

Relationship between Attitude of Government Girls Secondary School Students towards Learning Mathematics and Academic Achievement

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Abstract: This study investigated the relationship between the attitudes of government girls' secondary school students towards learning mathematics and their academic achievement. The population of the students consisted of all female students studying in government schools in the district of Malakand. A sample of 300 students selected from 20 schools were randomly selected. An adapted questionnaire related to attitudes toward mathematics developed by Ali (2008) was used to collect data from the sampled students. Students' marks obtained in the subject of mathematics in the annual examination held under the Board of Intermediate & Secondary Education (BISE), Malakand, are used as a measure of students' academic achievement. The reliability of the questionnaire was established through Cronbach's alpha, which was found to be .96. The study revealed a positive attitude towards girls' students towards the subject of mathematics. A positive, moderately significant relationship was found between the attitude of female students towards mathematics and academic achievement. The study recommended that mathematics teachers use interactive and inquiry-related activities in class to present mathematics as an interesting and creative subject that will be useful for them in the future.

Keywords: Attitude towards Mathematics, Learning Mathematics, Academic Achievement

Introduction

Mathematics has a central position among school subjects and is known as the mother of philosophy because of its practical implications in day-to-day life (Oracion et al., 2021). It has been long argued that students with a solid foundation in mathematics are essential for future careers, academic success, and cognitive growth (Addae & Agyei, 2018; Agyei et al., 2024). Centintav and Yilmaz (2023) mentioned that learning mathematics for personal development has become more significant for every student in this era of science and technology. Mathematics possessed a central position from the ancient age in the development of higher-order thinking and logical skills (Moote et al., 2020). Many subjects like statistics, engineering, physics, and many other fields depend on mathematics (Widana, 2018). Mathematics helps students develop critical, innovative, logical, analytical, and collaborative thinking skills. Therefore, it is imperative to offer mathematics subjects from elementary to onwards to equip students with such skills (Sulaiman & Ismail, 2020). Thurm et al. (2024) have mentioned that a strong mathematical background is a prerequisite for pursuing further academic and professional qualifications in many fields. Competency in mathematical knowledge and skills is significant in politics, science, technology, and society. It provides a base for science and technology in many societies of the world (Hagan et al., 2020).

The rate of learning in the subject of mathematics depends upon the students' disposition towards mathematics (Darmayanti et al., 2023). The attitude of students towards mathematics determines the level of students' interest and participation in the teaching-learning process. Students' attitude towards mathematics is

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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 toward 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. Many factors are responsible for influencing students' performance in mathematics. These factors may include socioeconomic status, students' aptitude, instructional strategies, classroom management, teacher-related variables, shortage of learning resources, and lack of parental participation, school environment (Hussain et al., 2020; Maamin et al., 2021). Mazana et al., (2019) reported that students' poor performance in the subject of mathematics was attributed to institutional resources, teachers' moral strategies, institutional resources, and failure to understand instructions poor learning and assessment strategies.

Literature Review

Many research studies have shown a positive significant relationship between students' attitudes towards mathematics and their achievement in the subject. These studies have shown that perception towards mathematics and students' achievement has been greatly influenced by instructional strategies and procedures utilized by teachers and teacher self-efficacy and beliefs (Hidayatullah & Csíkos, 2024; Karakose et al., 2023; Olawale & Hendricks, 2024). Inquiry-based learning and guided discovery learning are innovative teaching strategies used by mathematics teachers to facilitate effective teaching (Appiah et al., 2022). Harefa (2023) concluded that a positive significant relationship existed between eighth-grade students' interest in mathematics learning and their outcomes in the subject of mathematics.

Kenosi et al. (2024) concluded that secondary school students' attitudes towards mathematics had a positive moderate significant relationship with students' academic performance. The findings depicted that those students who showed a more positive attitude towards learning mathematics would perform better, and those students who exhibited a negative attitude towards learning mathematics would perform poorly. Mazana et al. (2019) found that initially, students had positive attitudes toward mathematics, but later on, as the students moved from one stage to another stage, their attitudes slowly and gradually turned negative. The study also found a significant positive weak relationship between students' attitudes towards mathematics and students' academic performance. The factors that contributed to liking and disliking mathematics included students' aptitude attributes and the physical, psychological, and social environment of the classroom.

Standslause et al., (2013) found a positive significant relationship between teachers' attitude towards mathematics and students' performance in Kenya. Davadas & Lay, (2020) collected data from 808 students related to factors affecting students' attitudes towards mathematics. The study found a positive relationship between students' attitudes towards mathematics and parental influence, teacher affective support, classroom instruction, and previous achievement. The study also found that factors that affect students' attitudes towards mathematics in urban and rural secondary students are different. Adamu et al. (2015) concluded that a positive moderate significant relationship was found between college students' towards mathematics and their achievement in mathematics. No significant difference was found between male and female students in their attitude towards mathematics. However, the performance of female students was slightly better than that of their counterparts' male students. Wakhata et al. (2024) found that there is a direct, significant positive relationship between eleventh-grade students' attitudes toward linear programming word tasks in mathematics and students' performance. Both public and private grade 11th Ugandan students' attitude positively and directly impacted their performance in solving linear programming word problems.

Daninna (2017) found a positive, significant, strong relationship between the attitude of students towards learning mathematics and their academic achievement. The study also revealed that male students' attitudes toward mathematics were found to be more positive than those of female students. Similarly, the academic achievement of male students was found to be much better than that of their female counterparts. The study concluded that students' attitude towards mathematics predicted their academic achievement in the subject. (Bhowmik & Roy, 2016) found no significant difference between boys' and girls' Indian students' attitudes toward mathematics and their achievement in mathematics. They found a positive significant relationship between students' attitudes towards mathematics and academic achievement in mathematics. Mensah et al., (2013) found a significant relationship between teachers' and students' attitudes toward mathematics. The study also found a significant positive relationship between teachers and students attitudes toward mathematics and students' performance in mathematics.

Oluyomi et al. (2024) investigated the influence of mathematics anxiety, motivation, and attitudes on the mathematics performance of school students in Nigeria. A questionnaire was used to collect the data from 381 students. The results revealed that mathematics anxiety, motivation, and attitudes have a significant moderate relationship with students' performance in mathematics. The study also found mathematics anxiety and motivation have a significant impact on students' performance. Female students exhibited more anxiety as compared to male students. Male students were found to be more motivated towards learning mathematics than their female counterparts. Students' attitude towards mathematics was found to be positive and had a positive influence on students' performance, while on the other hand study revealed no significant differences between male and female students regarding this aspect.

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. Shone *et al.* (2024) investigated the impact of the perception of students towards mathematics and self-efficacy on students' mathematics achievement. The study found a strong positive relationship between students' mathematics perception and self-efficacy and their achievement in mathematics. Students' perceptions of mathematics and self-efficacy were proven to be significant predictors of students' mathematics achievement. Students' gender has a significant effect on students' perception of mathematics, self-efficacy, and students' mathematics achievement. Male students' perceptions of mathematics, self-efficacy, and achievement in mathematics were found to be better than those of their female counterparts.

Wang *et al.* (2024) conducted a systematic review to investigate the factors predicting mathematics achievement in Programme for International Students Assessment (PISA). They reviewed the results of 156 research papers. On the basis of the review, the authors identified 135 factors, which were further categorized into five major groups. These groups of factors consisted of the individual students, household context, school community, education system, and macro society. The analysis uncovered the seven factors that were found to be consistently associated with mathematics achievement in PISA. Among these seven factors, students' grade level and family socio-economic condition were consistently found to be positively correlated with students' mathematics achievement. While five factors, students' absenteeism, lack of students' punctuality, school repeating and students dropping out, students' misbehavior prevailed in school, shortage of teachers and general staff in school, and students' centered instruction, were consistently found to be negatively associated with students' mathematics' achievement.

Zakaria and Syamaun (2017) found that the Realistic Mathematics Approach (RMA) group performed better than that of the traditional group in mathematics achievement. The study also found no significant difference between the RMA and traditional method in attitude towards mathematics. The study recommended the use of RMA in teachers' mathematics learning. Kundu & Ghose, (2016) found a positive significant relationship between students' attitudes towards mathematics and achievement in the public examinations of secondary and higher secondary school students. The study concluded that a healthy attitude towards mathematics leads to good performance in mathematics. Hussein & Csikos, (2023) found a statistically significant difference between the effects of conceptual knowledge on students' achievement in the subject of mathematics. The experimental group performed better than the control group in the mathematics tests. The Iraqi school students' attitude towards mathematics was found to be more positive than that of the control group. Teaching mathematics conceptually reduced anxiety among male students more than that of their female counterparts. Igcasama et al. (2023) conducted a systematic review investigation and found that the flipped classroom setting approach has a significant positive influence on students' achievement in mathematics. The literature review also supported the idea that students in flipped classrooms demonstrated better performance than students in traditional classroom settings in the subject of mathematics. Various factors like the selection of technological tools, teacher facilitation methods, and instructional strategies may influence the mathematics learning of students in the flipped classrooms.

The above literature review showed that a positive attitude towards mathematics has a significant positive impact on students' academic achievement. The literature review also proved that those students who had positive attitudes towards mathematics had high academic achievement in the subject. The literature also showed that the experimental group performed better than that of the control group. The literature also revealed

that both boys and girls students had positive attitudes toward mathematics. The literature also showed that questionnaires, interviews, and observations were used as research instruments for the collection of data. However, the results of these studies cannot be implemented in a remote, far-flung, and hilly area like Malakand. Therefore, it is imperative that a correlational study between the attitudes of government girls' secondary school students towards learning mathematics and academic achievement must be conducted to add something new to the existing body of literature.

Research Methodology

This study used a descriptive research design with the quantitative method. The population of the study consisted of all girls (4299) studying in government secondary girls' schools in the Malakand district. The study sample consisted of 353 female students who were selected from 20 schools using a simple random sampling technique. An adapted questionnaire developed by Ali (2008) related to students' attitudes towards mathematics was used to collect the data from the students. The student's annual examination scores in the subject of mathematics were used as their academic achievement in the study. The researchers obtained prior permission from the author to use the adapted questionnaire for the study. Five major aspects of attitude were used in the questionnaire. The first construct was related to students' perception towards mathematics, the second construct was related to perception towards teaching mathematics, the third construct was related to the perception of mathematics course, the fourth construct was related to the perception of problems in understanding a new topic or concept, and the fifth construct was related to perception about mathematical test and examinations. The reliability of the questionnaire was established through Cronbach's alpha value (inter-item consistency method). The researchers conducted the pilot test for this purpose. For pilot testing, two government school girls' students were selected, and the questionnaire was piloted on 50 students who were not part of the sample. The students were asked to fill out the questionnaire and also asked them to point out the ambiguities in the questionnaire related to language, structure, and grammar. After their response, the researchers calculated the alpha value through Statistical Package for Social Sciences (SPSS) which was found to be .87. After calculating the Cronbach's alpha value, the researchers administered the final version of the questionnaire for collection of data from the respondents.

Data Analysis

A total number of 353 female students participated in the study. Among these students, 181 were studying in the 9th class, while 172 were studying in the 10th class. The ages of these students ranged from 14 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 1

The attitude of Girls' Students towards Mathematics

S. No	Items	SA	A	UD	DA	SDA	M	SD
1	Liking of mathematics	156	151	2	18	26	4.12	.73
2	The usefulness of mathematics in daily life	280	57	4	7	6	4.61	.54
3	Interesting subject	194	117	2	16	24	4.13	.62
4	Easy to understand	102	125	6	44	76	3.38	.83
Grand mean and standard deviation scores							3.97	.87

Table 1 shows the attitude of government girls' school students towards mathematics. The frequency and mean scores revealed that attitude towards mathematics was found to be an average level of observance. The highest mean score among the four items was found to be for the item "Mathematics is useful in daily life." On the other hand, the lowest mean score was found for the item "mathematics is easy to understand" among the four questions. The overall mean score for the construct "attitude of girls' students towards mathematics" was found to be above average in observance, which showed that girls' students had a positive attitude towards mathematics.

Table 2*Attitude of Girls' Students towards Teaching of Mathematics*

S. No	Items	SA	A	UD	DA	SDA	M	SD
1	Mathematical concepts are easy and understandable	160	127	8	30	28	4.02	.76
2	Using example during teaching	260	70	3	15	5	4.60	.54
3	Using of audio-visual aids during the teaching of mathematics	198	83	14	37	21	4.13	.68
4	Teaching mathematics using a solving approach	207	83	6	38	19	4.19	.71
Grand mean and standard deviation scores							4.20	.70

Table 2 shows the attitude of government girls' school students toward the teaching of mathematics. The frequency and mean scores revealed that the attitude of students towards mathematics was found to be sufficiently above average level of observance. The highest mean score among the four questions was found to be for the item "using of example during teaching." On the other hand, the lowest mean score was found to be for the item "Mathematics concepts are easy and understand" among the four questions. The overall mean score for the construct "attitude of girls' students towards teaching mathematics" was found to be sufficiently above average level of observance, which showed that girls' students had a positive attitude towards teaching mathematics subject.

Table 3*Attitude of Girls' Students Towards Mathematics Course*

S. No	Items	SA	A	UD	DA	SDA	M	SD
1	The mathematics syllabus is updated	80	102	28	74	69	3.14	.96
2	Textbook is based on individual differences	208	108	18	11	8	4.41	.54
3	Mathematical concepts are based on students' learning outcomes	216	113	12	6	6	4.49	.68
4	Course contents are boring and overloaded	79	97	23	65	89	3.03	.71
Grand mean and standard deviation scores							3.77	.83

Table 3 shows the attitude of government girls' school students towards mathematics courses. The frequency and mean scores revealed that students' attitudes toward mathematics courses were found to be above average in terms of observance. The highest mean score among the four questions was found to be for the item "Mathematical concepts are based on students' learning outcomes". On the other hand, the lowest mean score was found to be for the item "Course contents are boring and overloaded" among the four questions. The overall mean score for the construct "attitude of girls' students towards mathematics course" was found to be an average level of observance, which showed that girls' students had a positive attitude towards mathematics course/content.

Table 4*The attitude of Girls' Students towards Problems in Understanding New Topic or Concepts*

S. No	Items	SA	A	UD	DA	SDA	M	SD
1	Feeling no worries about understanding mathematics because I will understand it with the passage of time	152	157	9	15	20	4.15	.67
2	Seeking help in understanding	217	101	6	15	14	4.39	.41
3	Seeking help from class fellows	100	156	8	16	73	3.55	.84
4	Seeking help from family members	136	121	6	23	67	3.67	.79
Grand mean and standard deviation scores							3.94	.68

Table 4 shows the attitude of government girls' school students towards problems in understanding new topics or concepts. The frequency and mean scores revealed that students' attitude towards problems in understanding a new topic or concepts was found to be above average level of observance. The greatest mean score was found

to be for the item "Seeking help in understanding" among the four questions. On the other hand, the lowest mean score was found to be for the item "Seeking help from class fellows" among the four questions. The overall mean score for the construct "attitude of girls' students towards problems in understanding of new topic or concept" was found to be above average level of observance, which showed that girls' students had a positive attitude towards problems in understanding of new topic or concept.

Table 5

Attitude of Government Girls' Secondary School Students towards Tests or Examination in Mathematics

S. No	Items	SA	A	UD	DA	SDA	M	SD
1	Do not like lengthy questions because I have doubts to make mistakes	250	50	10	10	33	4.34	.67
2	It is difficult for me to revise the whole course for the final examination	216	89	10	9	29	4.29	.69
3	I am afraid of solving conceptual examinations in test or examination	173	91	7	28	54	3.85	.83
4	I like to solve objective-type questions in the test and examination	79	109	12	32	121	2.98	.98
Grand mean and standard deviation scores							3.87	.84

Table 5 shows the attitude of government girls' school students towards tests or examinations in mathematics. The frequency and mean scores revealed that students' attitudes towards tests or examinations in mathematics were above the average level of observance. The greatest mean score was found to be for the item "Do not like lengthy questions because I have doubt to make mistakes" among the four questions. On the other hand, the lowest mean score was found to be for the item "I like to solve objective type questions in the test and examination" among the four questions. The overall mean score for the construct "attitude of girls' students towards test or examination in mathematics" was found to be an average level of observance, which showed that girls' students had positive attitudes towards tests or examinations in mathematics subject.

Table 6

Relationship between Attitude of Government Girls' Secondary School Students towards Learning Mathematics and Academic Achievement

Variables	n	M	SD	r	p
Students' Attitude towards Mathematics	353	3.98	.96	.58	.032
Students' Academic Achievement	353	68.4	15.62		

Table 6 shows the relationship between the attitudes of girls' secondary school students towards learning mathematics and their academic achievement. The value of the coefficient of correlation showed that a positive moderate significant relationship was found between the attitude of girls' students towards learning mathematics and their academic achievement.

Discussion

The study found that female students in the government secondary school district in Malakand have a positive attitude towards learning mathematics. The study also found a positive, moderately significant relationship between the attitude of female students towards learning mathematics and their academic achievement. The results of the study also found that female students have a positive attitude toward mathematics. They also perceived that teachers taught this subject very well. Students also revealed that the content and course of mathematics subject were up to date. Students believed that they had problems understanding a new topic or concept in the subject of mathematics. Students perceived positive attitudes towards tests and examinations in the subject of mathematics. However, they did not like to solve objective-type questions in the subject of mathematics.

The findings of this study were in line with the findings of the previous research conducted at the national and international levels. Many researchers in other countries also found that secondary school students had positive attitudes towards learning mathematics (Kenosi et al., 2024; Mensah et al., 2013). Oluyomi et al. (2024) found that male students have more positive attitudes towards learning mathematics than female

students. Mazana et al., (2019) concluded that as students move forward from lower to higher grades, their attitude toward mathematics turns from positive to negative.

The study found a positive moderate significant relationship between attitude toward learning mathematics and the scores achieved in the annual examinations. Most of the previous research studies have testified to the results of the current study (Harefa, 2023; Kenosi et al., 2024; Standslause et al., 2013; Davadas & Lay, 2020; Adamu et al., 2015; Mensah et al., 2013; Wakhata et al., 2024; Bhowmik & Roy, 2016; Kundu & Ghose, 2016). These studies concluded that a positive moderate significant relationship existed between eighth-grade students' interest in learning mathematics and their outcomes in the subject of mathematics. Researchers like Akendita et al. (2024) found that the perception of students towards mathematics had a positive statistically significant effect on students' mathematics achievement. Shone *et al.* (2024) found a significant positive impact of the perception of students towards mathematics on students' mathematics achievement. Daninna (2017) found a positive, significant, strong relationship between students' attitudes toward mathematics and their academic achievement.

Conclusions

The study concluded that the attitude of government girls students toward learning mathematics was positive. They had a positive attitude towards the subject of mathematics. They enjoy teaching mathematics in their class. They believed the content was interesting and aligned with the modern emerging trends. Students felt that new topics or concepts were challenging for them. They perceived that they prepared them for tests and examinations in the subject. However, the revision and objective questions were difficult for them to solve. A positive moderate significant relationship was found between the attitude of government girls' students towards learning mathematics and their academic achievement. Those girls' students who had a positive attitude towards mathematics performed better than those who didn't have a positive attitude towards learning mathematics.

Recommendations

The study recommended that mathematics teachers may use various research-based teaching methods to provoke the interest of the students. They may use conceptual approach knowledge and inquiry-based teaching methods, which may increase the academic achievement of the students. Mathematics teachers may provide a safe, secure, and congenial environment in the classroom where students can openly express their difficulties and also share their learning experiences openly with the teacher and the class fellows. Mathematics teachers must keep in mind the physical and mental levels of the students and then teach accordingly. Individual differences must be addressed in the classroom, and a differentiating approach may be used to enhance students' academic achievement. Parents may also be aware regularly of the performance of their daughters in the subject of mathematics and may regularly contact the teachers so that their daughters may perform better in the subject.

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