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PRIMARY SCHOOL STUDENTS' ATTITUDES TOWARDS MATHEMATICS IN PAKISTAN: GRADE LEVEL DIFFERENCES, TEACHER SUPPORT, AND ACADEMIC ACHIEVEMENT

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Abstract

This study investigated attitudes towards mathematics in students attending Grades 3-5 during primary education, and how these attitudes are related to grade level, gender, and type of school attended, location of school, teachers' perceived support and mathematics achievement. A quantitative, cross-sectional survey design was used to gather data from 781 students attending both public and private educational institutions in urban and rural areas. An Urdu adaptation of the Attitudes towards Mathematics Inventory (ATMI) was used to collect data. Descriptive and inferential statistics were used to analyze the data. The results showed that students held a moderate level of positive attitudes towards mathematics (M= M = 3.18; SD= SD = 0.47), and a relatively high level of perceived support from teachers (M= M = 4.34; SD= SD = 0.96). Overall attitudes were found to vary significantly according to the grade level. Grade 3 students had more positive attitudes compared to Grades 4 and 5. No significant differences were found between genders. Overall attitudes were more positive in urban students compared to those in rural locations. Overall attitudes towards mathematics and perceived teacher support were positively related to achievement. The regression model indicated that 18.1% of the variance in achievement could be predicted, and it was found that type of school and teacher support were significant predictors. This highlights how student attitudes and perceived teacher support play an important role in primary mathematics education. However, the subscales lacked good reliability, and the factor model did not fit well. Further confirmation is required due to the inconsistency of the statistical results.

1. INTRODUCTION

Mathematics is an important part of primary education. The development of fundamental mathematical skills allows children to develop their reasoning and problem-solving abilities as well as helping them in their future academic

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studies. In years 3-5 students begin to move beyond simple mathematical skills and are presented with more complex mathematical concepts. This can affect how confident, interested and motivated they become when working with mathematics.

Mathematical attitudes refer to how a student feels about mathematics, what they believe about its usefulness and difficulty and how willing they are to participate in mathematical activities.

This is important as it may cause students who have a high level of confidence to tackle difficult problems but cause a lack of engagement with maths due to ongoing issues and anxieties. Previous research has looked into the relationship between maths attitudes, anxiety, self-efficacy and achievement (Mata et al., 2012; Putwain & Wood, 2023; Zakariya, 2022). This means that both attitudes and achievement are separate outcomes and cannot completely be attributed to one factor.

In Pakistan primary mathematics is taught in a variety of settings. There may be a difference in resources between public and private schools, urban and rural areas. The way it is taught can depend on the teacher, the relationships in the class and the support given by the parents. Knowing this helps teachers determine what the needs of these pupils are and adapt their teaching methods.

Mathematics is taught in various ways at the primary level in Pakistan. This can vary between public and private schools and urban and rural areas. It can also depend on the teacher, relationships within the classroom and how much support they get from the parents. Knowing this helps teachers identify the needs of these students and change their teaching styles. Mathematics attitudes and achievement, perceived teacher support and school context)

This study investigated attitudes towards mathematics in primary school students across both public and private schools in urban and rural areas. The investigation explored affective, cognitive and behavioural aspects of attitudes towards mathematics in relation to grade, gender, where the student attended school, teacher support and mathematics achievement.

2. Research Questions

The purpose of this study was to investigate the attitudes toward mathematics held by primary school students and how they relate to student characteristics, the school environment, perceptions of teacher support and achievement.

Research Questions

1. What are students' attitudes toward mathematics (Affective, Cognitive and Behavioural) in Grades 3-5?
2. Are there significant differences in students' attitudes toward mathematics based on grade level, gender, and school type and school location?
3. How do students' attitudes toward mathematics relate to perceptions of teacher support and mathematics achievement?
4. To what extent can mathematics achievement be predicted by school type, perceptions of teacher support, attitudes toward mathematics, and other variables?

3. Methodology

3.1 Research design

This study was designed using a quantitative cross-sectional survey approach. This enabled the researchers to determine students' attitudes towards mathematics and how they relate to particular demographic, school related and academic variables at one point in time.

3.2 Participants and sampling

The research employed a quantitative cross-sectional survey design. A sample of 781 students (Grade 3-5) from both public and private schools were included in the analysis. Participants came from urban and rural areas of Pakistan. A stratified cluster sampling method was used.

In the manuscript please clarify what districts and schools were included in this study. Describe how participants were selected. Please report how many participants were in each grade, gender, school type and area. Also clarify why there is a

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discrepancy between the total population (600) mentioned above and the final sample (781).

3.3 Research instrument

A translated version of the Attitudes towards Mathematics Inventory (ATMI) was used to assess student attitudes towards mathematics as measured on an affective, cognitive and behavioural scale. This was translated into Urdu and adapted to meet the needs of the study. A pilot study was conducted with 30 students from primary schools to check the clarity and appropriateness of the items.

The final manuscript should indicate how many items were used. How many response choices were given? What was the scoring system? How was it translated and adapted? Was it a full version (40 items) or shortened version of the original ATMI?

3.4 Data analysis

Descriptive statistics were conducted to summarize study variables. One way ANOVA was used to explore differences between grade levels, independent samples t-tests were used to compare differences between groups, and Pearson correlation were carried out to explore relationships between the study variables were included and multiple linear regression was performed to examine factors associated with mathematics achievement.

The statistical package used, any missing data techniques, testing of assumptions and handling of school level clustering should be mentioned in your final submission.

4. Results

4.1 Descriptive statistics

Table 1 presents the descriptive statistics for the three dimensions of mathematics attitudes, perceived teacher support, and overall mathematics attitudes.

Table 1. Descriptive statistics for the main study variables

Variable	N	Mean	SD	Min	Max
Affective attitudes	781	2.66	0.46	1.33	3.33
Cognitive attitudes	781	2.98	0.55	1.33	3.67
Behavioural attitudes	781	2.82	0.44	1.67	3.44
Teacher support	781	4.34	0.96	0.00	5.00
Overall mathematics attitudes	781	3.18	0.47	1.50	3.83

The students' mean attitude towards mathematics was 3.18 (SD = SD = 0.47). The cognitive attitude had the highest mean rating (M = M = 2.98, SD = SD = 0.55); this was followed by behavioural attitude (M = M = 2.82, SD = SD = 0.44) and affective attitude (M = M = 2.66, SD = SD = 0.46). The students' mean perception of teacher support was 4.34 (SD = SD = 0.96).

These results indicate that the students have moderately positive attitudes towards mathematics and perceive the teacher to provide a relatively high level of support. To interpret the actual values of the means we need to consider the scale used for responses and whether higher scores indicated a more positive attitude.

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4.2 Reliability and construct validity

The table 2 Reported internal consistency estimates.

Table 2. Reliability of the study instruments

Scale	Cronbach's alpha
Overall mathematics attitudes	0.890
Teacher support	0.906
Cognitive attitudes subscale	0.459

The overall attitude scale demonstrated good internal consistency, with both Cronbach's alpha and McDonald's omega reported as .89. The teacher support scale also showed high internal consistency. However, the cognitive subscale had a low alpha of .459, raising concerns about the consistency of its items.

The table 3 summarizes the reported confirmatory factor analysis results.

Table 3. Confirmatory factor analysis model fit

Fit index	Reported value
Chi square	1368
Degrees of freedom	246
Model significance	$p < .001$
Comparative Fit Index (CFI)	0.86
Tucker Lewis Index (TLI)	0.84
Standardised Root Mean Square Residual (SRMR)	0.06
Root Mean Square Error of Approximation (RMSEA)	0.07
Reported RMSEA confidence interval	0.07 to 0.08

The confirmatory factor analysis produced a CFI of .86, TLI of .84, SRMR of .06, and RMSEA of .07, with a reported confidence interval of .07 to .08. These results provide partial support for the proposed factor structure rather than unequivocal evidence of construct validity. The confidence interval level and all model fit statistics should be checked against the original output.

Table 4. Differences in mathematics attitudes and teacher support by grade level

Variable	F	df between	df within	p
Affective attitudes	19.51	2	515	< .001
Cognitive attitudes	8.67	2	517	< .001
Behavioural attitudes	11.24	2	518	< .001
Teacher support	35.04	2	434	< .001
Overall mathematics attitudes	30.23	2	497	< .001

4.3 Differences across grade levels

A one way analysis of variance examined differences in mathematics attitudes and perceived teacher support across Grades 3, 4, and 5.

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There were statistically significant differences between the different grade levels on all 5 variables. Overall the means for attitudes were 3.44 (Grade 3), 3.08 (Grade 4) and 3.04 (Grade 5). This shows that students in Grade 3 had more positive attitudes towards mathematics compared to Grades 4 and 5.

Therefore there appears to be a difference in attitudes towards mathematics between the three grades. However, this is a cross-sectional study so we cannot infer that individual's attitudes to mathematics decrease as they progress through school. The authors should give full results of the post-hoc tests including the mean differences, confidence intervals and adjusted p-value.

4.4 Differences by gender and school location

The independent samples t test revealed that there was no significant difference between males and females in their general attitude towards maths (p=.511). This therefore provides no evidence that there is a difference in attitude between males and females within this sample. See Table 5 below:

Table 5. Differences in mathematics attitudes between urban and rural students

Variable	t	df	p
Affective attitudes	−0.173	779	.863
Cognitive attitudes	4.058	779	< .001
Behavioural attitudes	3.402	779	< .001
Teacher support	1.402	779	.161
Overall mathematics attitudes	2.473	779	.014

The overall average attitude scores in urban schools (M=M = 3.22), SD=SD = 0.45) were higher than those in rural schools (M=M = 3.12), SD=SD = 0.49) There was a significant difference in cognitive and behavioural attitudes, but not in affective attitudes or perception of teacher support.

This suggests that there are differences in some aspects of attitudes towards mathematics between urban and rural schools. However, the study does not identify any factors within the school or community that may account for this.

4.5 Relationships between attitudes, teacher support, and achievement

Pearson correlation analysis examined the relationships between mathematics attitudes, perceived teacher support, and mathematics achievement.

Table 6. Correlations between the study variables and mathematics achievement

Variable	Correlation with achievement	p
Overall mathematics attitudes	.224	< .001
Teacher support	.320	< .001

Mathematics attitudes were positively associated with achievement (r = .224, p less than .001), as was perceived teacher support (r = .320, p less than .001), according to the detailed results. Students with more positive attitudes and greater perceived teacher support tended to have higher achievement scores. These associations do not establish causation.

4.6 Predictors of mathematics achievement

Multiple linear regression was used to examine the factors associated with mathematics achievement.

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The reported model explained 18.1% of the variance in achievement.

Table 7. Summary of the multiple regression model

Model statistic	Reported value
R squared	.181
Variance explained	18.1%
Overall model	Statistically significant

Table 8. Reported regression coefficients for mathematics achievement

Predictor	Standardised coefficient, β	p
School type	−0.506	< .001
Teacher support	0.270	< .001
Behavioural attitudes	−0.133	.009
Affective attitudes	Not supplied	Not significant
Cognitive attitudes	Not supplied	Not significant

Results from the regression analysis indicate that perceived teacher support had a positive relationship with mathematics achievement. School type was a significant factor however, we cannot infer the direction of the relationship without knowing whether the coding was correct and which category was the reference variable. The negative relationship between behaviour attitudes and achievement needs to be explored further and cannot be assumed to be because positive attitudes decrease achievement. The negative relationship between extra tuition and achievement could imply that students have academic problems already.

5. Discussion

This study investigated mathematics attitudes within primary schools and how they are influenced by year group, school setting, perceived teacher support and achievement. Results showed that attitudes varied between year groups, urban students had more positive attitudes towards mathematics and there was no statistical difference in attitudes between genders. There was a positive correlation between mathematics attitudes, teacher support and achievement.

5.1 Grade Level Differences

Students in Grade 3 had more positive attitudes towards mathematics overall when compared to students in Grades 4 and 5. This could be explained by increasing cognitive demands and different classroom experiences, however this was not directly investigated. The cross-sectional design of this study means we are unable to determine if the attitude of individual students decreases as they progress through school. Longitudinal studies could investigate this.

5.2 Teacher Support and Achievement

Perceived teacher support was relatively high and positively associated with achievement. This finding highlights the value of examining students' classroom experiences alongside academic outcomes. However, the study did not identify which forms of support were most influential or establish a causal effect. Future research could distinguish instructional support, feedback, and emotional encouragement.

5.3 School Location and Gender

Students at an urban school had more positive attitudes towards mathematics overall than those

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of a rural school. This could be due to differences in resources, teaching techniques, parental support and opportunities for learning. However, there was no statistically significant difference between genders so we cannot conclude that there is no difference in overall attitude towards mathematics based on gender in other situations.

5.4 Mathematics Attitudes and Achievement

However, there is still a large amount of unexplained variance (Model Explained Variance = 18.1%). There may be other factors contributing to student achievement such as prior knowledge, attendance, and quality of teaching and learning opportunities.

The negative regression coefficient for behaviour attitudes should be handled with caution. This does not indicate that having positive behavioural attitudes will decrease levels of achievement, without checking how they are coded for, the model used and the results.

6. Discussion, Implications and Conclusion

This suggests that different year groups have different attitudes towards mathematics. Year 3 pupils held more positive attitudes than those in Year 4 and 5. Urban pupils also held slightly more positive attitudes than rural pupils. The results also show that having a positive attitude towards mathematics plus the belief that teachers provide support leads to higher achievement levels. However due to the cross sectional design of this research we cannot determine any cause effect relationships or why these differences occur. This demonstrates how important it is to create an encouraging teaching environment where explanations are clear, feedback is useful and problem solving can take place. Considering the experiences of children in Years 4 and 5 and the differences in learning environments between schools highlights areas that could be supported within teaching. The results showed poor reliability and only partial validation of the measurement structure using the factor analysis. In addition statistical discrepancies need further investigation using the raw data. The instrument should be validated in future research, additional detail on the statistical analysis should be given and the attitudes and achievement of students should be studied in a wider variety of schools.

These results should be taken with caution as the cognitive attitudes sub-scale

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