practical and scholarly contributions.