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Impact of Teaching Methods on Students' Mathematics Learning: A Study in Public Secondary Schools, Shaheed Benazirabad

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ABSTRACT

This research explores the effect of instructional approaches to mathematics achievement of students in Shaheed Benazirabad public secondary schools. The study utilizes a quantitative research method with a comparative study design in comparing the effects of conventional and contemporary approaches to teaching on student learning. Data were gathered using two instruments: an observation checklist to measure the instructional methods practiced in classes and a mathematics achievement test for the students. There was a purposive sampling of 180 students and their teachers. The results of the simple linear regression showed that teaching methodology predicts students' mathematics performance significantly ($R^2 = 0.21$, $p < 0.001$). In addition, the independent samples t-test revealed a statistically significant difference between students who were instructed in the traditional manner ($M = 11.62$) and those instructed in the new way ($M = 14.27$), (t (178) = - 6.79, $p < 0.001$). The findings indicate that even though traditional is still more used in public schools, modern student-centered methods have greater learning outcomes. The research concludes that incorporating innovative pedagogies in teaching mathematics is imperative to enhance students' conceptual development and performance. According to the findings, a number of recommendations are provided for teacher professionalization, curriculum reform, and increased provision of resources.

INTRODUCTION

Background of the Study

Mathematics is commonly viewed as the basis of logical reasoning, problem-solving, and critical thinking. Mathematics is a foundational subject that is taught throughout one's academic years and is crucial for achievement in a majority of professional and technical careers. As important as it is universally, mathematics is one of the most difficult subjects for students to learn, particularly at the high school level. In schools worldwide, numerous students find it difficult to learn mathematical concepts, and this difficulty often results in poor performance, low self-esteem, and lack of interest in the subject. During education discourse, how maths is taught has become a growing concern, especially in areas where students continue to under-achieve. The teaching methodology determines how pupils perceive and learn mathematical concepts. The method used by an instructor may advance critical understanding or resort to surface learning. Evidence indicates that conventional teaching practices—like lectures, board work, and mechanical exercises—are very common in developing nations, especially among public education systems (Ali & Anwar, 2020). These instructor-focused methods tend to focus more on memorization and mechanical exercises rather than conceptual comprehension, thus curtailing students' use of mathematics to solve everyday problems. Conversely, contemporary pedagogies position the learner at the center of the learning process. Teaching methods like inquiry-based, collaborative problem-solving, manipulative, and integration of technology have been found to improve student learning engagement and performance (Boaler, 2016). These approaches stimulate students to be critical thinkers, investigate ideas on their own or in teams, and connect mathematical concepts with their own everyday life. Research has indicated that students who are exposed to contemporary approaches are more inclined to have an optimistic attitude toward math and retain knowledge for a longer time (Sullivan et al., 2014).

Pakistan's education system, particularly in poorer areas such as Shaheed Benazirabad, continues to experience serious challenges in embracing such contemporary pedagogical methods. Classrooms in most public secondary schools are packed, there are few teaching aids, and teachers have no access to professional development (Shah, 2019). Consequently, traditional practices continue to dominate. These approaches can be easy in resource-poor environments, but they tend not to cater to the unique learning requirements of students, especially in a subject as hypothetical as mathematics. Though national education policies in Pakistan promote student-centered approaches and the incorporation of technology, practice is uneven (MoFEPT, 2020). Teachers themselves tend to be uneducated in contemporary pedagogy, or they encounter institutional impediments that render it hard to move from examination-driven teaching. Therefore, education policy suggestions diverge from what happens in classrooms. Knowing the efficacy of various teaching methods in these conditions is critical for informed choice and education reform. In different countries, comparisons between conventional and contemporary teaching styles have given varied outcomes. Others maintain that conventional techniques give form and discipline and are, therefore, appropriate for skill development at the elementary level. Others indicate that contemporary, interactive methods have a greater impact on conceptual understanding and student interest (Ertmer & Ottenbreit-Leftwich, 2013). The success of any instructional method is very much context-dependent and relies on a variety of factors such as teacher skill, student background, classroom context, and resource availability.

In the case of Shaheed Benazirabad, a rural area in Sindh province, there is scarce empirical research that has been done to measure how pedagogy affects mathematics learning outcomes. The majority of public schools in the area stick to traditional practices with no experimentation

and innovation in teaching methods. With learning achievements still low, especially in mathematics, there is an increasing requirement to evaluate the teaching strategies applied and their performance in attaining hoped-for learning accomplishments (Rehmani, 2017). The current study seeks to investigate the effect of pedagogy on students' learning of mathematics in Shaheed Benazirabad's public secondary schools. It aims to examine the degree to which instructional practices impact academic achievement and to compare whether contemporary approaches produce superior results to conventional ones. Through its focus on this particular district, the study draws attention to an otherwise neglected geographical context of education studies. Its results should be able to inform teachers, school administrators, policymakers, and curriculum developers to enhance mathematical instruction in similar socio-educational contexts. This study is particularly relevant at a moment when Pakistan is making an effort to ensure all achieve quality education under Sustainable Development Goal 4 (UNESCO, 2021). Increasing mathematics achievement with effective teaching is an important step in the direction of that goal. If new approaches are found to be more effective, their adoption can help minimize learning gaps and bring up the general quality of secondary education in public institutions.

Statement of Problem

Mathematics is one of the major subjects in secondary school that enhances analytical thinking, rational reasoning, and problem-solving skills in students. Although it is an essential subject, mathematics is one of the toughest subjects for students, especially in Pakistani public secondary schools. Year by year, examination results show persistent underachievement in mathematics, which leads to serious concerns about the quality of teaching and learning in the subject. One of the key reasons for poor student performance in math is the instructional approach followed in classrooms. In most public schools, particularly in rural districts such as Shaheed Benazirabad, instruction is still based on conventional techniques like lecturing, memorization, and textbook problem-solving. Such instructor-dominated strategies tend to neglect students' unique learning requirements, suppress interaction, and not build conceptual knowledge. Thus, students are reduced to passive learners, finding it difficult to connect mathematical theories with practical situations (Ali & Anwar, 2020). Innovative teaching strategies—like student-centered learning, activity-based learning, and the use of technology—have provided encouraging outcomes in improving the involvement of learners and the quality of learning in mathematics. Yet, in under-resourced districts, there is minimal application of these strategies owing to inadequate training, lack of adequate classroom resources, and pedagogical practice resistance (Shah, 2019). In addition, whereas national and international research has underscored the role of pedagogical approaches towards ensuring students' performance, a significant research disparity exists in localized research that analyzes the comparative influence of conventional and contemporary pedagogical methods on learning mathematics, especially in Shaheed Benazirabad's public secondary schools. This research aims to bridge this gap by examining how various modes of instruction affect mathematics students' learning outcomes and how traditional versus contemporary methodologies compare in terms of effectiveness. The results will provide useful lessons for enhancing instructional practices and student performance in equivalent learning environments.

Significance of the Study

This research is important because it analyzes the impact of teaching methods on the mathematical learning outcomes of secondary school students. From the research, teachers will learn which teaching strategies work best in enhancing students' performance, particularly in poorly equipped public schools. For education planners and school administrators, the research will give valuable recommendations to inform teacher training programs and instructional interventions. It emphasizes the necessity of transition from conventional, teacher-based approaches to newer, more participative, student-based practices. The study also has relevance

for policy makers, providing localized insights from Shaheed Benazirabad that can help inform future education reforms towards better mathematics education in rural government schools. From a pedagogical perspective, the research adds to literature by comparing and contrasting conventional and contemporary approaches in a live classroom environment. It also provides the basis for future research in the same districts in Pakistan.

Research Objectives

1. To determine the extent to which teaching methodologies influence students' learning outcomes in mathematics.
2. To evaluate the comparative effect of traditional and modern teaching methodologies on students' performance in mathematics.

Research Questions

1. To what extent do teaching methodologies impact students' learning outcomes in mathematics?
2. Which teaching methodology (traditional or modern) is more effective in improving student learning outcomes in mathematics education?

Hypotheses

1. Teaching methodologies do not significantly influence students' learning outcomes in mathematics.
2. There is no significant difference in students' mathematics performance between traditional and modern teaching methodologies.

LITERATURE REVIEW

Teaching practice is central in the manner students acquire mathematical ideas. Historically, mathematics was instructed through lecture modes that focus on routine memorization and procedural problem-solving. Such instructor-focused methods include passive learning, as the students listen, replicate, and repeat without thoroughly interacting with the material (Ali & Anwar, 2020). Although these approaches can enable the rapid completion of the syllabus, they hardly foster understanding at a conceptual level or ensure long-term memory recall. These methods, on the other hand, focus on active learning, investigation, collaboration, and application of real-life examples. They involve methods like activity-based learning, inquiry-based teaching, teamwork, and incorporation of technology. Research indicates that these methods enhance students' capacity for applying mathematics knowledge, motivation, and anxiety reduction in the subject (Boaler, 2016; Sullivan et al., 2014).

Effectiveness of Traditional vs Modern Teaching Methods

Teaching effectiveness in mathematics learning is well known to be one of the determinants of students' outcomes. Conventionally, techniques like lecturing, memorization, and textbook drills are prevalent in most public schools in developing nations. Though they support syllabus coverage, they contribute to passive learning and do not enhance conception (Farooq & Shah, 2008). On the contrary, contemporary teaching practices focus on student participation, critical thinking, and applicability to real-life scenarios. Some of these include activity-based learning, group discussions, technology incorporation, and problem-solving exercises. Evidence shows that students taught using such interactive approaches develop a better understanding of mathematical concepts and perform more effectively in tests (Anthony & Walshaw, 2009; Oludipe & Awokoyemi, 2010). Research has further identified that contemporary techniques lower maths anxiety and develop constructive attitudes towards maths. For example, Ndlovu and Mji (2012) established that students in technology-enhanced, interactive classrooms experienced better academic performance than those in conventional classrooms.

Yet success with newer methods hinges on classroom environment, teacher preparation, and resources available. In crowded classrooms with scant equipment, it may be difficult to introduce student-centered methods (Mahajan & Singh, 2017). Further, teachers' personal beliefs concerning instruction influence their method selection (Uusimaki & Nason, 2004). Studies comparing and contrasting traditional and newer methods of teaching mathematics have found universal support for student-centered methods. For example, a research conducted by Ertmer and Ottenbreit-Leftwich (2013) revealed that students given technology-supported interactive instruction performed significantly higher in problem-solving tasks compared to students given traditional instruction. Likewise, a Pakistan-based comparative study concluded that students given activity-based and inquiry-based instruction demonstrated greater levels of participation and improved performance in mathematics tests compared to students who were instructed by lectures (Akhtar, 2018). Nonetheless, the success of contemporary approaches is subject to various determinants like teacher training, class size, resource availability, and administrative backing. In spite of these strengths, conventional approaches continue to dominate most public schools in Pakistan based on numerous systemic impediments. Teachers are usually overworked, undertrained, and required to get students ready for examinations instead of understanding (Shah, 2019). Consequently, uptake of new pedagogies is low, especially in the rural regions.

Theoretical Framework

Constructivist Learning Theory

Constructivism, which was developed mainly by Jean Piaget and later extended by Jerome Bruner, stresses that students actively construct meaning based on their current knowledge and experience. Learning, as viewed by this theory, is not a reception process of absorbing information, but an active process where students construct meaning through interaction, investigation, and reflection. Constructivist theory informs student-centered methodologies in mathematics education, including discovery learning, inquiry-based instruction, and activity-based teaching. Such methods invite learners to discover mathematical issues, acquire reasoning abilities, and use knowledge to solve real-world problems (Bruner, 1966). Constructivism is compatible with contemporary instructional approaches emphasizing critical thinking, experiential learning, and conceptual comprehension. It resists the constraints of conventional, lecture-dominated approaches that tend to receive students as passive audiences.

Vygotsky’s Sociocultural Theory

Lev Vygotsky's Sociocultural Theory emphasizes the social aspect of learning and the role of cultural context in cognitive development. His theory of the Zone of Proximal Development (ZPD) states that students learn most effectively when they are helped by more knowledgeable peers—e.g., teachers or peers—on a range of tasks that they cannot accomplish on their own but can do with guidance. This theory legitimates a use of collaborative learning, peer debate, and teacher scaffolding, which are all essential to a contemporary approach to teaching. In mathematics education, these practices facilitate deeper understanding by having students vocalize their thinking, work through problems collaboratively, and gain immediate feedback. Vygotsky's theory highlights the need to instruct in ways that are responsive to levels of students' development, social setting, and learning setting—factors frequently overlooked in unyielding traditional schooling methodologies.

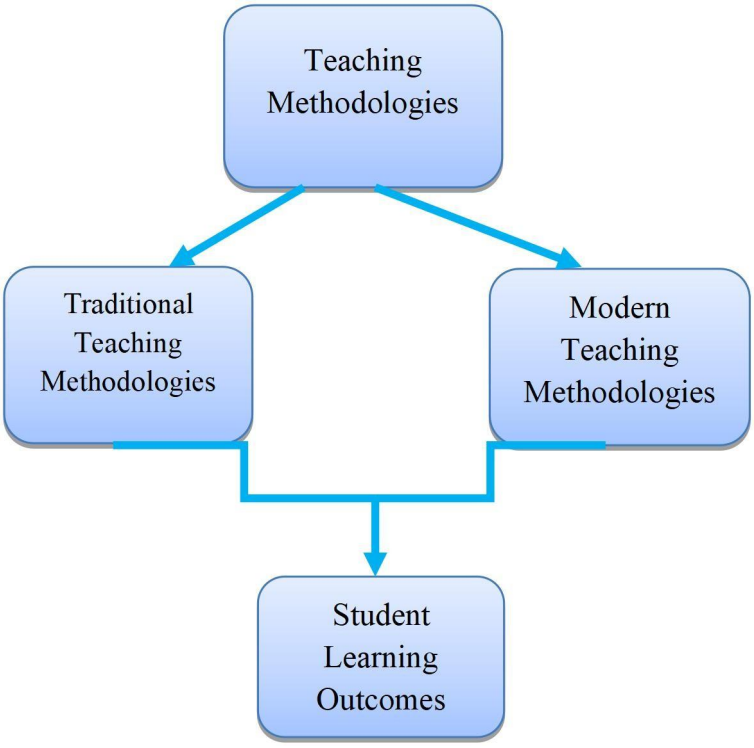
This research applies these theoretical bases to investigate the influence of various pedagogies—traditional versus contemporary—on the learning performances of students in mathematics. Traditional methods approximate behaviorist perspectives centered on repetition and external regulation, while contemporary methods represent the constructivist and sociocultural ideology

that learning is interactive, developmental, and situated. Using these theories, the research investigates not only if instructional approaches influence students' learning, but also how the process of learning is constructed through interaction, engagement, and teaching strategies. This theoretical framework assists in explaining the findings with regard to student participation, classroom dynamics, and conceptual development in mathematics learning.

Conceptual Framework

The theoretical model of this research is premised on the notion that instructional methods have a direct impact on students' math performance. There are two variations of instruction that are discussed as independent variables: traditional and modern. Traditional instruction is often characterized by lecture-oriented, teacher-directed approaches, whereas modern instruction focuses on student-centered, interactive instructional strategies like activity-oriented assignments, inquiry learning, and technology use. The dependent variable, student math performance, is measured by an achievement test that is formatted to measure conceptual understanding and problem-solving skill. This theory is based on constructivist learning theory that posits that students construct knowledge better when actively involved in meaningful learning experiences (Vygotsky, 1978; Bruner, 1996). The model offers a foundation for investigating to what degree teaching practices influence learning outcomes and comparing the effectiveness of conventional and contemporary pedagogy in public secondary institutions.

Figure 1



Research Gap

While global literature largely endorses current teaching methods in mathematics, there are limited localized studies in rural Pakistani districts. Where research does exist, findings tend to generalize without taking into account regional conditions, student backgrounds, instructor training, and infrastructure. Empirical studies are needed that look at teaching methods in particular, hard-to-reach areas such as Shaheed Benazirabad. Knowing how traditional and

contemporary methods affect mathematics learning in such an environment can assist in planning more successful interventions for comparable public school settings.

Research Methodology

Research Design

The current research utilized a quantitative approach in examining the effect of conventional and contemporary instructional methods on the learning achievement of students in mathematics. Quantitative research was deemed appropriate since it enabled objective measurement, numerical comparisons, and statistical testing of the association between teaching approaches and academic performance (Creswell, 2014). The research employed a comparative design, which allowed the researcher to compare differences in students' achievement between two groups, one instructed using conventional lecture-oriented methods and the other instructed using contemporary, student-centered approaches like activity-based and inquiry-based instruction. The design was appropriate for establishing statistically significant differences in outcomes from various teaching practices within the natural context of the classroom. Through this method, the study quantified the efficacy of instructional strategies in actual classroom settings and offered evidence-based recommendations for enhancing mathematics instruction in public secondary schools of Shaheed Benazirabad.

Population

The population for this research was all the students enrolled in Shaheed Benazirabad District, Sindh, Pakistan, public secondary schools. Both male and female students enrolled in grade 9 and 10, where mathematics is one of the compulsory subjects on the syllabus, were included. This population was chosen since students at the secondary level are at a crucial phase of constructing abstract mathematical thinking, and their learning outcomes are also greatly determined by the methods of instruction. In this research, public sector schools were specifically targeted since these schools normally adhere to uniform curricular regulations and are highly inclined to use conventional teaching methods because of restricted resources and professional development programs. Additionally, this population was of significance in investigating the comparative efficacy of conventional and contemporary teaching methodologies within an actual and practical learning environment.

Sampling and Sample Size

This research used a purposive sampling method to choose secondary schools and students in terms of the nature of teaching practice used—traditional or contemporary. Purposive sampling was suitable since the research involved the choice of specific cases that matched the research aim of comparing pre-specified instructional methods. This method allows the researcher to intentionally engage participants who share specific qualities applicable to the research, promising rich and concentrated data collection (Etikan, Musa, & Alkassim, 2016). Six Shaheed Benazirabad district public secondary schools were chosen in total—three employing conventional teaching practices and three employing modern, student-focusing methods. Among the schools, 180 Grade 9 and 10 students participated, with 90 students in each teaching category. Sample size was decided on the basis of convenience accessibility, availability of the subjects, and comparative research design. Based on Cohen's (1992) statistical power standards, a sample size of 64 subjects per group can be used to detect a medium-sized effect with 80% power at a significance level of 0.05. Therefore, 90 students per group were deemed a sufficient sample to perform with reliable outcomes and enhance group comparisons' validity.

Data Collection Tool

Two major instruments were employed for collecting data in this research:

a) Structured Observation Checklist

A structured observation checklist was employed to classify mathematics classes according to the teaching method used—traditional or modern. The checklist contained such indicators as teacher-centered instruction, student engagement, technology application, group work, and inquiry strategies. The tool allowed the researcher to confirm the instructional practice being followed in each classroom before collecting student outcome data. Such checklists are routinely applied in classroom-based research to determine observable teaching behaviors (Wragg, 2013).

b) Mathematics Achievement Test

To assess students' learning achievements, a mathematics achievement test was constructed in accordance with the Grade 9 and 10 national curriculum. The test consisted of 20 items, which were a combination of multiple-choice questions, short-answer items, and an application-based item. The test was designed to gauge concept understanding, problem-solving abilities, and application in real-life settings. The test was checked by subject specialists to guarantee content validity, and pilot-tested for simplicity and dependability. Internal consistency reliability (KR-20) was 0.78, and this is acceptable in education testing (Gay, Mills, & Airasian, 2012).

Data Collection Procedure

Data collection was conducted in two phases in six sample public secondary schools in Shaheed Benazirabad district. The researcher collected data by making classroom observations by employing the structured checklist to identify whether or not teachers were implementing traditional or modern teaching methodologies. This was required in order to categorize the schools into the two comparison groups, the traditional-method schools and the modern-method schools. During the second phase, a standardized mathematics achievement test was given to students at Grade 9 and 10 in both treatment and control groups. The test took place under standard conditions in order to allow for fairness and limit outside influence. The results obtained were subsequently used for descriptive and inferential statistical analysis. Ethical principles were practiced during the process. School heads were first given permission, and students volunteered to participate. Their answers were kept private and were used only for scholarly purposes.

Data Analysis Technique

To test the first hypothesis, which sought to establish the overall effect of teaching methodology on students' academic achievement, a simple linear regression was employed. In this regression model, teaching methodology (rated as a categorical predictor) was held as the independent variable, while students' mathematics scores served as the dependent variable. This enabled the researcher to assess how much variation in teaching methodology predicts students' outcomes. The magnitude and direction of the relationship were evaluated using the regression coefficient and R^2. To examine the second hypothesis, which contrasted students' performance under conventional and contemporary teaching approaches, an independent samples t-test was performed. The test contrasted the mean scores of the students in the two categories to evaluate if there was a statistically significant difference between them. It was appropriate to test differences between two independent groups on a continuous outcome variable. All the data were analyzed with SPSS, and the statistical significance level was set at $p < 0.05$. Descriptive statistics like mean, standard deviation, and frequency distributions were also documented to give an overview of the performance pattern of students across the two instructional methods.

Research Ethics

All ethical precautions were taken into account during the study. Prior approval was obtained from school authorities prior to conducting observations and tests. Students were included on a

voluntary basis and notified of the research purposes. Personal or identifying information was not gathered, assuring total confidentiality and anonymity. The data were employed exclusively for academic use, and participants were treated with respect and fairness, in keeping with standard ethical standards for educational research (BERA, 2018).

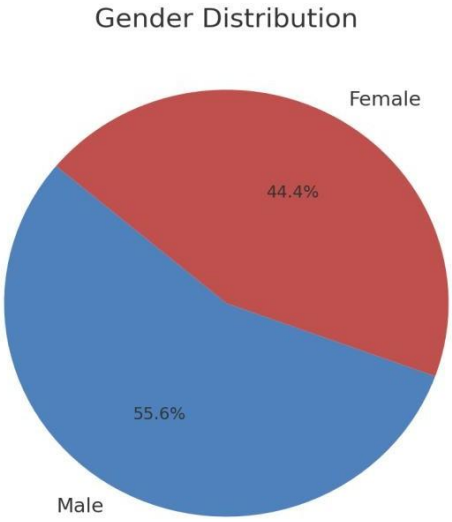
Results and Discussion

This section provides the demographic picture of the students who took part in the research. The data were examined with frequency counts and percentages.

Table 1 Gender Distribution

Gender	Frequency (f)	Percentage (%)
Male	100	55.6%
Female	80	44.4%
Total	180	100%

Figure 2

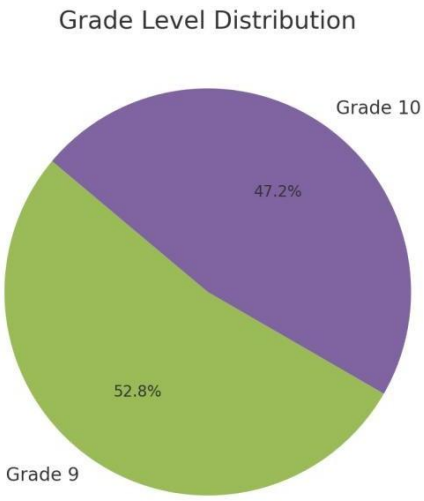


A sample of 180 students from Shaheed Benazirabad's public secondary schools took part in this research. Demographic information — processed in tables and augmented with pie charts — presents a well-organized and purposefully balanced sample, guaranteeing the validity of the research results. Out of 180 individuals, 100 (55.6%) were male, half of whom were female (80 or 44.4%). Although male students outnumber female students slightly, the gender split is still adequately balanced. This provides an even balance so that gender-neutral interpretations are possible, reducing the likelihood of gender bias in assessing how varying teaching methods influence student performance. The pie chart that accompanies it gives a speedy visual indication of this ratio, reaffirming the inclusivity of the sample.

Table 2 Grade Level

Grade Level	Frequency (f)	Percentage (%)
Grade 9	95	52.8%
Grade 10	85	47.2%
Total	**180**	**100%**

Figure 3

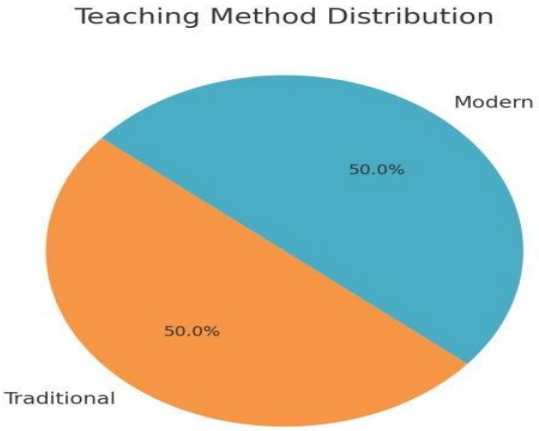


The sample of students was taken almost equally from both grades: 95 students (52.8%) were from Grade 9 and 85 students (47.2%) were from Grade 10. The balance ensures that the results are generalizable to both lower and upper secondary pupils, capturing differences in cognitive development, curriculum experience, and difficulty of assessment. The almost equal distribution enhances the internal validity through the control of grade-level variation.

Table 3 Types of Teaching Methods Observed

Teaching Method	Frequency (f)	Percentage (%)
Traditional	90	50.0%
Modern	90	50.0%
Total	**180**	**100%**

Figure 4



One of the most significant aspects of the design of this study was equal representation of instructional approaches. precisely 90 students (50%) were taught by conventional means, and the other 90 students (50%) were taught using contemporary, student-centered instructional approaches. Such careful balance is not only methodologically advisable but also necessary for a comparative study. It makes sure that the differences in academic performance, if noted, can reasonably be expected to attribute to the teaching style and not to sampling bias. The visual evidence through pie chart also ensures this equal distribution.

Descriptive Analysis of Data

Table 4 Observation of Traditional Teaching Practices

Traditional Teaching Practices	Mean	Std. Deviation
1. Teacher uses lecture method only	0.89	0.31
2. Emphasis on rote memorization	0.83	0.38
3. Limited student questioning	0.80	0.40
4. No use of multimedia/technology	0.87	0.34
5. Focus only on textbook examples	0.91	0.28

The data on observation show a strong dependence on textbook-based approaches of teaching in the majority of the observed classrooms. The most observed maximum was for the item "Focus only on textbook examples" (M = 0.91, SD = 0.28), indicating that nearly all teachers relied heavily on textbooks with minimal contextual elaboration. Likewise, "Teacher uses lecture method only" had a high mean score (M = 0.89, SD = 0.31), reflecting favoring one-way content delivery with little student interaction or participation. The question "No use of multimedia or technology" (M = 0.87, SD = 0.34) attests that educational aids like projectors, animations, or digital materials were seldom incorporated into lessons. In addition, the fact that routine memorization (M = 0.83, SD = 0.38) and restricted student questioning (M = 0.80, SD = 0.40) were prevalent indicates a predominantly passive learning culture, where discussion, analytical thinking, and critical thinking were not being employed to their full potential. Overall, the relatively high mean scores on all five traditional items indicate that teacher-centered instruction

is the prevalent pedagogy in Shaheed Benazirabad's public secondary schools, perhaps denying students opportunities for active learning and conceptual understanding.

Table 5 Observation of Modern Teaching Practices

Modern Teaching Practices	Mean	SD
1. Use of real-life examples	0.42	0.49
2. Students engaged in group work	0.39	0.49
3. Teacher uses multimedia or visual aids	0.35	0.48
4. Inquiry-based discussions encouraged	0.37	0.48
5. Individual feedback based on students' understanding	0.40	0.49

Conversely, the self-observation of contemporary pedagogies showed modest enactment of student-oriented pedagogical approaches. The highest mean was seen for "Use of real-life examples" (M = 0.42, SD = 0.49), as less than half of the teachers made an effort to link mathematics content to practical or real-world situations. The following item "Teacher provides feedback based on students' understanding" (M = 0.40, SD = 0.49) and "Students engaged in group work" (M = 0.39, SD = 0.49) were also seldom observed, indicating a lack of personalized and collaborative learning activities. Similarly, "Inquiry-based discussions" (M = 0.37, SD = 0.48) and "Use of multimedia or visual aids" (M = 0.35, SD = 0.49) were scored low by mean, suggesting that new and discovery-oriented teaching aids are never incorporated into class activities. They point to a mismatch between pedagogical aspirations and the realities of classroom practice. Even with international pressure in favor of constructivist learning conditions, observed schools exhibit low levels of interaction with contemporary methods that may promote student motivation, comprehension, and future intellectual development.

Table 6 Students' Mathematics Achievement Scores

Group	N	Minimum	Maximum	Mean	SD
Traditional Method	90	6	17	11.62	2.54
Modern Method	90	9	19	14.27	2.68
Total	180	6	19	12.95	2.91

Students instructed under contemporary teaching practices scored much better (M = 14.27, SD = 2.68) than their counterparts under conventional practices (M = 11.62, SD = 2.54). The spread was also greater in the contemporary group (Max = 19), symbolizing greater conceptual understanding and performance. The overall mean of all students was 12.95, portraying average learning performance. These results were in agreement with those of classroom observation, where contemporary practices were fewer, and potentially restrictive of common student achievement.

Hypothesis Testing

Hypothesis 1: Teaching methodologies do not significantly influence students' learning outcomes in mathematics.

Table 7 Simple Linear Regression

Model	Unstandardized B	SE	t	P
(Constant)	11.62	0.28	41.50	.000
Teaching Methods	2.65	0.39	6.79	.000**
R^2	0.21			

Note n = 180, ***p< .001, Dependent variable: Students' Learning in Mathematics.

A linear regression was done to establish if teaching method substantially predicts the achievement of students in mathematics. The independent variable, teaching method, was labeled 0 for traditional and 1 for modern. The model was statistically significant, F (1,178) = 46.1, p < 0.001, and it shows that teaching method is a robust predictor of student performance. The R^2 of 0.21 indicates that 21% of the variance in test scores among students can be attributed to the teaching method type. The unstandardized coefficient for teaching method, B = 2.65, indicates that students who were taught using contemporary methods averaged 2.65 points higher in test scores than those who were taught by conventional means. The p = .000 shows that this difference is very highly statistically significant. Therefore, the null hypothesis (H_{01}) is rejected and it is stated that teaching methods have a substantial impact on students' learning achievements in mathematics.

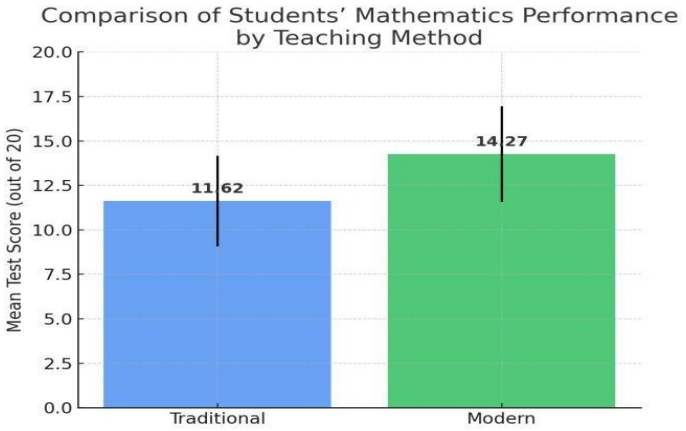
Hypothesis 2: There is no significant difference in students' mathematics performance between traditional and modern teaching methodologies.

Independent Samples t-Test Comparing Students' Mathematics Achievement by Teaching Method

Table 8 Independent Samples t-Test

Teaching Method	N	Mean	SD	t	Df	P
Traditional Method	90	11.62	2.54			
Modern Method	90	14.27	2.68	**-6.79**	178	**.000**
Note: Equal variances assumed. Significant at $p < 0.05$.						

Figure 5



Independent samples t-test was used to compare whether there was a significant difference in achievement among students taught with traditional and contemporary teaching methods. There was a statistically significant difference between the two groups t (178) = - 6.79, $p < 0.001$. Students taught with contemporary teaching methods (M = 14.27, SD = 2.68) performed better than those taught with traditional methods (M = 11.62, SD = 2.54). The p = .000 is less than 0.05, leading us to reject the null hypothesis. There is a significant difference in students' mathematics performance between traditional and modern teaching methodologies with modern methods showing superior results.

Discussion

The purpose of the present research was to examine the effect of teaching methods on mathematics learning of students at public secondary schools in district Shaheed Benazirabad. The findings of the simple linear regression analysis revealed that teaching methodology is a significant predictor of mathematics achievement of students. The model was significant, $F(1,178) = 46.1$, $p < .001$, and had an R^2 value of 0.21, representing that 21% of variance in students' performance is accounted for by the manner of teaching method employed (traditional or modern). The positive unstandardized coefficient (B = 2.65) implies that students taught with modern teaching methods scored on average 2.65 points higher than those instructed with traditional methods. This result is consistent with the increasing opinion in educational science that the way of teaching is essential to determine academic achievement. These findings are in accordance with constructivist theory of learning, which posits that learning is most effective when learners are actively constructing knowledge and not merely receiving information (Vygotsky, 1978; Bruner, 1996). The application of contemporary approaches—e.g., activity-based learning, group discussion, inquiry-based teaching, and technology integration—gives students more chances to interact, learn in context, and think collaboratively, which are missing from typical classrooms. A study conducted by Uusimaki and Nason (2004) and Sullivan et al. (2014) further suggested that contemporary practices not only enhance conceptual understanding of mathematics but also lower student anxiety and create a positive attitude towards the subject. Thus, the results of the regression in this research confirm previous findings that pedagogical method is not a neutral factor, but a strong determinant of pupils' academic achievement.

The results of the independent samples t-test indicated a statistically significant difference in mathematics performance among students based on the teaching method utilized. Students taught with contemporary teaching practices obtained a significantly higher mean (M = 14.27, SD = 2.68) than those taught with conventional methods (M = 11.62, SD = 2.54), with a t-value of - 6.79 and $p < .001$. These findings necessitate the rejection of the null hypothesis that no significant difference between the two groups exists. This finding is in line with a large body of literature which views the positive influence of contemporary, student-centered teaching methods on the academic performance of students in mathematics. For example, Boaler (2016) and Anthony and Walshaw (2009) discovered that active pedagogical strategies of inquiry-based instruction, collaborative problem-solving, and technology integration increase students' motivation and strengthen conceptual understanding. On the other hand, teacher-directed approaches heavily based on rote learning and one-way delivery of lecture tends to encourage passive learning and restrict the capacity of students to apply mathematics concepts critically (Farooq & Shah, 2008). The findings also concur with the data from the observation checklist, which was that although the conventional practices were used more often in the classrooms, the only classrooms that made use of contemporary pedagogical practices exhibited improved student performance. This emphasizes the prowess of cutting-edge pedagogical practices even

when offered in a small number of classrooms. In addition, the wide gap among groups supports the necessity for professional development programs intended to prepare teachers in public secondary schools—especially those in disadvantaged districts such as Shaheed Benazirabad—to take on more student-centered and interactive approaches using the skills and tools needed. These results support the argument made by Ertmer and Ottenbreit-Leftwich (2013) that teacher training, beliefs, and classroom culture are important factors in the effective incorporation of modern methods.

Conclusion

This research examined the effect of instruction methodologies on student mathematics performance at the secondary level in Shaheed Benazirabad public schools. Results indicated that instructional methodology has a very effective influence on student performance. Particularly, students instructed through contemporary, student-oriented methodologies like inquiry-based learning, group learning, and integrating technology performed much better in mathematics than their peers instructed through conventional, lecture-based methodologies. The descriptive analysis revealed that while older approaches are more frequently employed, contemporary approaches albeit in limitations provides greater learning outcomes. The regression analysis also substantiated that the teaching method is a statistically significant predictor for students' academic performance. Moreover, the independent t-test revealed a distinct performance difference in favor of contemporary approaches to teaching. The findings validate the constructivist theory of learning, which places importance on student participation and active construction of knowledge. The findings also underscore the need to reform pedagogy in public schools, where ancient instructional approaches continue to prevail. Closing this gap is crucial to enhancing mathematics achievement and making learners ready for actual problem-solving in the real world.

Recommendations

Based on the result of this research, the following are the proposed recommendations:

- Teachers must be motivated and prepared to implement student-centered approaches like problem-solving activities, peer learning, and computer-based instruction to deepen mathematical understanding.
- Government and school administration must conduct periodic professional development workshops centered on the effective application of contemporary pedagogies in mathematics.
- Curriculum developers ought to incorporate interactive learning activities and facilitate flexible lesson planning in order to facilitate contemporary teaching methods in mathematics classes.
- Schools must be equipped with enough technological equipment (e.g., multimedia projectors, digital materials, math software) to facilitate the use of innovative pedagogy.
- School authorities should observe teaching approaches in the classroom and offer ongoing support and guidance to teachers innovating new approaches.

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