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An Experimental Study and Analysis on Performance of Students in Mathematics in Schools of NCR Delhi

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Abstract

The present study explores the achievement levels of students in mathematics in Delhi schools and examines how their performance varies according to gender, age, school type and locality. The study used a Mathematics Achievement Test (MAT) developed and validated by the researcher. The test was administered to 480 students studying in middle schools from both government and private institutions across urban and rural areas of Delhi. The data were analyzed using descriptive statistics, *t*-tests, and one-way ANOVA. The results revealed that the overall level of achievement in mathematics was moderate, with only a small percentage of students demonstrating high achievement. Gender-wise comparison showed that there was no significant difference in mathematics achievement of students and boys and girls performed equally well. Students from private schools scored higher than those from government schools. However, age-wise and locality-wise differences were statistically insignificant. The findings highlight the need to strengthen mathematical reasoning, practical problem-solving and concept-building practices in schools through improved pedagogy and individualized learning support.

Keywords: Mathematics achievement, students' achievement, gender differences, school type, urban–rural divide, Delhi schools.

1. Introduction

Mathematics forms the foundation of logical thinking, problem-solving and everyday decision-making. The achievement of students in mathematics not only reflects their understanding of the subject but also the quality of teaching and learning processes within schools. Globally, improving mathematics performance remains a key educational priority (OECD, 2020).

In India, several studies and national assessments, including NAS (2021) and PISA frameworks, have pointed out wide disparities in students' mathematical achievement levels (NCERT, 2023; Singh & Kumar, 2022). Factors such as teaching quality, students' attitudes, parental involvement and school environment play crucial roles in shaping outcomes (Sharma & Sharma, 2022).

In Delhi, where schools vary widely in resources and student demographics, examining students' mathematical achievement provides valuable insights for policymakers, educators and curriculum designers. Studies have shown that factors such as gender, socio-economic background, school type and locality can shape learning opportunities and achievement (Singh et al., 2023; Wilkins, 2022). Aligned with NEP 2020's emphasis on competency-based and conceptual learning, the present research investigates mathematics achievement at the middle school level in Delhi. This provides a data-based picture of students' performance and helps identify priority areas for instructional improvement. It aims to measure students' achievement levels and analyze how they differ according to gender, age, school type and locality.

2. Need and Significance of the Study

Mathematics is often perceived as a challenging subject by students and low achievement levels in mathematics continue to be a concern in Indian schools (Kumar, 2023). Understanding the factors influencing mathematics achievement helps educators design strategies that promote both cognitive and affective growth. Mathematics is one of the core subjects influencing students' academic confidence and future career pathways. Yet, national reports repeatedly highlight concerns related to students' proficiency levels (NCERT, 2023; NAS, 2021). Many students find mathematics difficult due to gaps in conceptual understanding, limited exposure to hands-on learning, and inconsistencies in teaching practices (Kumar, 2023; Sharma & Sharma, 2022).

Research also shows that gender and school background sometimes influence achievement, although recent studies reveal that these differences may be narrowing when learning environments are equitable (Singh et al., 2023; Wilkins, 2022). Students in private and urban schools often benefit from better access to resources, technology, and trained teachers (OECD, 2023).

Understanding the current status of mathematics achievement in Delhi is particularly important because the city represents a diverse educational ecosystem. Such insights can help educators strengthen teaching methods, support low achievers and align learning practices with NEP 2020's vision of foundational numeracy, competency-based evaluation and inclusive education.

The study is significant in the following ways:

- It can help understand how well students are actually performing in mathematics, beyond exam marks or school reports.
- By comparing achievement across gender, age, school type and locality, it can help identify where learning gaps exist and who needs extra help.
- The findings can help in highlighting areas of mathematics where students struggle and guiding teachers to focus more on those topics.
- The study can help find out whether mathematics achievement in students differs with respect to gender, age, type of school and locality.
- The dimension-wise analysis (Number System, Algebra, Geometry, Data Handling) can provide curriculum experts a clear direction on where to enrich content or provide remedial support.
- School administrators and policymakers can use these findings to design teacher training programmes, allocate resources and set academic priorities.
- The study supports the national focus on competency-based learning, strengthening foundational numeracy and reducing learning gaps.

3. Objectives of the Study

To understand the patterns of mathematics achievement among middle-school students, this study was undertaken with the following objectives:

- To study the level of achievement of students in mathematics.
- To compare male and female students' achievement in mathematics.
- To compare achievement according to different age groups of students.
- To compare mathematical achievement according to type of school (government and private).
- To compare achievement with respect to locality of school (rural and urban).

4. Hypotheses

H□1: There is no significant difference in mathematics achievement with respect to gender.
H□2: There is no significant difference in mathematics achievement with respect to age.
H□3: There is no significant difference in mathematics achievement with respect to type of school.
H□4: There is no significant difference in mathematics achievement with respect to locality of school.

5. Methodology

5.1 Research Design

A **quantitative research design** was adopted for this study, as it focuses on collecting and analysing numerical data related to students' mathematics achievement. The **survey method** was used because it is the most suitable approach for studying large groups, identifying patterns and comparing the performance of different categories of students. This method allowed the researcher to administer standardised tool, gather structured responses and statistically examine differences across gender, age, school

type and locality. Quantitative survey designs are widely recommended in educational achievement studies as they help establish measurable trends and provide objective evidence for comparisons (Creswell, 2021; OECD, 2023).

5.2 Population and Sample of the Study

The population comprised all middle-school students in Delhi's government and private schools. A sample of 480 middle-school students was selected by adopting the Simple Random Sampling Technique. The sample included 320 government school students and 160 private school students, thereby reflecting a balanced representation.

5.3 Tool: Mathematics Achievement Test (MAT)

A Mathematics Achievement Test (MAT) was developed by the researcher, covering four key domains from the middle-school curriculum, such as Number System, Algebra, Geometry and Data Handling. The test comprised 28 multiple-choice questions with a maximum score of 28. The test demonstrated high content validity and a reliability coefficient of 0.74 (Cronbach's Alpha).

5.4 Data Collection Procedure

The MAT was administered to **480 students** from government and private schools located in both urban and rural areas of Dehi. Scores were compiled and analysed using mean, SD, *t*-test and ANOVA.

6. Results

6.1 Descriptive Statistics and Level of Achievement

6.1(a) Descriptive Statistics of Test Scores

The descriptive statistics of students' scores on the Mathematics Achievement Test (MAT) are presented in Table 6.1(a).

Table 6.1(a): Descriptive Statistics of Students' Test Scores

S. No	Name of the statistics	Score
1	N	480
2	Minimum	7
3	Maximum	28
4	Range	21
5	Mean	18.63
6	Standard Deviation	4.78
7	Variance	22.90
8	Skewness	-0.108
9	Kurtosis	-0.653

As shown in Table 6.1(a), the mean score of the students is 18.63, with a standard deviation of 4.78 and a variance of 22.90, based on a sample size of N = 480. The range of scores is 21, with the lowest score being 7 and the highest score being 28. The skewness value of -0.108 indicates a slight negative skew, suggesting that the distribution of scores is nearly symmetrical but with a small tail towards the lower end. The kurtosis value of -0.653 suggests distribution is with fewer extreme scores**.**

6.1(b) Descriptive Statistics of Different Dimensions of Mathematics Achievement

In addition to the overall achievement scores, the Mathematics Achievement Test (MAT) also assessed students' performance across specific content dimensions: Number System, Algebra, Geometry, and Data Handling. Table 6.1(b) presents the Mean and Standard Deviation (SD) for each of these dimensions.

Table 6.1(b): Mean and Standard Deviation for Different Dimensions of Mathematics Achievement

Dimensions	N	Mean	Std. Deviation
Number System	480	5.4125	2.19523
Algebra	480	3.4729	1.47890
Geometry	480	5.5000	1.84922
Data Handling	480	4.2458	1.45997

As shown in Table 6.1(b), students scored the highest on the Geometry dimension (Mean = 5.50, SD = 1.85), followed closely by the Number System (Mean = 5.41, SD = 2.20). The lowest mean score was observed in Algebra (Mean = 3.47, SD = 1.48), indicating that this area may be more challenging for students. The Data Handling dimension showed a moderate mean score of 4.25 with relatively low variability (SD = 1.46). These results suggest varying levels of student proficiency across different mathematical content areas, which may inform targeted instructional interventions or curriculum design.

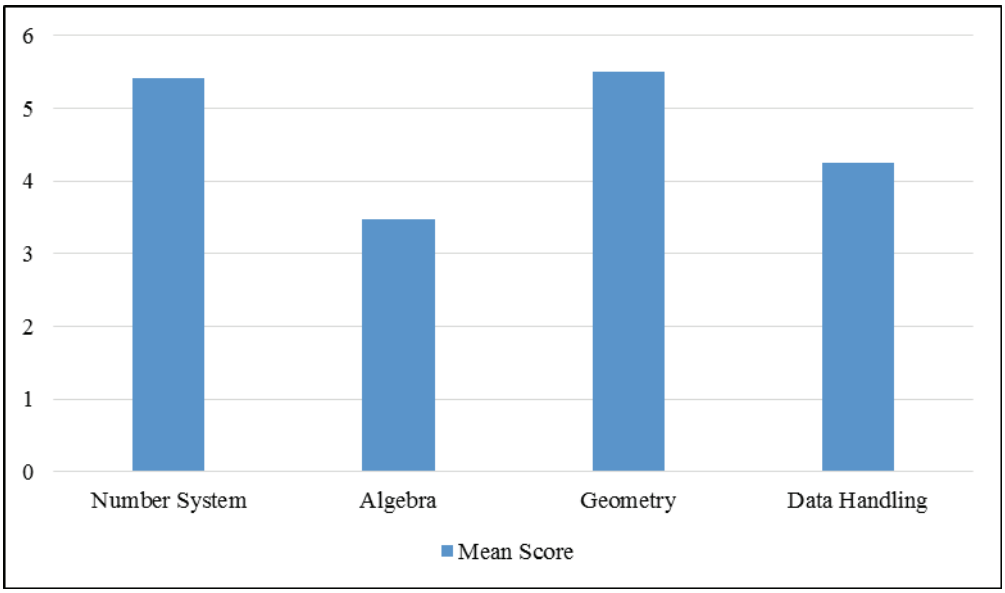

Figure 6.1(b): Different Dimensions of Mathematics Achievement

6.1(c) Level of Students' Achievement

To understand the distribution of student performance on the Mathematics Achievement Test (MAT), students' total scores were categorized into three achievement levels based on the Normal Probability Curve (NPC). Using the descriptive statistics Mean = 18.63 and Standard Deviation = 4.78 three groups were defined as Low-Level Achievement Group: Students scoring from the minimum score (7) to Mean - 1 SD (approximately 14); Moderate-Level Achievement Group: Students scoring between Mean - 1 SD (14) and Mean + 1 SD (approximately 23) and High-Level Achievement Group: Students scoring from Mean + 1 SD (23) to the maximum score (28). The categorization is presented in the table 6.1 (c) below.

Table 4.2.1(c): Distribution of Students Across Different Achievement Levels

Level	Score Range	Frequency	Percent
Low	7 to 14	105	21.9
Moderate	14 to 23	265	55.2
High	23 to 28	110	22.9

The table indicates that 55.2% of the students fall within the moderate achievement group, while 21.9% belong to the low achievement group, and 22.9% fall under the high achievement group. This distribution reflects a generally normal trend in student achievement, with the majority of students performing around the mean, and equal proportions performing at the lower and higher ends of the score spectrum. See figure 6.1(c)

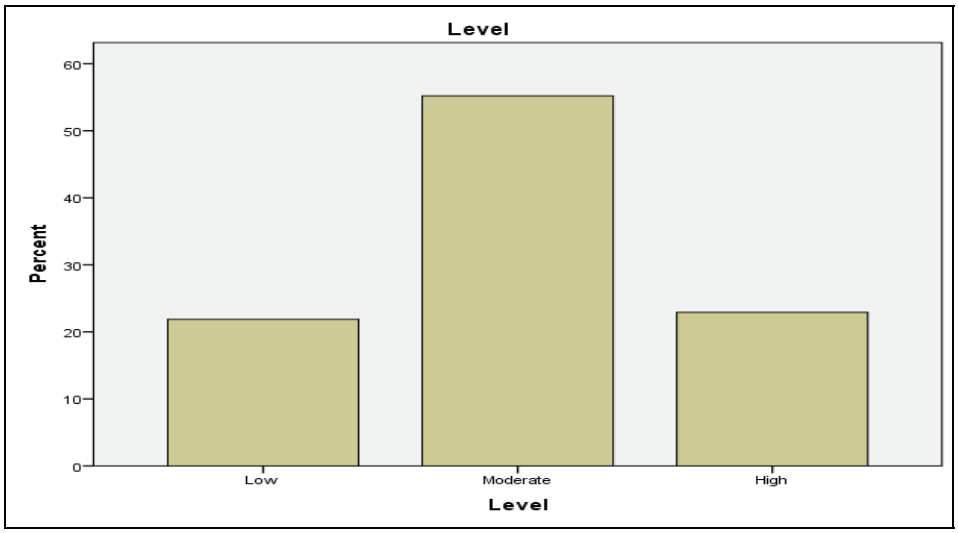

Figure 6.1(c): Distribution of Students across Different Achievement Levels

6.2 Gender and Students' Mathematics Achievement

To study gender-based differences in students' mathematics achievement, a comparative analysis was conducted between male and female students across different dimensions of the *Mathematics Achievement Test (MAT)*. For this purpose, a set of null hypotheses were formulated to statistically test the significance of observed differences.

Null Hypotheses

H□ 6.2(i) **:** There is no significant difference in students' achievement in Number System with respect to gender.

H□ 6.2(ii) **:** There is no significant difference in students' achievement in Algebra with respect to gender.

H□ 6.2(iii) **:** There is no significant difference in students' achievement in Geometry with respect to gender.

H□ 6.2(iv) **:** There is no significant difference in students' achievement in Data Handling with respect to gender.

H□ 6.2(v) **:** There is no significant difference in the overall mathematics achievement of students with respect to gender.

These hypotheses were tested using t-test for independent samples and the findings are presented in Table-6.2.

Table 6.2: Shows mean, SD and 't' values on Dimension wise Students Math Achievement with respect to their gender

Dimension	Gender	N	Mean	Std. Deviation	t-value	p-value
Number System	Male	304	5.4112	2.32052	-.017#	.986
	Female	176	5.4148	1.96646		
Algebra	Male	304	3.4441	1.45454	-.561#	.575
	Female	176	3.5227	1.52298		
Geometry	Male	304	5.5362	1.83440	.563#	.574
	Female	176	5.4375	1.87816		
Data Handling	Male	304	4.2664	1.49523	.406#	.685
	Female	176	4.2102	1.40045		
Total	Male	304	18.6579	4.81006	.160#	.873
	Female	176	18.5852	4.75618		

Not significant

The results of the independent samples *t*-test presented in Table-6.2 reveal that there is no statistically significant difference between male and female students in their mathematics achievement across all dimensions of the Mathematics Achievement Test (MAT), as well as in their overall scores.

In the Number System dimension, the mean scores for male (M = 5.41) and female (M = 5.41) students are nearly identical, with a *t*-value of -0.017 and a *p*-value of .986, indicating no significant difference. Similarly, in the Algebra dimension, male students scored a mean of 3.44 compared to 3.52 for female students, but the difference was not statistically significant (t = -0.561, p = .575). For the Geometry dimension, male students had a slightly higher mean (M = 5.54) than female students (M = 5.44), yet the difference again was not significant (t = 0.563, p = .574).

In the Data Handling dimension, male students scored a mean of 4.27, and female students scored 4.21. The *t*-test yielded a value of 0.406 with a *p*-value of .685, showing no significant difference. Finally, when comparing the overall mathematics achievement scores, male students had a mean of 18.66 and female students had a mean of 18.59. The *t*-value of 0.160 and *p*-value of .873 further confirmed the absence of a statistically significant gender difference. Based on these findings, it can be concluded that gender does not play a significant role in determining students' achievement in mathematics, either in specific content areas or in overall performance. This supports the view that both male and female students have similar

levels of proficiency in mathematics when exposed to comparable learning environments and opportunities.

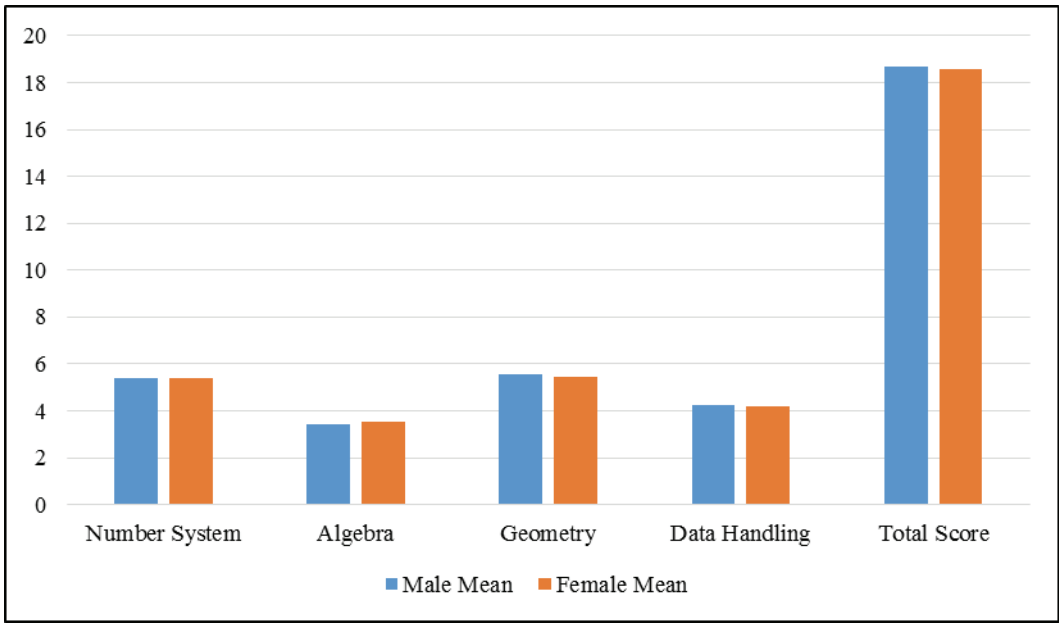

Figure-6.2: Dimension wise Students Math Achievement with respect to their gender

6.3 Age and Students' Mathematics Achievement

To study gender-based differences in students' mathematics achievement, a comparative analysis was conducted among different age students across different dimensions of the *Mathematics Achievement Test (MAT)*. For this purpose, a set of null hypotheses were formulated to statistically test the significance of observed differences.

Null Hypotheses

H□ 6.3(i) : There is no significant difference in students' achievement in Number System with respect to Age.

H□ 6.3(ii) : There is no significant difference in students' achievement in Algebra with respect to Age.

H□ 6.3(iii) : There is no significant difference in students' achievement in Geometry with respect to Age.

H□ 6.3(iv) : There is no significant difference in students' achievement in Data Handling with respect to Age.

H□ 6.3(v) : There is no significant difference in the overall mathematics achievement of students with respect to Age

These hypotheses were tested using one way ANOVA and the findings are presented in Table-6.3

Table 6.3: One-Way ANOVA for Students' Mathematics Achievement Based on Age

Variable	Age	N	Mean	Std. Deviation	F-value	p-value
Number System	Up to 11	114	5.4561	1.92395	0.210#	0.811
	11 to 12	246	5.4472	2.30422		
	More than 12	120	5.3000	2.22136		
	Total	480	5.4125	2.19523		
Algebra	Up to 11	114	3.4649	1.45845	0.002#	0.998
	11 to 12	246	3.4756	1.48097		
	More than 12	120	3.4750	1.50608		
	Total	480	3.4729	1.47890		
Geometry	Up to 11	114	5.2018	1.95607	1.995#	.137
	11 to 12	246	5.5732	1.80270		
	More than 12	120	5.6333	1.82390		
	Total	480	5.5000	1.84922		
Data Handling	Up to 11	114	4.0263	1.44798	2.140#	.119
	11 to 12	246	4.2642	1.44537		
	More than 12	120	4.4167	1.48711		
	Total	480	4.2458	1.45997		
Total	Up to 11	114	18.1491	4.90301	.765#	.466
	11 to 12	246	18.7602	4.63564		
	More than 12	120	18.8250	4.98175		
	Total	480	18.6313	4.78553		

Not significant

To explore whether students' mathematics achievement varied significantly with age, a one-way ANOVA (Analysis of Variance) was conducted. Students were categorized into three age groups: *Up to 11 years*, *11 to 12 years*, and *More than 12 years*. The analysis was performed separately for each dimension of the Mathematics Achievement Test (Number System, Algebra, Geometry, and Data Handling), as well as for the overall test scores. The results are presented in Table-6.3.

In the Number System dimension, the mean scores across the three age groups were very close (5.46, 5.45, and 5.30), and the ANOVA yielded an *F*-value of 0.210 with a *p*-value of 0.811. This indicates no statistically significant difference in students' performance in the number system based on age. For the Algebra dimension, the mean scores were also nearly identical (3.46, 3.48, and 3.48), resulting in an *F*-value of just 0.002 and a *p*-value of 0.998. These values strongly confirm the absence of any significant difference in algebra achievement across age groups.

In the Geometry section, the means slightly increased with age (5.20, 5.57, and 5.63), but the *F*-value was 1.995 and the *p*-value was 0.137, which is not statistically significant at the 0.05 level. A similar trend was observed in Data Handling, where the means were 4.03, 4.26, and 4.42 respectively, yet the *F*-value (2.140) and *p*-value (0.119) again failed to indicate a significant difference. When considering the overall mathematics achievement, the mean scores for the age groups were 18.15, 18.76, and 18.83 respectively. The *F*-value of 0.765 and *p*-value of 0.466 confirm that the variation in total scores across age groups is not statistically significant.

Thus, the ANOVA results reveal that age does not significantly influence students' achievement in mathematics, either in individual content areas or in the overall test score. This suggests that within the sampled age range, mathematical achievement is consistent and not significantly affected by students' age group.

6.4 Type of School and Students' Mathematics Achievement

To study gender-based differences in students' mathematics achievement, a comparative analysis was conducted between government and private students across different dimensions of the *Mathematics Achievement Test (MAT)*. For this purpose, a set of null hypotheses were formulated to statistically test the significance of observed differences.

Null Hypotheses

H□ 6.4(i) : There is no significant difference in students' achievement in Number System with respect to Type of School.

H□ 6.4(ii) : There is no significant difference in students' achievement in Algebra with respect to Type of School.

H□ 6.4(iii) : There is no significant difference in students' achievement in Geometry with respect to Type of School.

H□ 6.4(iv) : There is no significant difference in students' achievement in Data Handling with respect to Type of School.

H□ 6.4(v) : There is no significant difference in the overall mathematics achievement of students with respect to Type of School.

These hypotheses were tested using t-test for independent samples and the findings are presented in Table-6.4.

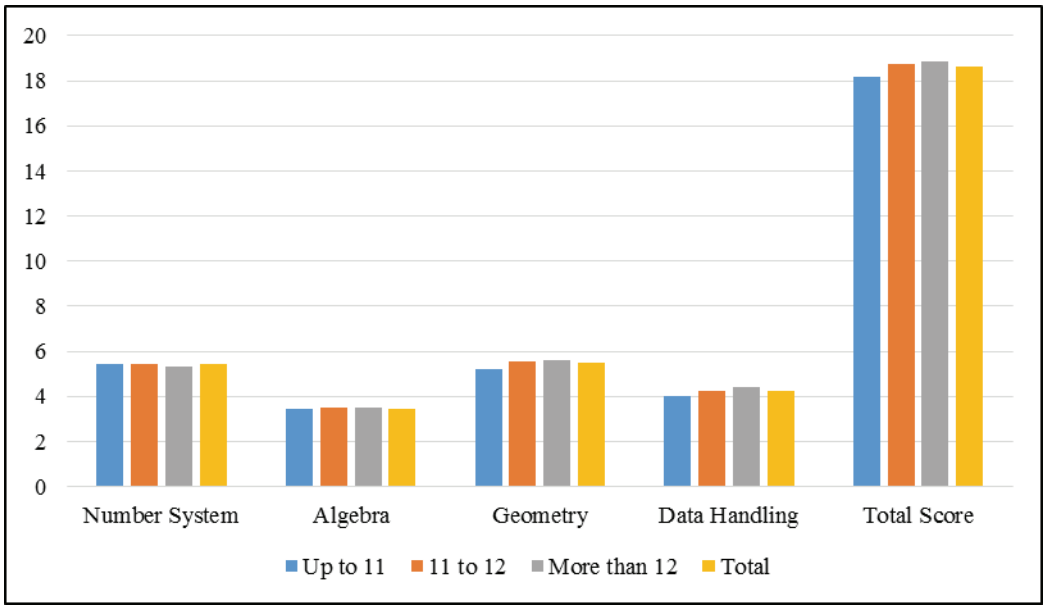

Figure-6.3: Age-wise Mean Scores in Mathematics

Table-6.4: Shows mean, SD and 't' values on Dimension wise Students Math Achievement with respect to type of school

Domain	Type of school	N	Mean	Std. Deviation	t-value	p-value
Number System	Government	320	5.4188	2.28522	.088#	.930
	Private	160	5.4000	2.01004		
Algebra	Government	320	3.4406	1.49489	-.676#	.499
	Private	160	3.5375	1.44887		
Geometry	Government	320	5.2656	1.88246	-3.988**	.000
	Private	160	5.9688	1.69135		
Data Handling	Government	320	4.0875	1.48298	-3.397**	.001
	Private	160	4.5625	1.36298		
Total	Government	320	18.2125	4.96052	-2.729**	.007
	Private	160	19.4688	4.30872		

** Significant at 0.01 level; # Not significant

To examine whether the type of school influences students' mathematics achievement, an independent samples *t*-test was conducted comparing students from government and private schools. The analysis covered each dimension of the Mathematics Achievement Test (MAT)—Number System, Algebra, Geometry, and Data Handling—as well as the total test scores. The findings are summarized in Table-6.4.

In the Number System dimension, the mean scores were very close: 5.42 for government school students and 5.40 for private school students. The *t*-value of 0.088 and *p*-value of 0.930 suggest no significant difference between the two groups in this area. Similarly, for Algebra, students from private schools (M = 3.54) performed slightly better than those from government schools (M = 3.44), but the difference was not statistically significant (t = -0.676, p = 0.499).

However, in the Geometry dimension, private school students (M = 5.97) performed significantly better than government school students (M = 5.27), as indicated by a *t*-value of -3.988 and a *p*-value of 0.000, which is statistically significant at the 0.01 level. A similar pattern was observed in the Data Handling dimension, where private school students (M = 4.56) again outperformed their government school counterparts (M = 4.09), with a *t*-value of -3.397 and a *p*-value of 0.001.

When considering the total mathematics achievement score, students from private schools (M = 19.47) scored significantly higher than those from government schools (M = 18.21). The difference was statistically significant with a *t*-value of -2.729 and a *p*-value of 0.007.

These results indicate that while no significant difference was found in the Number System and Algebra dimensions, private school students significantly outperformed government school students in Geometry, Data Handling, and overall mathematics achievement. This suggests that type of school may play a role in certain areas of mathematics learning, potentially due to differences in instructional quality, resources, or teaching strategies available in private versus government schools.

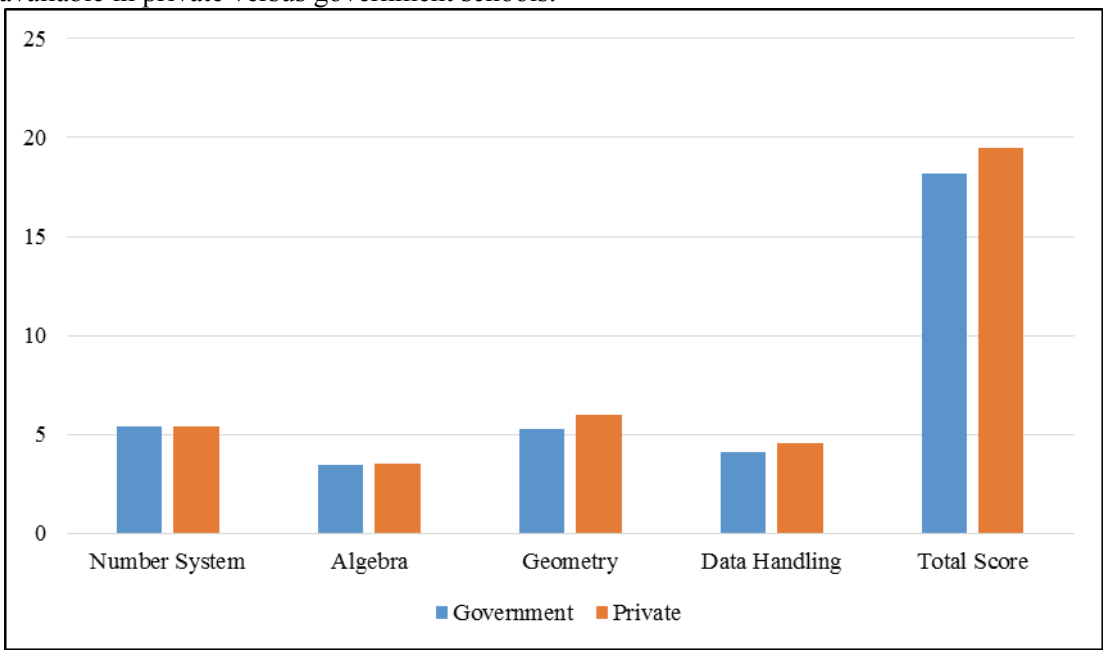

Figure-6.4: Type of School-wise Mean Scores

6.5 School Locality and Students' Mathematics Achievement

To study gender-based differences in students' mathematics achievement, a comparative analysis was conducted between rural and urban school students across different

dimensions of the *Mathematics Achievement Test (MAT)*. For this purpose, a set of null hypotheses were formulated to statistically test the significance of observed differences.

Null Hypotheses

H□ 6.5(i) **:** There is no significant difference in students' achievement in Number System with respect to locality.

H□ 6.5(ii) **:** There is no significant difference in students' achievement in Algebra with respect to locality.

H□ 6.5(iii) **:** There is no significant difference in students' achievement in Geometry with respect to locality.

H□ 6.5(iv) **:** There is no significant difference in students' achievement in Data Handling with respect to locality.

H□ 6.5(v) **:** There is no significant difference in the overall mathematics achievement of students with respect to locality.

These hypotheses were tested using t-test for independent samples and the findings are presented in Table-6.5.

Table-6.5: Shows mean, SD and 't' values on Dimension wise Students Math Achievement with respect to their locality

Domain	Locality	N	Mean	Std. Deviation	t-value	p-value
Number System	Rural	321	5.3458	2.17989	-.946#	.345
	Urban	159	5.5472	2.22670		
Algebra	Rural	321	3.4143	1.43385	-1.234#	.218
	Urban	159	3.5912	1.56389		
Geometry	Rural	321	5.4517	1.82646	-.813#	.417
	Urban	159	5.5975	1.89643		
Data Handling	Rural	321	4.2586	1.40706	.271#	.786
	Urban	159	4.2201	1.56564		
Total	Rural	321	18.4704	4.55109	-1.046#	.296
	Urban	159	18.9560	5.22693		

Not significant

To determine whether locality has an influence on students' performance in mathematics, an independent samples *t*-test was conducted comparing the scores of students from rural and urban areas across different dimensions of the Mathematics Achievement Test (MAT) and in overall achievement. The results are summarized in Table-6.5.

In the Number System dimension, the mean score for rural students was 5.35, slightly lower than the 5.55 scored by urban students. However, the *t*-value of -0.946 and *p*-value of 0.345 indicate that the difference is not statistically significant. A similar pattern is seen in the Algebra dimension, where urban students scored a mean of 3.59 compared to 3.41 for rural students, but the difference again was not significant ($t = -1.234$, $p = 0.218$).

In the Geometry section, urban students (M = 5.60) again slightly outperformed rural students (M = 5.45), yet the difference was not statistically meaningful ($t = -0.813$, $p = 0.417$). Interestingly, in the Data Handling dimension, rural students had a marginally higher mean score (4.26) than their urban peers (4.22), though the difference was negligible and non-significant ($t = 0.271$, $p = 0.786$).

Finally, in terms of overall mathematics achievement, urban students (M = 18.96) scored slightly higher than rural students (M = 18.47). However, the *t*-value of -1.046 and *p*-value of 0.296 reveal that the difference is not statistically significant.

In conclusion, the analysis shows that locality (rural vs. urban) does not have a significant impact on students' mathematics achievement, either in specific content areas or in total score. This suggests that students from both rural and urban areas perform similarly when provided with equitable academic conditions.

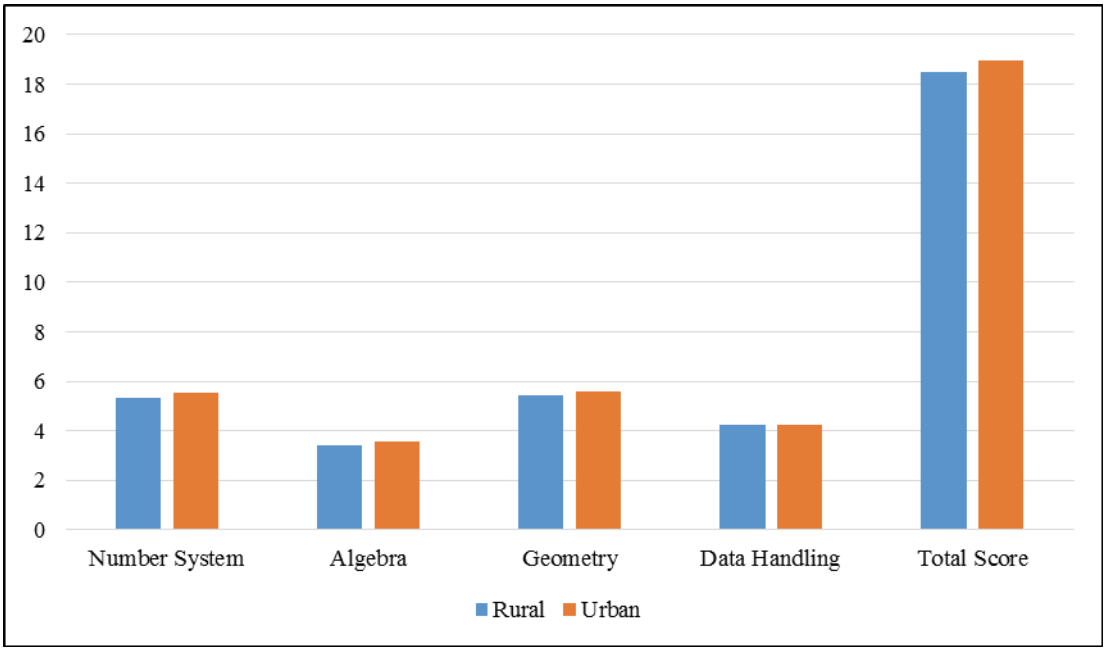

Figure-6.5: Locality-wise Mathematics Achievement

7. Findings and Conclusions

7.1 Findings of the Study

- A majority of students (55.2%) demonstrated moderate achievement in Mathematics Achievement Test, 22.9% scored high and 21.9% scored low.
- The students scored the highest in Geometry (Mean = 5.50), followed by Number Systems (Mean = 5.41) and Data Handling (Mean = 4.25). The students scored the lowest in Algebra with a mean score of 3.47.
- There was no significant difference in the mathematics achievement of students with respect to gender. The male and female students performed equally well.
- There was no significant difference in the mathematics achievement of students with respect to age.
- Private school students significantly outperformed government school students in Geometry, Data Handling and overall mathematics achievement. No significant difference was found in Number System and Algebra domains.
- There was no significant difference in mathematics achievement of students with respect to locality (rural/urban).

7.2 Conclusions drawn from the Study

- The study revealed that more than half of the students (55.2%) demonstrated moderate achievement in the Mathematics Achievement Test (MAT), while 22.9% scored high and 21.9% scored low. This means that the majority of students possess only a basic understanding of mathematics, with a small proportion excelling and a similar proportion struggling at the bottom. This finding reflects the current national trend, as reported in NCERT's National

Achievement Survey (2020), which highlighted that most middle school students in India perform within the average range, particularly in mathematics. The result suggests that targeted support is required for the bottom 20% of learners, while enrichment and advanced challenges should be designed for the top 20% to ensure that all students are adequately supported in their mathematics learning.

- When domain-wise performance was analysed, students scored the highest in Geometry, followed by Number Systems, while Algebra proved to be the weakest area. This suggests that students are more comfortable with visual and spatial topics but find it difficult to deal with abstract concepts, which require greater symbolic and procedural fluency. These results align with findings from Srinivasan and Mehta (2021), who also observed that middle school students perform significantly better in Geometry due to its visual and real-life applications but struggle with Algebra because of its abstract nature. The present study highlights the urgent need to strengthen Algebra pedagogy, particularly through the use of visual aids, models and activity-based methods, while teacher training programmes should place greater emphasis on improving strategies to teach abstract algebraic concepts.
- The study also found no significant gender differences in mathematics achievement, with both boys and girls performing equally well in MAT. This is a positive trend as it suggests that classrooms are becoming more inclusive and teaching practices are helping to create balanced learning opportunities for both genders. It also shows that when girls are provided equal access and encouragement, they are capable of performing at the same level as boys. This result is consistent with the global trends reported in TIMSS (2019), which showed narrowing gender gaps in mathematics achievement worldwide and challenges the long-standing stereotype that "boys are better at mathematics." Equal performance across genders reflects positively on current classroom practices and policy efforts that focus on gender equity in education.
- The study reported that neither age nor school locality had a significant impact on students' mathematics achievement. This indicates that mathematics performance depends more on teaching quality, classroom environment and student interest rather than on external demographic factors. Kumari and Das (2018) found similar results, reporting that age was not a strong predictor of mathematics achievement at the middle school level as cognitive development within this range is fairly uniform. Likewise, NCERT's longitudinal study (2018) also observed no clear link between age and mathematics performance. With regard to locality, NCERT (2020) reported that digital initiatives such as DIKSHA and other e-learning platforms have helped narrow the gap between students from different regions, particularly in Delhi NCR. Reddy and Sinha (2020) also found that the achievement gap between urban and non-urban learners is gradually shrinking, especially when schools ensure consistent teacher quality and classroom support.
- The study found that private school students showed significantly higher performance in Geometry and Data Handling and overall mathematics achievement. This suggests that private schools may be giving more emphasis on visualization, use of resources, and application-oriented teaching. Though the findings suggest that school type does not affect all areas equally, but its influence is visible in those domains which require resources, visualization, and practice beyond textbooks. Kumar & Saini (2019) found that private school students in India often

outperform government school students in applied domains of mathematics due to better classroom resources and more activity-based learning opportunities. OECD (2020) findings from PISA assessments also confirm that resource availability and school environment strongly influence performance in applied mathematical domains, though not always in basic arithmetic skills.

The study concludes that while students in Delhi demonstrate moderate mathematics achievement, there are clear differences based on school type. Private schools appear to provide stronger academic support, contributing to higher performance in certain mathematical domains. Gender and age did not influence achievement significantly, suggesting that learning opportunities, teaching quality and resource availability play a more decisive role than biological factors. Efforts to strengthen conceptual teaching, improve instructional strategies in Algebra and enhance mechanisms of support in government and low-resource schools may further boost students' confidence and achievement in mathematics. Strengthening teacher training and integrating technology-based teaching, as encouraged by NEP 2020, can also help narrow learning gaps and support all learners effectively.

References

Creswell, J. W. (2021). *Research design: Qualitative, quantitative and mixed methods approaches* (5th ed.). Sage.

Kumar, A. (2023). Understanding student performance in mathematics: A review of factors influencing achievement. *Journal of Indian Education Research,* 47(2), 45–59.

Kumar, R., & Saini, P. (2019). A comparative study of mathematics achievement of government and private school students. *International Journal of Educational Studies,* 7(1), 32–41.

Kumari, S., & Das, R. (2018). Relationship between age and mathematics achievement among middle school learners. *Journal of Educational Psychology Studies,* 12(4), 101–108.

NCERT. (2018). *Longitudinal Study Report on School Students' Learning Progression.* National Council of Educational Research and Training.

NCERT. (2020). *National Achievement Survey 2020.* Ministry of Education, Government of India.

NCERT. (2023). *National Curriculum Framework for School Education (NCF 2023).* National Council of Educational Research and Training.

NAS. (2021). *National Achievement Survey 2021: National Report.* Ministry of Education, Government of India.

NEP. (2020). *National Education Policy 2020.* Ministry of Education, Government of India.

OECD. (2020). *PISA 2018 Results: Where all students can succeed.* OECD Publishing.

OECD. (2023). *Education at a Glance 2023.* OECD Publishing.

PISA. (2021). *Programme for International Student Assessment Report.* OECD Publishing.

Reddy, V., & Sinha, S. (2020). Rural-urban differences in mathematics achievement: A study of learning environments. *Indian Journal of Educational Measurement,* 56(3), 78–92.

Sharma, M., & Sharma, R. (2022). Factors influencing mathematics learning at the middle school level. *Asian Journal of Education & Development,* 10(1), 14–26.

Singh, A., & Kumar, P. (2022). Disparities in mathematics performance: Evidence from Indian school systems. *Journal of School Education Studies,* 38(2), 90–104.

Singh, R., Kaur, J., & Mehta, G. (2023). Gender, school background and mathematics learning: An Indian perspective. *International Journal of Cognitive and Affective Learning,* 11(1), 22–34.

Srinivasan, S., & Mehta, P. (2021). Understanding the gaps in algebra learning among middle school students. *Journal of Mathematics Education Research,* 15(2), 52–67.
TIMSS. (2019). *Trends in Mathematics and Science Study 2019 International Report.* IEA Publishing.
Wilkins, N. (2022). School-based factors affecting mathematics achievement: A global review. *Journal of Educational Effectiveness,* 8(3), 120–135.