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RESEARCH ARTICLE

Exploring the Relationship between Government Girls Secondary School Students' Attitude and Motivation towards Learning Mathematics

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Abstract: This study investigated the relationship between government girls' secondary school students' attitude and their motivation towards learning mathematics. The study adopted a quantitative method for the collection and analysis of data. The population consisted of all female students studying in government secondary schools in the Malakand district during the academic session 2024. The sample consisted of 353 female students in 9th and 10th classes. The study used an adopted questionnaire for the variable attitude of students towards learning mathematics, while a self-constructed questionnaire for the variable motivation towards learning mathematics was used to collect data from the respondents. The study revealed that government girls' secondary school students had a positive attitude towards learning mathematics. The study found that girls' students have above-average levels of motivation for learning mathematics. A positive moderate significant relationship was explored between government girls' secondary school students' attitudes and motivation towards learning mathematics. The study recommended that government secondary school teachers try to develop positive attitudes among students and motivate them to learn mathematics by adopting appropriate teaching methodologies to teach mathematics effectively and interestingly. The mathematics teachers may use both intrinsic and extrinsic motivational techniques during instruction to develop positive attitudes of students towards learning mathematics.

Keywords: Attitude toward Mathematics, Motivation, Intrinsic Motivation, Extrinsic Motivation

Introduction

The importance of mathematics has been acknowledged by the National Council of Teachers of Mathematics as "Those who understand and can do mathematics will have significantly enhanced opportunities and options for shaping their future". The rate of learning in the subject of mathematics depends upon the students' disposition towards mathematics (Darmayanti et al., 2023). Students' attitudes towards mathematics determine the level of students' interest and participation in the teaching-learning process. Students' attitude towards mathematics is a significant predictor which determines the rate of success. Previous research studies have found various factors that may positively or negatively affect the attitude and achievement of students towards mathematics. These factors may include the attitude of students towards a subject, pedagogical approaches used for instruction, teacher's teaching style, school climate, socio-economic status of students, parental involvement, parents' qualifications, and many others.

Students may like or hate to study mathematics. Attitude could be defined as a long-term positive or negative emotional disposition towards mathematics (Marchis, 2011). Similarly, attitude can also be described as either liking or disliking the subject and a tendency to refrain from or practice mathematics

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activities (Kibrislioglu, 2016). It can also be stated that the way one feels towards mathematics determines whether one's reaction towards mathematics is favourable or unfavourably. In the same way, students' attitudes towards mathematics showed the interest, enjoyment, and application of mathematics in daily life (Mazana et al., 2019). Ashby (2009) has identified some factors that may affect attitudes towards mathematics, such as beliefs, confidence, the utility of mathematics in day-to-day life and practice, and anxiety due to mathematics. Throughout the world, people are concerned about student's performance. The issue of low performance in mathematics has been a concern throughout the world. Most of the students considered mathematics as a challenging, feared, less preferable subject, and students did not want to continue it in college (Chand et al., 2021). Therefore, it is imperative that studies related to students' attitudes towards mathematics and its relationship with factors like students' motivation may be investigated.

Review of Related Literature

Asante (2012) conducted a study investigating senior high school students' attitudes towards mathematics and also found differences in the attitudes of boys and girls towards mathematics. The study also explored the factors that are encountered in shaping the attitude of students towards mathematics. The data were collected from 109 boys and 72 girls students through the Attitudes Towards Mathematics Inventory (ATMI). The study results revealed that there was a significant difference between boys and girls students towards mathematics. The factors that contributed to shaping students' attitudes towards mathematics included the environment of the school, the attitudes and beliefs of teachers, teachers' teaching styles, and parents' attitudes. The study recommended that teachers and the community organize seminars for students, parents, school administrators and other stakeholders to develop positive attitudes towards mathematics.

Farooq and Shah (2008) investigated the students' attitudes towards mathematics. The researchers collected data from 379 boys and 306 girls students through a valid and reliable questionnaire. The study found that both boys and girls students of Lahore have the same positive attitude towards mathematics. No significant difference was found between the attitudes of boys and girls towards mathematics. Students' gender has not proved to be a significant predictor in determining students' attitudes towards mathematics.

Kibrislioglu (2015) found that sixth-grade students had relatively positive attitudes towards mathematics. Further, the study found a significant difference between the attitudes of high- and low-achieving students towards mathematics. The study found no statistically significant difference between male and female students' attitudes towards mathematics. Adebule and Aborisade (2014) compared the male and female students' attitudes of senior school students towards mathematics. A valid and reliable questionnaire was used to collect data from 600 sampled students. The study found no significant difference between male and female students' attitudes towards mathematics. The study concluded that gender has not proved to be a significant, influential factor in determining students' attitudes towards mathematics.

Kasimu and Imoro (2017) found differences in the attitudes of public and private school students towards mathematics in Ghana. A highly valid and reliable questionnaire was used to measure students' attitudes towards mathematics. The results revealed no significant difference in the attitude between public and private school students towards mathematics. However, a slight degree of confidence in favour of private school students towards learning mathematics was found. The study further revealed no significant differences in the attitude of students towards mathematics were found between boys and girls students of public and private school students. Davadas and Lay (2017) found that parental influence, teacher affective support, and classroom instruction were influential factors that affected the attitude of students towards mathematics. The results showed that teacher affective support and classroom instruction predict the attitude of students towards mathematics more than that of parental influence. Atanasova-Pacemska et al. (2015) found that factors like students' gender, students' grades, the structure of the students, teachers'

teaching methodology, teachers' personalities and choice of students' choice of future education have no significant effect on primary school students towards mathematics.

Yaşar (2016) found that students exhibited a moderate level of attitude towards mathematics. A significant difference was found between the students' attitudes towards mathematics related to mathematics classes, fathers' education level and types of schools in which students were studying. On the other hand, no significant differences were found between students' attitudes towards mathematics and students' gender, mathematics teachers' gender, mothers' educational level, attending extra courses, tuition taught in mathematics, perceived success status, income level of students, number of siblings, students' order in the family as a sibling, and parents' profession. The study also found that the gender of mathematics teachers, mothers' profession, and fathers' educational level were the main factors that determine the attitudes of students towards mathematics subjects.

Akendita et al. (2024) found that the perception of students towards mathematics and the teacher's efficacy had a positive statistically significant effect on students' mathematics achievement. In the same way, teacher efficacy had a statistically significant effect on students' perception of mathematics. The study also revealed that teacher efficacy moderated the relationship between the perception of students of mathematics and the achievement of students in mathematics. Stailud and Zanzini (2024) investigated the factors affecting the interest and attitude of students towards mathematics in Zambia. By using a mixed-method approach, the study found that high school students had shown interest and positive attitudes towards mathematics. The loss of interest and the negative attitude shown by students were due to teachers' behaviour and interaction with students. The study recommended teachers review their teaching-learning approach and interaction patterns with students. Those concepts that arouse the interest of the students and can practically be applied in real-life situations may be included in the mathematics curricula.

Oredina et al. (2024) found that students had positive to highly positive attitudes towards mathematics. The students performed very well on the mathematics, CAT, and IQ tests. Students' CAT and IQ scores were positively significantly correlated with students' performance in mathematics. Students' CAT scores were significantly correlated with students' attitudes towards mathematics. Students' attitudes towards mathematics were significantly correlated with students' performance in mathematics. The study concluded that the majority of students find mathematics interesting, enjoyable and fun. The majority of the students acquired the necessary competencies in mathematics, such as good computation, problem-solving, and comprehension abilities. The study concluded that those students who had a positive attitude towards mathematics tended to perform better in the subject. Students' attitudes towards mathematics had a positive impact on their performance in mathematics.

Utsumi and Mendes (2000) found that students showed a positive attitude towards mathematics. No statistically significant differences in attitudes towards mathematics were found between male and female primary school students. Public school students have a more positive attitude towards mathematics than private school students. The study found that most of the students were not helped in the completion of homework or assignments given in the subject of mathematics by their family members. These characteristics do not significantly influence students' attitudes towards mathematics. The study also revealed that the number of days allocated for teaching the subject has no significant effect on students' attitudes towards mathematics. Most of the students have mentioned that mathematics is their favourite subject. The study found that those students who understood the mathematical problems asked by teachers in the classroom had positive attitudes towards mathematics. Female students had a slightly positive attitude towards mathematics as compared to male students. Statistical significant differences were found among the 6^{th}, 7^{th} and 8^{th} grade students regarding attitude towards mathematics. The students of 6^{th}-grade students had a more positive attitude towards mathematics than that of 7^{th} and 8^{th}-grade students. Those students who have never failed previously in a grade have a positive attitude towards mathematics compared

to those who have failed in a previous grade. Students' age has a significant effect on their attitudes towards mathematics. Those students whose ages were 11 or 12 years had a more positive attitude towards mathematics than those whose ages were 16 years or older. The study also found that with the increase in self-perception of mathematical performance, the attitude of students towards mathematics also improved.

Marchis (2011) found that factors like a teacher's attitude towards mathematics and the amount of confidence or support given by the teacher to students, practical implications of mathematics in day-to-day life, self-efficacy and self-judgment were the major factors that influencing the attitude of secondary school students towards mathematics in Romania. Pedersen and Haavold (2023) found that inquiry-based teaching has the potential to foster positive attitudes towards mathematics among students. Those students who often experienced inquiry-related activities during instruction tend to see mathematics as a creative and enjoyable subject. The study also found that the inquiry-based approach had a moderate relationship with students' beliefs about mathematics; a weak relationship was found between inquiry-based instruction and students' transition from primary to secondary. The effect of inquiry-based motivation was found to be stronger than in girls. Amirali (2010) found that eighth-year students perceived mathematics as a useful subject for day-to-day life, developed problem-solving skills among the students, and strengthened their future careers. The findings also highlighted students' confusion and contradictions about the nature of mathematics. The study also revealed that female students hold a more positive attitude towards mathematics than males. Similarly, girls students hold less mathematical anxiety than boys.

Darmayanti et al. (2023) collected data from teachers and students through observation and interviews related to causes of students to make mistakes and difficulties in learning mathematics. The study found that the material provided by the teacher, low student motivation, and the tendency to do homework regularly were common problems for students in learning mathematics. In the same way, mathematics teachers are unable to teach effectively and have low subject command. The study suggested that the provision of a conducive learning environment in the classroom motivates students to learn more by providing rewards to improve their grades, which are for their learning and reminding them to complete their homework. Similarly, for the solution of educator problems' the school may conduct regular assessments, observe teachers in the classroom who are teaching, call teachers to the office who do not attend classes, arranging and conduct teachers' training, especially in the subject of mathematics.

Akinsola and Olowojaiye (2008) found that Behavioural Objective Based Instructional Strategy (BOBIS) and Study Question-Based Instructional Strategy (SQBIS) have significant effects on students' attitudes towards mathematics. A significant difference was found in the attitude towards mathematics between experimental and control groups by using BOBIS. The experimental group students showed a more positive attitude towards mathematics than the control group taught with SQBIS. The study revealed that both BOBIS and SQBIS were proved to be viable instructional strategies that might promote positive attitudes of students towards mathematics in school. Thus, it proved that mathematics teachers' instructional methods in the classroom positively affect students' attitudes towards mathematics.

Albelbisi et al. (2024) found a negative relationship between secondary students' attitudes towards online homework tools and mathematics anxiety. The study also found that perceived usefulness and perceived ease of use are predictors of attitude toward the use of online homework. The study proved that online homework tools in mathematics learning are useful in maximizing students' capacity. The study recommended that mathematics teachers may implement online homework tools in learning mathematics.

Maghfiroh et al. (2023) argued that it is imperative to investigate the causes of students' low learning outcomes in mathematics. For this purpose, they conducted a study to explore the relationship between motivation and learning anxiety and student learning outcomes in mathematics. The study used a quantitative approach with a descriptive design. The researchers selected 30 students in the first year by

using a simple random sampling technique. The researchers used questionnaires and tests for data collection. Pearson's co-efficient correlation was used to analyze the data. The study revealed a significant positive relationship between learning motivation, learning anxiety, and students' learning outcomes in class XI.

Aust et al. (2024) explored the effects of formative assessment on intrinsic motivation mediated by students' perceived competence support in primary school mathematics instruction. The study used a sample of 27 teachers and 613 students. The study results revealed that formative assessment has a direct significant effect on intrinsic motivation. The study also found a significant direct effect of intrinsic motivation on students' perceived competence, which, in turn, has a significant effect on intrinsic motivation. A small indirect effect of students' perceived competence support was found between formative assessment and intrinsic motivation.

Živković et al. (2023) investigated the influence of emotional and cognitive-motivational factors on students' performance in the subject of mathematics. The study sample consisted of 84 boys and 61 girls in fifth grade. The study depicted that students' performance in mathematics was negatively correlated with math anxiety. On the other hand, the study found that students' math performance was positively correlated with math enjoyment and math self-efficacy. The study also revealed a negative association of math anxiety with math enjoyment and math self-efficacy, while enjoyment in mathematics was positively associated with math self-efficacy. The hierarchal regression analysis showed a significant impact of math enjoyment and math self-efficacy on fifth-grade students' performance in mathematics.

Hidayatullah and Csíkos (2024) argued that there are various factors which influence students' academic achievement. Among these factors, beliefs, parents' educational level, motivation, and attitudes have a significant influence on students' academic achievement. To fill this gap, the researchers have conducted a study to investigate the structural relationship between beliefs, parents' educational background, motivation, and attitudes on students' achievement in the subject of mathematics. The study sample was comprised of 448 boys and 446 girls from fifth- and sixth-grade students from six schools in Indonesia. The results of the structural equation model showed that this model has significantly predicted students' achievement in the subject of mathematics. Beliefs, attitudes, and motivation are positively associated with students' mathematics achievement. Parents' educational level has positively significantly influenced students' mathematics achievement and motivation. There was an indirect influence of beliefs with achievements through motivation and attitude. The study also has an indirect, insignificant influence on parents' educational level and students' achievement through motivation.

The above discussion showed that various factors influence the attitude and interest-related factors towards learning mathematics. Students' motivation is also a necessary and significant predictor of their academic achievement. Therefore, this study intended to explore the relationship between secondary school girls' students' attitudes and motivation towards learning mathematics.

Objectives of the Study

- To find out the level of girls' students' attitude towards learning mathematics in government girls' secondary schools of Malakand
- To find out the level of girls' students' motivation towards learning mathematics in government girls' secondary schools of Malakand
- To explore the relationship between girls' students' attitudes and motivation towards learning mathematics in government girls' secondary schools of Malakand

Research Questions

- What is the level of girls' students' attitudes towards learning mathematics in government girls' secondary schools of Malakand?

- What is the level of motivation of girls' students towards learning mathematics in government girls' secondary schools in Malakand?
- What is the extent of the relationship between girls' students' attitudes and motivation towards learning mathematics in government girls' secondary schools of Malakand?

Research Methodology

The researchers adopted a quantitative method by following a survey design for the collection and analysis of data. All girls' students studying in government schools in the Malakand district constitute the population of the study. By using a simple random sampling technique, researchers selected 353 female students from 20 Government schools. The researcher used an adapted questionnaire developed by Ali (2008) to measure the attitude of secondary school students. A written request was sent to the original author, and obtained permission to use/adapt the questionnaire. A self-developed questionnaire was used to measure the intrinsic and extrinsic motivation levels of female students in mathematics. The questionnaire consisted of 43 Likert-type items. Among 43 items, 20 items were related to students' attitudes towards learning mathematics, and 23 items were related to motivation.

The variable attitude towards mathematics was further divided into five constructs. The motivation variable was split into constructs, i.e. intrinsic and extrinsic motivation. The content and face validity of the questionnaire were established through a panel of experts, which consisted of mathematics teachers and teachers at the Department of Education at the university who had sufficient experience in teaching and research. They were requested to check the questionnaire and highlight any ambiguities. They checked the questionnaire and returned it, suggesting minor changes. After the validity of the questionnaire, the next important step was to pilot the final questionnaire in the field. The final questionnaire was piloted over 50 students who were not part of the sample but identical to the sample. The reliability of the questionnaire was measured through the inter-item consistency method by calculating Cronbach Alpha values for the whole questionnaire as well as for each variable. The alpha values for the variable attitude towards mathematics were found to be .87, while for the variable motivation towards learning mathematics, it was found to be .91. The values of alpha showed that the questionnaire was highly reliable. After establishing the reliability of the questionnaire, the final step was the collection of data. The researchers prepared 360 survey packets for this. Each survey packet was accompanied by a consent letter in which the researchers requested the participants to voluntarily participate in the study. The researchers finally collected 353 usable filled survey packets from the respondents and fed the collected data into a spreadsheet in Statistical Package for Social Sciences (SPSS). The data were analyzed by using appropriate statistical tests.

Data Analysis

The researchers fed the collected data of 353 girls' students in a spreadsheet of SPSS, in which 181 were studying in the 9^{th} class while 172 were studying in the 10^{th} class. The ages of these students ranged from 14 years to 17 years. The mean scores were interpreted as

Mean score range 1 < Sufficiently below Average Level of Observance < 2

Mean score range 2.1 < Below Average Level of Observance < 2.9

A mean Score range equal to 3 corresponds to the category of Average Level of Observance

Mean Score range 3.1 < Above Average Level of Observance < 4

Mean Score range 4.1 < Sufficiently above Average Level of Observance < 5

Table 01

Level of Girls' Students Attitude towards Learning Mathematics

Constructs of Students' Attitude Towards Learning Mathematics	*n*	*M*	*SD*
The attitude of Girls' Students towards Mathematics	353	3.97	.87
Attitude of Girls' Students towards Teaching of Mathematics	353	4.20	.70
Attitude of Girls' Students Towards Mathematics Course	353	3.77	.83
The attitude of Girls' Students towards Problems in Understanding New Topics or Concepts	353	3.94	.68
Attitude of Government Girls' Secondary School Students towards Tests or Examinations in Mathematics	353	3.87	.84
Grand Mean and Standard Deviation Scores	353	3.95	.64

The mean and standard deviation scores depicted that the attitude of girls' students towards learning mathematics ranged between above-average levels to sufficiently above-average levels of observance. The mean score of four constructs was found to be above average level of observance, whereas the mean score of one construct was found to be sufficiently above average level of observance. The grand mean score for the variable "attitude towards learning mathematics" was found to be above average level of observance, which depicted that the level of girls' students' attitudes towards learning mathematics was found to be positive and above average level.

Table 02

Level of Girls' Students Motivation towards Learning Mathematics

Constructs of Students' Motivation towards Learning Mathematics	*n*	*M*	*SD*
Intrinsic Motivation	353	3.86	.75
Extrinsic Motivation	353	3.95	.67
Grand Mean and Standard Deviation Scores	353	3.90	.69

The mean and standard deviation scores depicted that the motivation of girls' students towards learning mathematics was found to be an average level of observance. The mean score of the two constructs was found to be above average level of observance. The grand mean score for the variable "motivation towards learning mathematics" was found to be above average level of observance, which depicted that the level of girls' students' motivation towards learning mathematics was found to be positive and of above average level.

Table 03

Relationship between Girls' Students' Attitude and Motivation towards Learning Mathematics

Variables	*n*	*M*	*SD*	*r*	*p*
Girls' Students Attitude towards Learning Mathematics	353	3.90	.64	.62	.001
Girls' Students Motivation towards Learning Mathematics	353	3.90	.69		

Table 03 revealed the results of the association between the attitude and motivation of students towards learning mathematics. The value of the coefficient of correlation revealed that there is a positive moderate significant relationship between attitude and motivation towards learning mathematics. Students having a more positive attitude leads to more motivation towards learning mathematics. Those girls' students who had more positive attitudes towards learning mathematics were found to be more motivated towards learning mathematics. On the other hand, those girls' students who had negative attitudes towards learning mathematics were found to be less motivated towards learning mathematics.

Discussion

The study found that girls' students of government secondary schools had positive attitudes towards learning mathematics. It was also found that girls' students' motivation for learning mathematics was above average in observance. The study depicted a positive moderate significant relationship between students' attitudes and motivation towards learning mathematics. The results of this study were aligned with the findings of the previous studies. Different researchers from different countries found that students have positive attitudes towards learning mathematics. However, there are various factors that may affect students' attitudes towards learning mathematics. These factors may include school and home environment, students' gender, teachers' teaching styles, learners' learning styles, beliefs and attitudes of teachers, and parents' attitudes. Asante (2012) found a significant difference between male and female students in terms of learning mathematics. Akinsola and Olowojaiye (2008) concluded that mathematics teachers' instructional methods in the classroom positively affect students' attitudes towards mathematics. Darmayanti et al. (2023), Stailud and Zanzini (2024) and Yaşar (2016) argued that material provided by the teachers, low student motivation and laziness in doing homework regularly were the common student's problems in learning mathematics. Similarly, mathematics teachers are unable to teach effectively and have low subject command.

The studies suggested that the provision of a conducive learning environment in the classroom motivates students to learn more by providing rewards to improve their grades, which are for their learning and remind them to complete their homework. Amirali (2010) revealed that female students hold a more positive attitude towards mathematics than males. Similarly, girls students hold less mathematical anxiety than boys. Utsumi and Mendes (2000) found that students showed a positive attitude towards mathematics. No statistically significant differences in attitudes towards mathematics were found between male and female primary school students. Public school students have a more positive attitude towards mathematics than private school students. Pedersen and Haavold (2023) found that inquiry-based teaching has the potential to foster positive attitudes towards mathematics among students. Oredina et al. (2024) found that students had positive to highly positive attitudes towards mathematics. Akendita *et al.* (2024) revealed that teacher efficacy had moderated the relationship between the perception of students toward mathematics and the achievement of students in mathematics. Yaşar (2016) found that students exhibited a moderate level of positive attitude towards mathematics.

Farooq and Shah (2008) found that both boys and girls students of Lahore have the same positive attitude towards mathematics. No significant difference was found between the attitudes of boys and girls towards mathematics. Students' gender has not proved to be a significant predictor in determining students' attitudes towards mathematics. Živković et al. (2023) depicted that students' performance in mathematics was negatively correlated with math anxiety. On the other hand, the study found that students' math performance was positively correlated with math enjoyment and math self-efficacy. The study also revealed a negative association of math anxiety with math enjoyment and math self-efficacy, while enjoyment in mathematics was positively associated with math self-efficacy. The hierarchal regression analysis showed a significant impact of math enjoyment and math self-efficacy on fifth-grade students' performance in mathematics. Hidayatullah and Csíkos (2024) revealed that beliefs, attitudes and motivation are positively associated with students' mathematics achievement. Parents' educational level has positively significantly influenced students' mathematics achievement and motivation. There was an indirect influence of beliefs with achievements through motivation and attitude. The study also has an indirect, insignificant influence on parents' educational level and students' achievement through motivation.

Conclusions

The study concluded that girls' students of government secondary schools in Malakand district had positive attitudes and were highly motivated towards learning mathematics. The attitude and motivation levels of

girls' students were found to be above average level of observance. Those girls' students who had a positive attitude towards learning mathematics were found to be more motivated towards learning mathematics. Similarly, students who had negative attitudes towards learning mathematics were found to be less motivated to learn mathematics. This indicates that for learning mathematics, a positive attitude and motivation are necessary.

Recommendations

The study proposed recommendations for government officials, policymakers, curriculum developers, mathematics teachers and students. The study recommended that mathematics teachers must use reinforcement techniques during instruction to capture the attention of the students. They must use interesting teaching skills and methods to teach mathematics interestingly and effectively. They must use reinforcement techniques during instruction to motivate students to perform better in the subject of mathematics. Teachers may use heuristic, experimental, and problem-solving methods to teach mathematics interestingly and effectively. Curriculum developers may develop mathematics curricula in such a way in which students' physical and mental growth levels must be kept in mind to design various activities and exercises in the mathematics book. The government may send mathematics teachers abroad for training to equip themselves with modern techniques of teaching and integrate teaching with the latest technological tools.

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