International Journal of Contemporary Issues in Social Sciences
Volume 3, Issue 1, 2024 ISSN(P):2959-3808 | 2959-2461

URBAN-RURAL DISPARITIES IN SECONDARY STUDENTS' MATHEMATICS ACHIEVEMENT: A COMPARATIVE STUDY

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Received: 8 December, 2023 **Revised:** 6 January, 2024 **Accepted:** 14 January, 2024 **Published:** 21 January, 2024

ABSTRACT

A comparative analysis of the academic achievement in mathematics of secondary school students from urban and rural areas of District Sahiwal was undertaken. A stratified random sampling technique was utilized to select a total sample of 400 students. A 50-item multiple choice test based on the 9th-grade mathematics textbook was developed, with facility and discrimination indices calculated for quality assurance. Reliability analysis was also performed. The test was hand-scored on a one-mark-per-item basis and administered by the researcher in the presence of the respective mathematics teachers. Statistical analysis encompassed measures of central tendency and dispersion (arithmetic mean and standard deviation) and z-tests for comparative inference. Results demonstrated superior overall performance amongst the urban cohort compared to their rural counterparts. Across regions, female students outperformed male students. Rural male and female student achievement was analogous, while significant differences were observed between urban and rural females to benefit the former grouping. Urban females surpassed urban males. In rural schools, converse relationships are held. Recommendations centered on quality improvements in rural secondary schools via enhanced resourcing and staffing. Emphasis was placed on addressing shortages of science and mathematics teachers in rural areas, especially female secondary schools. Additional interventions should focus on evidence-based best practices for mathematics achievement gains in rural areas.

Keywords: comparative analysis, achievement, mathematics, secondary level

INTRODUCTION

We are living in the age of science and technology. Technological innovations and scientific discoveries contribute a lot to our lives. It is claimed that science and technology are affected by the environment around us, and all modern facilities are because of this progress (Banerjee et al., 2014). Research shows that students' math achievement is affected by several factors, including their relationships with teachers. Students' experiences in math class greatly impact how well they do. Many studies find that positive teacher-student relationships lead to better math outcomes. When teachers build good relationships and see students as friends, students are more likely to succeed.

On the other hand, when teachers only connect with high-achieving students, lower-achieving students fall further behind. It is a problem because math is an important subject for many fields, yet many students struggle with it. Good teacher-student relationships can help improve math achievement, especially for struggling students. Fostering positive bonds between teachers and all students seems key to helping students excel in math.

Mathematics is considered the language underlying science and technology; comprehending advancements in these fields would be challenging without a working knowledge of mathematical concepts. Specifically, mathematics involves the

scientific study of measurements, quantities, and magnitudes. The New Oxford Dictionary (2005) defines mathematics as 'the science of numbers and space', underscoring the central role of numerical calculations and relationships. In Hindi and Punjabi, mathematics translates to "Ganitia," or the science of computations. Fundamentally, mathematics relies upon calculations and quantifications, functioning as a numerical framework around which broader progress revolves. In other words, mathematics deals with interconnected numbers and number systems. Studying mathematics develops vital cognitive skills, including logical reasoning, imagination, and problem-solving capabilities. Furthermore, mathematics provides mental training to settle a habit of logical thinking in the mind (Sidhu, 1967). Given its emphasis on calculations, reasoning, and logic, developing mathematical skills and knowledge lays the necessary groundwork for an individual to succeed in many life endeavors.

Mathematics has catalyzed revolutionary transformations in societies and civilizations over time. Mathematical education has been instrumental in developing modern civilization by advancing all scientific fields. Mathematics represents the science of all sciences and the art of all arts. While not always visibly at the forefront, mathematics subtly enables progress underneath the surface across domains. Indeed, mathematics constitutes an inextricable element of daily life, playing a vital role in today's complex world (Devlin, 2012). Modern areas of overt practical importance like theoretical computer science, financial mathematics, and statistics host mathematicians actively pushing boundaries. Without mathematics, our current electronic age would remain unrealized. Critical discoveries, including jet aircraft, televisions, bridge infrastructure, machinery, record-keeping systems, and business operations, rely on mathematical advancements. In summary, the foundations of modern civilization across science, technology, engineering, business, and more have been laid through mathematics (Ernest, 2018).

Mathematical language has distinct semantics and symbolism, requiring specialized instructional techniques. Effective teaching demands engagement from both instructors and students. However, mathematics teachers in Pakistan often struggle to impart this linguistic domain adequately. Such failure stems largely from over-reliance on traditional pedagogies emphasizing rote rules, formulas, and patterns while undervaluing practical, concrete applications. Consequently, students frequently fail to grasp mathematics' theoretical foundations and cannot deeply comprehend conceptual underpinnings (Amirali, 2010). Compounding these challenges, most schools lack the necessary mathematical apparatuses to assist teachers in explaining theories. Syllabus improvements have also been suggested as an imperative step.

Objective of the Study

The objective of the study was:

To compare the difference between the achievement of secondary school students in Mathematics based on gender and locale.

Research Questions

Based on objectives, the following were the research questions.

What is the difference between the achievement of secondary school students in mathematics based on gender?

What is the difference between the achievement of secondary school students in mathematics based on locale?

LITERATURE REVIEW

Studying mathematics often supports learning in other disciplines. Strong connections exist between mathematics and fields like physics, engineering, psychology, logic, philosophy, and the fine arts (Saleem, 2005). As Bacon (cited in Saleem, 2005) summarized, mathematics is the 'key of sciences'. Without mathematical knowledge, comprehending other scientific domains becomes challenging. Similarly, mathematics has been taken as an efficient, necessary tool for the sciences; scientific progress would be greatly impeded without it. Consequently, those ignorant of mathematics struggle to grasp critical aspects of the world around them.

Additionally, mathematics teachers play a pivotal role in teaching and learning. As Papola (2005) stated, mathematics functions analogously to a whetstone, honing one's abilities for distinct, logical, and careful thinking. In short, mathematical

concepts, skills, and instruction intrinsically aid study in other disciplines by developing vital cognitive capacities while illuminating connections between complex ideas.

The teaching of mathematics is essential for meeting technological and industrial needs. The need for more and better scientists and engineers is growing daily owing to rapid industrial and technical advancement. More emphasis is now being placed on teaching science and Mathematics in our educational program (Bashir & Shami, 2006). It shows that teaching Mathematics is necessary for developing scientific knowledge, which will further lead towards the development of the state of life and will develop and stabilize society. Teaching Science and Mathematics at the secondary level should be improved through necessary changes in curricula, adequate laboratories, and improving teachers' competence. Appropriate teaching of mathematics assists in almost every field of education. Learners in the sciences like physics, chemistry, logic, and economics need a background knowledge of mathematics to understand all these sciences. The above discussion shows that mathematics learning and educational achievement are essential for students at the basic and advanced levels. We cannot explain the theories and logic in sciences exactly without it. It is the backbone of almost all the sciences. Educational achievement is the learning or proficiency acquired in given knowledge or skill areas. It is the academic achievement concerning certain subjects. Generally, it is measured with the help of achievement tests designed to measure the knowledge, understanding, and skill in a specific subject or group of subjects.

The achievement test measures knowledge and skill in a content area. It seeks to measure academic progress. Educational achievement is the most frequently used and authentic way to see the educational or academic attainments in a particular area. The government of Pakistan (2005) in National Education Policy (1992 and 1998-2010) and Education Sector Reforms (ESR) Action Plan (2001-2005) recognized that "learning achievement is one of the key components to assess and improve the quality of education in a particular area. " In this regard, the National Education Assessment System (NEAS) (2005) conducted a study at the national level to assess and improve the achievement of 8th and 4th-grade students" achievement in four subjects: Language, Mathematics, Science, and Social Studies. It was concluded that many context and background factors such as gender, location, student age, home environment, parents' education, teachers' qualifications and experience, classroom environment, and academic qualifications of head teachers are linked with the student's achievement. Parent involvement can also affect achievement (Shah et al., 2021). In the same way, teacher's motivation was also found effective in students' academic performance at public secondary schools were also explored (Ahmad et al., 2023). Another study found a significant impact of teachers' proficiencies in technology Integration on students' achievement (Ali et al., 2022).

Achievement in Mathematics is affected by many factors. A study conducted by International Student Assessment on the Achievement in Mathematics (2003) concluded that high Mathematics confidence, the anxiety level of the learner, school environment, teaching methods adopted in the classroom, parents' involvement, socio-economic background of the learner, and ability of the learner affect the achievement of the students in Mathematics. It shows that achievement in Mathematics is not possible without controlling all these factors. For high academic results, these elements should be controlled.

Mathematics teachers sometimes may "dislike their subject and profession" (Saleem, 2005, p. 25). It becomes the cause of low achievement in mathematics. The attitude of teachers is also very important. Sometimes, teachers avoid giving individual attention to the students. They do not try to keep individual differences, students' abilities, and many other factors that may enhance students' achievement. A common defect in our educational setup is that most teachers are not adequately qualified. There is also a lack of science and Mathematics" teachers, especially in the secondary schools of rural Punjab (NEP, 1998-2010).

Although the government has established secondary and higher secondary schools in rural and urban areas in Pakistan to provide secondary education, these schools work under the same policy, objectives, curriculum, examination system, and administration. However, educational facilities, students' socio-economic backgrounds, and the teaching

environment differ (Asadullah et al., 2009). The quality of schooling is linked with the qualifications of teachers, curricula, educational material, teaching methodologies, equipment, and physical facilities such as classrooms, laboratories, libraries, and furniture. The students' status and standards in urban schools are quite different from those of the students in rural schools (Asadullah et al., 2009). This difference also leads to differences in the educational achievement of the students.

Zenvenberg et al. (2004) asserted that though the intellectual disabilities of the students matter to a small extent, most students are at risk of failing in Mathematics. These are those students who come from working-class or lower-class backgrounds, students from indigenous cultures, students whose first language is not English, students living in remote or rural/isolated areas, students with disabilities, and gender groups. Other factors, such as social class, gender, area, race, ethnicity, and age, affect access to better education facilities and resources. This unequal access leads to differences in achievement.

Though all these factors affect the achievement of the students, the difference in the status of the students as well as the schools of urban and rural areas count a lot. Generally, it is thought that the students of urban areas show better academic achievement/results in Mathematics than the students of rural areas because of the provision of better facilities. Teachers and head teachers are appointed according to the same criteria, but most good and experienced teachers and head teachers prefer to be transferred to urban schools. It results in a shortage of teachers in rural areas, especially in female schools. In most of the schools in rural areas, vacancies for Science and Mathematics teachers remained vacant. Similarly, students and parents prefer urban schools because of social and cultural context and for better results. So, considering the above aspects, the present study is designed to explore the situation regarding the teaching and learning of Mathematics and to compare the educational achievement of students in urban and rural areas.

Studies show superior mathematics achievement among urban adolescent students compared to rural counterparts in developing contexts. Though urbanization holds no direct cognitive benefit, higher urban achievement likely stems from increased access to quality inputs like experienced teachers, peer effects, infrastructure, and family resources (Asadullah, 2022).

While mean urban achievement eclipses rural learning nationally, examination of results by gender reveals a more complex picture. Rural males tend to perform on par with or marginally below urban males on mathematics assessments in South Asia. Meanwhile, considerable gaps persist between rural and urban females, potentially indicative of sociocultural constraints disproportionately impacting rural girls' access to education, attitudes, and outcomes (Kainuwa et al., 2013). Rural female students score nearly five percentage points lower in mathematics than their counterparts nationally, versus a 1.4-point difference separating rural and urban males (Sathar et al., 2003). Hence, the urban advantage appears largely attributable to sharp discrepancies between metropolitan girls significantly outperforming rural female cohorts.

Inferior rural learning conditions represent the predominant explanatory factor behind urban-rural achievement divides (Aslam & Kingdon, 2011). Rural public schools frequently suffer teacher shortages, especially in critical areas like mathematics and science, while attracting less qualified instructors overall. Financial restrictions also limit rural students' access to necessary learning materials. However, gender gaps indicate additional socio-cultural dynamics influencing mathematics outcomes between regions. Masculine stereotypes surrounding science and mathematics fields may disproportionately discourage rural female engagement and achievement, as could religiously conservative norms emphasizing boys' education over girls' in traditional South Asian communities (Kainuwa et al., 2013). While linked structural conditions enable unequal urban advantage, localized societal beliefs likely reinforce gender divides.

RESEARCH METHODOLOGY

For the present study, the students of the 9th class in urban and rural government high schools for boys and girls of Sahiwal district were taken as the population. Out of the 148 secondary schools, 20 were selected, including ten urban secondary schools and ten rural secondary schools in the Sahiwal

district, considering available time and financial constraints. The stratified random sampling technique was used to select the schools from the district. For this purpose, a list of secondary schools in urban and rural areas in the Sahiwal district was used. There were 12 urban male schools, 12 urban female schools, 89 rural male schools, and 35 rural female schools. Five schools were selected randomly from each subgroup (strata) of the schools as mentioned above. This way, five male urban, five female urban, five male rural, and five female rural schools were selected. In the second stage, 20 students were randomly selected from each selected school with the help of a Random Number Table (RNT) constructed by the National Education Assessment System (2007). In this way, a sample of 400 students was obtained to whom the achievement test in Mathematics was administered.

The breakup of the total students according to the above sampling was as follows:

Urban Male	=	100
Urban Female	=	100
Rural Male	=	100
Rural female	=	100
Total sample size	=	400

For the present study, an achievement test was designed, which consisted of 50 Multiple-choice items to measure the learning achievement of the students in Mathematics. The achievement test was developed from the content of 9the class textbook of Mathematics prescribed by the Punjab Textbook Board Lahore to compare the achievement of rural & urban secondary school students. The results were recorded on the master sheet and then tabulated. SPSS 13, MS-Excel, Minitab 13.0, and ITEMAN version 3.50 were used for statistical purposes. Mean, SD, Mcomb, and z-tests were used to compare students' performance from different groups.

Findings and Results

The following findings and results were drawn from the study.

The Arithmetic Mean of all urban students was 25.75, while the arithmetic mean of all rural students was 24.03, with a standard deviation of 6.64. Statistically, there was a significant difference between the achievement of urban and rural students. Moreover, the mean score of urban students was also an indicator of better achievement.

Table No. 1

Comparison of Achievement of Urban and Rural Sample Students

Category	Total N	Mean $\overline{X}$	Standard Deviation SD	Calculated z-value
Urban	200	25.75	8.10	2.35
Rural	200	24.03	6.46	

t.v. = 1.96 (α.05), c.v. = 2.35

The Arithmetic Mean of all male students was 24.82 with a standard deviation of 6.76, whereas female students had an arithmetic mean of 24.96 with a standard deviation of 7.94. Statistically, the overall achievement of female and male students in Mathematics was insignificant from the statistical point of view. However, the score of urban students was slightly better.

Table No. 2

Comparison of Achievement of Male and Female Sample Students

Category	Total N	Mean $\overline{X}$	Standard Deviation SD	Calculated z-value
Male	200	24.82	6.76	0.19
Female	200	24.96	7.94	

t.v. = 1.96 (α.05), c.v. = 0.19

The arithmetic mean of urban male students was 24.18 with a standard deviation of 7.05, whereas the value of rural male students was 25.46 with a standard deviation of 6.43. Statistically, there was an insignificant difference in achievement between urban male and rural male students. However, the difference in mean score showed better performance of rural male students.

Table No. 3

Comparison of Achievement of Urban Male and Rural Male Students

Category	Total N	Mean $\overline{X}$	Standard Deviation SD	Calculated z-value
Urban Male	100	24.18	7.05	1.35
Rural Male	100	25.46	6.43	

t.v. = 1.96 (α.05), c.v. = 1.35

The mean score of urban female students was 27.32, and the standard deviation was 8.78. For rural female students, the arithmetic mean was 22.61, and the standard deviation was 6.20. Statistically, there was a significant difference in achievement between urban female and rural female students. Moreover, the mean difference showed better performance.

Table No. 4

Comparison of Achievement of Urban Female and Rural Female Students

Category	Total N	Mean $\overline{X}$	Standard Deviation SD	Calculated z-value
Urban Female	100	27.32	8.78	4.34
Rural Female	100	22.61	6.20	

t.v. = 1.96 (α.05), c.v. = 4.34

It was found that urban male students had an arithmetic mean of 24.18 while urban female students had an arithmetic mean of 27.32. Statistically, there was a significant difference in achievement between urban female and urban male students in Mathematics. The mean score of Mathematics of urban female students was also an indicator of better achievement.

Table No. 5

Comparison of Achievement of Urban Male and Urban Female Sample Students

Category	Total N	Mean $\overline{X}$	Standard Deviation SD	Calculated z-value
Urban Male	100	24.18	7.05	2.79
Urban Female	100	27.32	8.78	

t.v. = 1.96 (α.05), c.v. = 2.79

The arithmetic mean of rural male students was 25.46, and that of rural females was 22.61. Statistically, there was a significant difference in achievement between rural male and rural female students in Mathematics. Moreover, the mean score of rural male students in Mathematics was also an indicator of better achievement.

Table No. 6

Comparison of Achievement of Rural Male and Rural Female Students

Category	Total N	Mean $\overline{X}$	Standard Deviation SD	Calculated z-value
Rural Male	100	25.46	6.43	3.20
Rural Female	100	22.61	6.20	

t.v. = 1.96 (α.05), c.v. = 3.20

DISCUSSIONS

The findings showing higher mathematics achievement among urban versus rural students align with prior research, indicating that urban students outperform their peers academically across subject areas (Aslam & Kingdon, 2011). Superior facilities, resources, and conditions in urban schools are commonly cited factors behind this achievement gap (Asadullah, 2022). However, the urban advantage in this study was largely attributable to the higher performance of urban female students over rural females, as urban and rural males achieved equivalently. It mirrors Asadullah's (2020) observation that gaps often widen between urban and rural students at higher education levels, especially for females, due to socio-cultural barriers limiting rural educational access. The lack of widespread gender differences in mathematics performance contradicts conceptions of male superiority in this domain (Hyde et al., 1990). However, higher achievement among urban female students compared to males aligns with meta-analytic findings that early gender gaps likely result from sociocultural rather than biological factors.

Moreover, higher rural male achievement builds on prior evidence that gender gaps flip in less developed areas, potentially due to gender bias and unequal access issues disproportionately impacting females (Hyde et al., 1990). The considerably lower rural female performance signals a critical need for interventions targeting this group's mathematics learning opportunities, environments, and resources (Kainuwa et al., 2013). Providing extended school hours, meals, and female teacher incentives in underdeveloped areas could help bridge gender and geographical achievement divides. Ultimately, ongoing research should inform localized solutions

addressing the multidimensional barriers limiting equal mathematics attainment across regions and genders.

REFERENCES

Ahmad, N., Bibi, N., & Imran, M. (2023). Effects of teacher's motivation on students' academic performance at public secondary schools in Karachi Pakistan. *AITU Scientific Research Journal*, *1*(2), 20-32.

Ali, Z., Ahmad, N., & Sewani, R. (2022). Examining elementary school teachers' professional proficiencies with technology integration and their impact on students' achievement. *Journal of Positive School Psychology*, *6*(7), 2950-2968.

Amirali, M. (2010). Students' conceptions of the nature of mathematics and attitudes towards mathematics learning. *Journal of Research and Reflections in Education*, *4*(1), 27-41.

Asadullah, M. N. (2022). *Gender dimensions of non-state Islamic faith-based schools in Asia*. UNESCO Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000381469?posInSet=2&queryId=84896d88-79b6-4a07-92a4-82a6352fa98d

Asadullah, M. N., Kambhampati, U., & Boo, F. L. (2009). Social divisions in school participation and attainment in India. *IDB-Research Department Working Papers*(692), 1-24.

Aslam, M., & Kingdon, G. (2011). What can teachers do to raise pupil achievement? *Economics of Education Review*, *30*(3), 559-574.

Banerjee, S., Das, N., & Mohanty, A. (2014). Impact of teacher competence and teaching effectiveness on students' achievement in life science subject at the upper primary stage. *Journal of Indian Education*, *39*(4), 29-48.

Bashir, T., & Shami, P. A. (2006). Teaching of Mathematics: Way Forward. *Journal on School Educational Technology*, *2*(1), 42-46.

Devlin, K. J. (2012). *Introduction to mathematical thinking* (Vol. 331). Keith Devlin Palo Alto, CA.

Ernest, P. (2018). *The philosophy of mathematics education today*. Springer.

Hyde, J. S., Fennema, E., & Lamon, S. J. (1990). Gender differences in mathematics performance: a meta-analysis. *Psychological Bulletin*, *107*(2), 139-155.

Kainuwa, A., Binti, N., & Yusuf, M. (2013). Influence of socio-economic and educational background of parents on their children's education in Nigeria. *International Journal of Scientific and Research Publications*, *3*(10), 2250-3153.

NEP. (1998-2010). *National Education Policy*. Islamabad: Ministry of Education

Papola, C. (2005). *Teaching of Mathematics*. Anmol Publications PVT. LTD.

Saleem, I. (2005). *Teaching of Mathematics, Lahore: Majeed Book Depot*. Majeed Book Depot.

Sathar, Z., Faizunnissa, A., Sultana, M., Lloyd, C. B., Diers, J. A., & Grant, M. J. (2003). Adolescents and youth in Pakistan 2001-2002: a nationally representative survey.

Shah, A. H., Shah, S. S. A., & Muhammad, Y. (2021). Role of Parental Involvement in their Children Academic Achievement: A Comparative Qualitative Study of Public and Private Elementary Schools. *Turkish Online Journal of Qualitative Inquiry*, *12*(8), 5655–5667.

Sidhu, K. S. (1967). *The teaching of mathematics*. Sterling Publishers Pvt. Ltd.

Zenvenberg, R., Dole, S., & Wright, R. (2004). Teaching mathematics in primary schools. *New South Wales, Australia: Allen & Unwin*.