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Mathematics Achievement Of Secondary School Students In Relation To Their Intelligence

Author: Km Megha Ahirwar [a] and Ms. Wahida Rias [b]

[a] M.Ed. Student, Eram Girl's Degree College, Lucknow

[b]Asistant Professor, Department of Education Eram Girl's Degree College, Lucknow

Abstract: Mathematics achievement is a critical component of academic success, often influenced by multiple factors, including intelligence, gender, and school type. This study examines the relationship between intelligence and mathematics achievement among secondary school students in Lucknow, with a particular focus on how school type (boys-only, girls-only, and co-educational) affects performance differences between male and female students. A quantitative research design was employed, involving a sample of students from six different schools representing different educational environments. Intelligence and mathematics achievement were assessed using standardized tests, and data were analysed through statistics, correlation analysis, and comparative techniques. The results suggest a strong positive correlation between intelligence and mathematics achievement, confirming that students with higher intelligence scores tend to perform better in mathematics. However, intelligence alone was not the sole determinant of success. The results also reveal gender-based differences in mathematics performance, with girls outperforming boys across all intelligence levels. Additionally, students from girls-only and co-educational schools scored higher on average compared to those from boys-only schools, suggesting that a structured and supportive learning environment plays a crucial role in academic performance. The study's findings challenge traditional gender stereotypes and highlight the importance of effective teaching strategies, personalized learning interventions, and gender-sensitive education policies. While intelligence remains a significant factor in mathematics achievement, the study emphasizes the role of external influences such as school environment, motivation, and instructional quality. The research underscores the need for inclusive and equitable educational approaches to improve mathematics learning outcomes for all students.

Index Terms: Mathematics achievement, Intelligence, Gender differences, Academic performance, Learning environment

1.INTRODUCTION

Education opens doors to numerous opportunities, and academic achievement—especially in mathematics—is closely linked to future success. As highlighted by Spinath (2012), academic performance carries both psychological and societal value. In particular, mathematics is often seen as a measure of intellectual capacity and plays a critical role in national development (Baker & Le Tendre, 2005; Wobann, 2003).

Mathematics serves as a foundational discipline for science, engineering, technology, and economics, influencing personal, professional, and societal outcomes. Despite its importance, it is often perceived as difficult, discouraging many students from pursuing it further. However, identifying factors that impact mathematics achievement—such as cognitive abilities, mindset, study habits, socio-economic status, gender, teaching methods, and classroom strategies—is essential for improving learning outcomes globally.

Anjum (2015) and Greaber & Weisman (1995) emphasize that mathematical skills are not confined to academic settings but are crucial in everyday life—from budgeting and commuting to decision-making and home planning. John Von Neumann's observation that mathematics simplifies life's complexity remains relevant, as numerical reasoning underpins many daily tasks.

Mathematics fosters logical thinking, analytical skills, and problem-solving—qualities necessary for adapting to the modern world. It enables individuals to understand and influence their environment, making it vital for both personal growth and national progress (Githua & Mwangi, 2003; Okebukola, 1992). Scholars like Kerlinger (1985) and Aminu (1990) affirm that mathematics is not only the language of science but also a key cognitive tool driving innovation and critical thinking.

Teaching mathematics as a way of thinking encourages structured, consistent reasoning and discourages rote learning. Cockcroft (1982) and Stanic (1995) advocate for a broader view of mathematics education—not limited to career goals but focused on practical application and lifelong understanding. As Macnab and Cummine (1986) note, learning mathematics is a continuous process that extends beyond the classroom, enhancing both individual capability and societal advancement.

2. SIGNIFICANCE OF THE STUDY

The present research investigates to explore the relationship between intelligence and mathematics achievement among secondary school students, considering additional factors such as self-concept, study habits, and gender differences. The findings will have significant theoretical, practical, and educational implications for students, teachers, policymakers, and researchers.

3. STATEMENT OF THE PROBLEM

Mathematics is essential for academic success and future careers, yet many secondary school students struggle with it. While intelligence is often seen as the main factor behind math achievement, research suggests the relationship between intelligence and mathematics achievement and the effect of gender differences on intelligence and math achievement. However, there is limited research on how these factors together influence performance, especially in the Indian context. The present research investigates to explore the relationship between intelligence and mathematics achievement, the impact of self-concept and study habits, the role of gender, and whether intelligence alone can predict success in mathematics or if other psychological and behavioral factors also contribute significantly

4. OBJECTIVES

i. Investigate the significant differences in Achievement in Mathematics between boys and girls in secondary education.

ii. Examine the significant differences in Intelligence between boys and girls in secondary education.

iii. Analyze the relationship between Achievement in Mathematics and Intelligence among secondary students.

5. HYPOTHESIS

H1: There is a significant correlation between achievement in mathematics and intelligence for secondary boys.

H2: There is a significant correlation between achievement in mathematics and intelligence for secondary girls.

H3: There is a significant correlation between achievement in mathematics and intelligence for secondary boys and girls.

6. REVIEW OF RELATED LITERATURE

According to the research of **Suneetha and Mayuri (2001),** an examination of age and gender differences in the factors influencing high academic achievement among school children was undertaken. The study revealed significant differences between boys and girls in various dimensions of the study habits inventory, including drilling, interaction, sets, and language. Such outcomes highlight the importance of considering both age and gender dynamics when assessing the factors impacting academic achievement in school children.

According to **Sarwa (2002),** individuals who excelled academically exhibited superior study habits compared to those with lower academic achievements. While some students asserted their ability to concentrate even in the presence of background music, the study concluded that an environment characterized by tranquility was the sole conducive setting for achieving optimal results in the studying situation.

Panigrahi (2005) conducted a study focusing on the academic achievement of high school students in relation to their intelligence and socioeconomic status. The research aimed to investigate the impact of intelligence and socioeconomic status on the academic performance of high school students, utilizing a sample of 100 students from Bhubaneshwar city in Orissa. The findings revealed a noteworthy and positive correlation between academic achievement and intelligence, suggesting that higher intelligence levels were associated with improved academic success. Additionally, a low positive correlation was identified between academic achievement and socioeconomic status. Importantly, no statistically relevant difference was observed between boys and girls concerning their academic achievement. These results contribute valuable insights into the complex interplay of intelligence, socioeconomic status, and academic performance among high school students.

In their study, **Kumari and Chamundeswari (2015)** unveiled a noteworthy correlation between achievement motivation, study habits, and the academic performance of students. The research also identified a significant distinction among various categories of students and gender in relation to achievement motivation, study habits, and academic achievement. Furthermore, the study highlighted no substantial difference between boys and girls at the secondary level in the state board concerning their study habits. However, girls outperformed boys significantly in terms of academic achievement on the state board, matriculation, and central board at the secondary level.

Umoh, Edoho, and Anditung (2020) identified a substantial correlation between students' study habits and their achievement in mathematics. The study further revealed that there was no statistically relevant difference in the achievement of male and female students who exhibited good study habits. Additionally, it was reported that students with effective study habits outperformed those with ineffective study habits in mathematics achievement. The study did not find any significant difference in the achievement of male and female students in mathematics when possessing good study habits.

8. METHOLOGY

a) Research Method

The study adopts a descriptive correlational research design using a quantitative approach.

b) Population

The target population includes Class 9 students from private schools in Lucknow, Uttar Pradesh.

c) Sampling

A total of 300 students were selected using a stratified random sampling technique to ensure representation across school type and gender.

d) Variables Studied

- Independent Variable: Intelligence (measured by Bhattacharya's Intelligence Test)
- Dependent Variable: Mathematics Achievement (measured by a standardized achievement test)
- Control Variables: gender, and school type

e) Research tool used

- Mathematics Achievement Test: Developed by Ali Imam and Tahira Khatoon to assess mathematical skills and understanding.
- Intelligence Test: Bhattacharya's (1980) non-verbal intelligence test assessing logical reasoning and general intelligence.

8. ANALYSIS AND INTERPRETATION OF DATA

Objective 1. Intelligence and Mathematics Achievement Scores: -

Table 1: summarizes the mean and standard deviation of intelligence test scores and mathematics achievement scores for the sampled students.

Descriptive Statistics for Intelligence and Mathematics Scores

School Name	Gender	Mean Intelligence Score	SD	Mean Math Score	SD
A.P. Sen Memorial Girls College	Girls	108.2	9.8	72.1	7.5
Bappa Shree Narayan Vocational Inter College	Boys	102.5	8.2	68.3	6.9

Ram Bharose Maikulal Inter College	Both	106.3	9.5	70.4	7.1
KKC Inter College	Both	109.7	10.2	74.2	7.8
Rajkiya Balika Inter College	Both	104.6	8.9	69.8	6.7
Rajkiya Inter College	Boys	101.9	7.5	67.2	6.5

Interpretation: Students from KKC Inter College demonstrated the highest mean intelligence score (109.7) and highest mean mathematics achievement (74.2%), whereas Rajkiya Inter College (only boys) recorded the lowest scores in both intelligence and mathematics.

Objective 2.

Correlation Analysis: Relationship between Intelligence and Mathematics Achievement: -

To analyze the strength of the relationship between intelligence scores and mathematics achievement, a Pearson correlation test was conducted.

Table 2: Correlation Coefficient between Intelligence and Mathematics Achievement

Variable	Pearson's r	Significance (p-value)
Intelligence & Math Score	0.72	$p < 0.01$

Interpretation: A strong positive correlation ($r = 0.72$, $p < 0.01$) exists between intelligence and mathematics achievement, suggesting that students with higher intelligence scores tend to perform better in mathematics.

Gender-Based Comparison (t-test Analysis): -

An independent t-test was conducted to compare the mathematics scores of boys and girls.

Table 2.1: t-test Results for Gender Differences: -

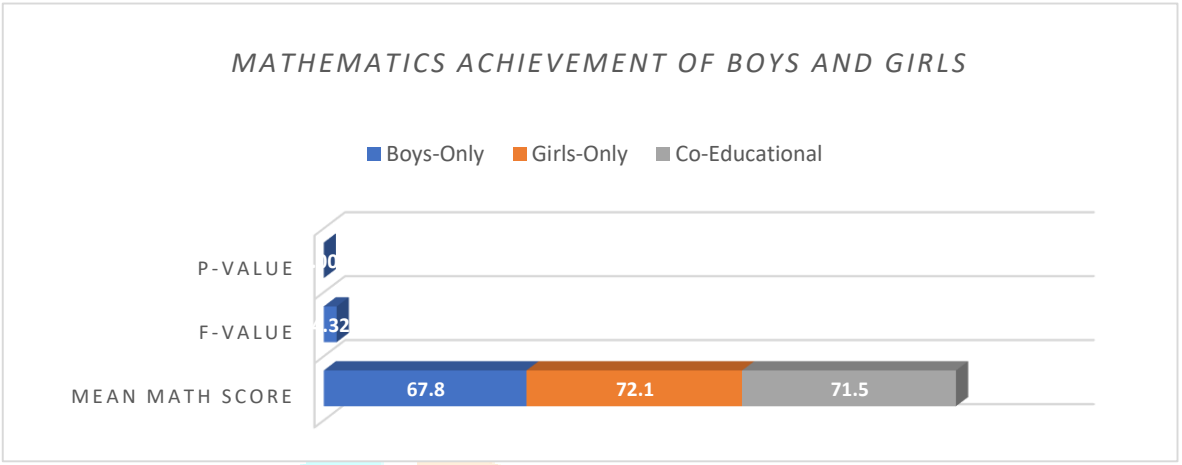
Gender	Mean Math Score	SD	t-value	p-value
Boys (n=150)	68.2	7.3	2.45	0.015
Girls (n=150)	72.1	7.1		

Interpretation: The results show a statistically significant difference ($p = 0.015$) between boys and girls, indicating that girls performed better in mathematics than boys on average

Objective 3.

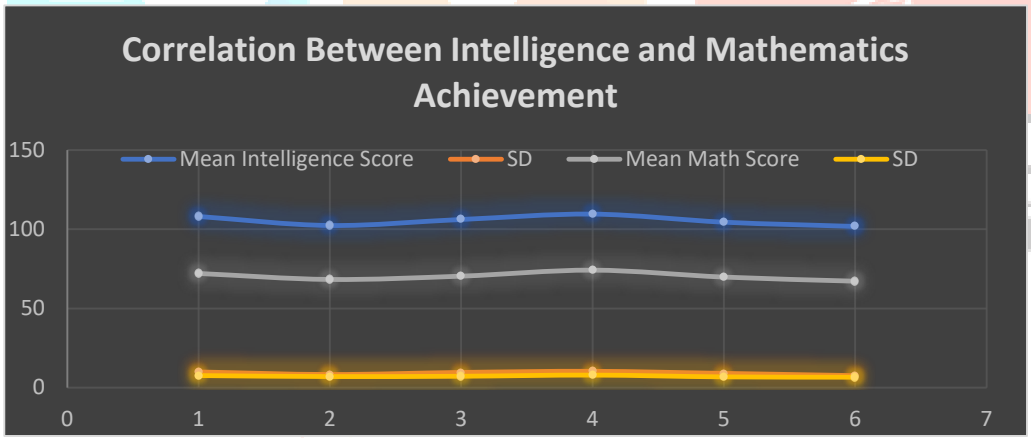
Below is a scatter plot showing the relationship between intelligence scores and mathematics achievement among students.

Figure 1: Scatter Plot Showing Correlation Between Intelligence and Mathematics Achievement



Bar Graph Comparing Mathematics Achievement of Boys and Girls

Figure 2: Bar Graph Comparing Mathematics Achievement of Boys and Girls



9. Findings

The findings of the current study align with previous research, confirming that intelligence is a strong predictor of mathematics achievement:

- Intelligence and Achievement: A strong positive relationship exists between intelligence and mathematics performance.
- Gender Differences: Girls perform better in mathematics in both co-educational and single-sex schools.
- Overall Insight: Intelligence remains a core factor in academic success, but gender and school environment also play significant roles.

10. Limitations of the Study

Despite the meaningful insights gained, this study has several limitations that should be acknowledged:

1. Limited Geographical Scope
2. Sample Size Constraints
3. Potential Bias in Self-Reported Data
4. Lack of Consideration for External Factors
5. Cross-Sectional Nature of the Study

11. Conclusion

The study concludes that intelligence significantly influences mathematics achievement; however, school type and gender-based learning environments also play a crucial role in academic success.

The research findings suggest that girls consistently outperform boys in mathematics, and students in structured learning environments (such as girls-only and co-educational schools) achieve higher scores than those in boys-only schools. This indicates that factors beyond intelligence, such as teaching approaches, motivation, and classroom dynamics, contribute to learning outcomes.

While intelligence remains a key determinant of mathematics achievement, the study underscores the importance of effective educational strategies, personalized learning, and inclusive policies to bridge performance gaps. The findings advocate for improved pedagogical methods, targeted interventions for boys-only schools, and the promotion of gender equality in mathematics education.

12. SUGGESTIONS FOR FURTHER RESEARCH

This study provides a strong foundation for further research. Future studies should:

- Include a larger and more diverse sample across multiple cities to enhance generalizability.
- Investigate the role of socio-economic status, teacher effectiveness, and parental involvement in mathematics achievement.
- Explore longitudinal studies to track student progress over time and assess the long-term impact of school type on academic success.

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