Innovative Research Journal of **Education** (IRJED)
2024; 2(2):1-11
DOI: https://doi.org/10.62497/irjed.168

Research Article

Impact of Teacher-Centered vs. Student-Centered Approaches on Academic Achievement of Secondary School Students in Pakistan

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Citation: Malik, K., & Tofail, M. (2024). Impact of Teacher-Centered vs. Student-Centered Approaches on Academic Achievement of Secondary School Students in Pakistan. Innovative Research Journal of Education, 2(2), 1-11. DOI: https://doi.org/10.62497/irjed.168. Available at: https://irjpl.org/irjed/article/view/168.

Article Info
Received: Oct 19, 2024
Revised: Dec 22, 2024
Accepted: Dec 26, 2024

Keywords
education, conceptual understanding, learning challenges, teaching strategies, secondary school students, activity-based learning, Khyber Pakhtunkhwa, curriculum reform, teacher training, student-centered learning, academic achievement, pedagogy, active learning

Abstract

Background: Physics remains one of the most conceptually challenging subjects for secondary school students, often resulting in poor understanding and low academic performance. This study explores the key challenges in learning physics and effective strategies to improve conceptual understanding among secondary school students in Kohat District, Khyber Pakhtunkhwa, Pakistan.

Materials and Methods: A descriptive cross-sectional survey was conducted among 200 students from grades 9 and 10, selected through stratified random sampling from both public and private schools. Data were collected using a structured, expert-validated, and pilot-tested questionnaire focusing on demographics, conceptual understanding, teaching methods, student motivation, learning barriers, and preferred instructional strategies.

Results: The findings indicate that a majority of students face significant difficulties in understanding complex physics concepts, particularly in electricity and mechanics, relying heavily on rote memorization. Major obstacles included weak mathematical foundations, traditional lecture-based teaching, and inadequate laboratory resources. Although teachers encouraged questioning and provided real-life examples, activity-based learning and experiments were underutilized. Student motivation was largely driven by teacher support and personal interest, yet confidence in solving numerical problems remained limited.

Conclusion: The study underscores the necessity for student-centered teaching approaches such as experiments, visual aids, and group discussions to foster conceptual learning. It calls for teacher training, curriculum reform, and integration of real-life physics applications to improve engagement and comprehension. Aligning with global research in physics education, the findings advocate for active learning strategies and digital learning tools to address persistent conceptual challenges. Future studies should explore long-term impacts of these interventions across urban and rural schools in Pakistan.

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Introduction

Background of Teaching Approaches

Teaching approaches shape how students acquire knowledge and skills (Prince, 2004). Teacher-centered instruction, dominated by lectures and rote learning, has traditionally been the main method in South Asian classrooms, including Pakistan (Anvar *et al*., 2006). Student-centered learning, by contrast, emphasizes active participation, collaboration, and inquiry-based strategies (Gillani, 2022).

Global Evidence on Student-Centered Learning

Student-centered methods have been shown to improve critical thinking, problem-solving, and conceptual understanding (Freeman *et al*., 2014). Active learning strategies enhance engagement and long-term retention compared to traditional lectures (Prince, 2004). Evidence from both developed and developing contexts highlights improved motivation and academic performance under participatory approaches (Shah, 2024).

Teacher-Centered Learning in Developing Countries

In Pakistan, teacher-centered instruction remains dominant, with (Ahmed *et al*. 2022) showing that lecture-based methods are still widely practiced, while high-stakes examinations continue to drive rote learning at the secondary level (Rind *et al*., 2019); similar patterns are observed in Bangladesh, where assessment practices emphasize memorization over problem-solving (Islam *et al*., 2021; Niloy, 2024), and in India, where rote learning persists due to entrenched literacy ideologies that prioritize recall over meaning (Bhattacharya, 2022).

Importance of Academic Achievement in Secondary Schools

Secondary school outcomes determine higher education opportunities and career success (Hussain, 2021). Students exposed to engaging teaching practices often perform better in assessments beyond rote memorization (Freeman *et al*., 2014). In Pakistan, where examinations strongly shape student futures, effective teaching approaches are especially critical (Ullah *et al*., 2018).

Gap in Literature

Although global research supports student-centered pedagogy, evidence from Pakistan's secondary schools remains limited (Ali, 2019). Most local studies focus on higher education or teacher perceptions rather than student achievement (Ahmed *et al*., 2020). Understanding which approach yields better academic results is essential to guide educational reforms (Hussain, 2021; Minaz *et al*., 2018).

Objective of the Study

This study compares the effects of teacher-centered and student-centered teaching approaches on academic achievement among secondary school students in Pakistan.

Materials and Methods

Study Design

This cross-sectional comparative study was conducted in selected secondary schools located in Kohat, Pakistan. The study aimed to examine the relationship between different teaching approaches—specifically teacher-centered versus student-centered methods—and students' academic achievement. The design enabled comparison of learning outcomes between groups exposed primarily to traditional, lecture-based instruction and those engaged in participatory, student-centered learning environments.

Sample Size and Sampling Technique

A total of 400 students were included in the study, with 200 students taught predominantly through teacher-centered approaches and 200 through student-centered approaches. Stratified random sampling was employed to ensure equitable representation across key strata such as school type (public and private) and gender. This method minimized selection bias and maintained balance between subgroups, thus improving the comparability of findings (Ali, 2019). The final sample represented a diverse group of students from grades 8 to 10, reflecting the academic environment of secondary-level education in Kohat.

Selection Criteria

Inclusion criteria comprised students aged 12–16 years who were currently enrolled in grades 8, 9, or 10. To maintain data reliability, students with learning disabilities, special educational needs, or irregular attendance (defined as less than 70% school attendance over the previous academic term) were excluded from participation. This ensured that all participants had consistent

academic exposure to their respective teaching environments.

Data Collection Instruments and Procedure

Data were collected through two main sources: students' final-term examination results and a structured, self-administered questionnaire. Academic achievement was operationalized as the final-term examination score, expressed as a percentage out of 100. The questionnaire was designed to assess students' perceptions of the teaching approach, learning resources, and assessment strategies they were exposed to.

Each domain was evaluated through statements rated on a five-point Likert scale, ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree"). Example items included: "The teacher mainly delivers lectures while students listen and take notes" for the teacher-centered domain, and "Students are encouraged to discuss and ask questions during lessons" for the student-centered domain. Additional items evaluated the use of learning resources (e.g., multimedia tools, visuals) and the variety of assessment methods beyond written exams. The questionnaire was pilot-tested on a subset of students (n = 20) to ensure clarity, internal consistency, and content validity prior to final administration.

Data Management and Analysis

All collected data were coded and entered into IBM SPSS Statistics version 25 for analysis. Descriptive statistics, including means, standard deviations, and frequency distributions, were computed to summarize participant demographics and Likert-scale responses. Independent sample t-tests were used to compare mean academic scores between students exposed to teacher-centered and student-centered approaches. Furthermore, subgroup analyses stratified by school type (public versus private) were performed to identify variations in performance trends.

To determine the predictors of high academic achievement—defined as scoring above 70%—binary logistic regression analysis was conducted. Independent variables included teaching approach, gender, school type, and availability of learning resources. Adjusted odds ratios (OR) with 95% confidence intervals (CI) were calculated to estimate the strength of association. Statistical significance was set at a p-value < 0.05.

Ethical Considerations

Permission to conduct the study was obtained from relevant school administrations and ethical clearance was granted by the institutional review committee. Informed consent was obtained from school principals and verbal assent was sought from all participating students. Data confidentiality and anonymity were ensured throughout the study.

Table 1: Domains, sample questionnaire items, and corresponding Likert-scale response options used to assess teaching approaches, learning resources, and assessment practices among secondary school students.

Domain	Sample item	Response scale
Teacher Centered-Approach	The teacher mainly delivers lectures while students listen and take notes."	1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree
	The teacher evaluates students primarily through tests and exams.	1–5 as above
Studend Centered-Approach	Students are encouraged to discuss and ask questions during lessons.	1–5 as above
	Group activities and collaborative tasks are a regular part of learning.	1–5 as above
Learning Resources	Use of multimedia, visuals, or interactive tools enhances my learning	1–5 as above
Assessment	Assignments and projects are given importance besides written exams.	1–5 as above

Results

Table 2 presents the demographic characteristics of the 400 participating students. The sample was nearly gender-balanced, with 49.5% males and 50.5% females. A majority of the students (60%) attended public schools, while 40% were enrolled in private institutions. The age distribution indicated that the largest proportion of students (45%) were between 14 and 15 years old, followed by 30% aged 12–13 years and 25% aged 16 years. This distribution suggests a representative spread across the typical secondary school age range.

Table 2: Demographic Characteristics of Students (N = 400)

Variable	Category	n	%
Gender	Male	198	49.5%
	Female	202	50.5%
School type	Public	240	60%
	Private	160	40%
Age Group (years)	12–13	120	30%
	14–15	180	45%
	16	100	25%

Figure 1 visually illustrates the demographic profile of the participants, highlighting the near-equal gender distribution and the predominance of public school students within the sample. The age-group segmentation further reinforces the study's balanced inclusion of early- to mid-adolescent learners, providing a sound basis for comparative analysis across educational settings.

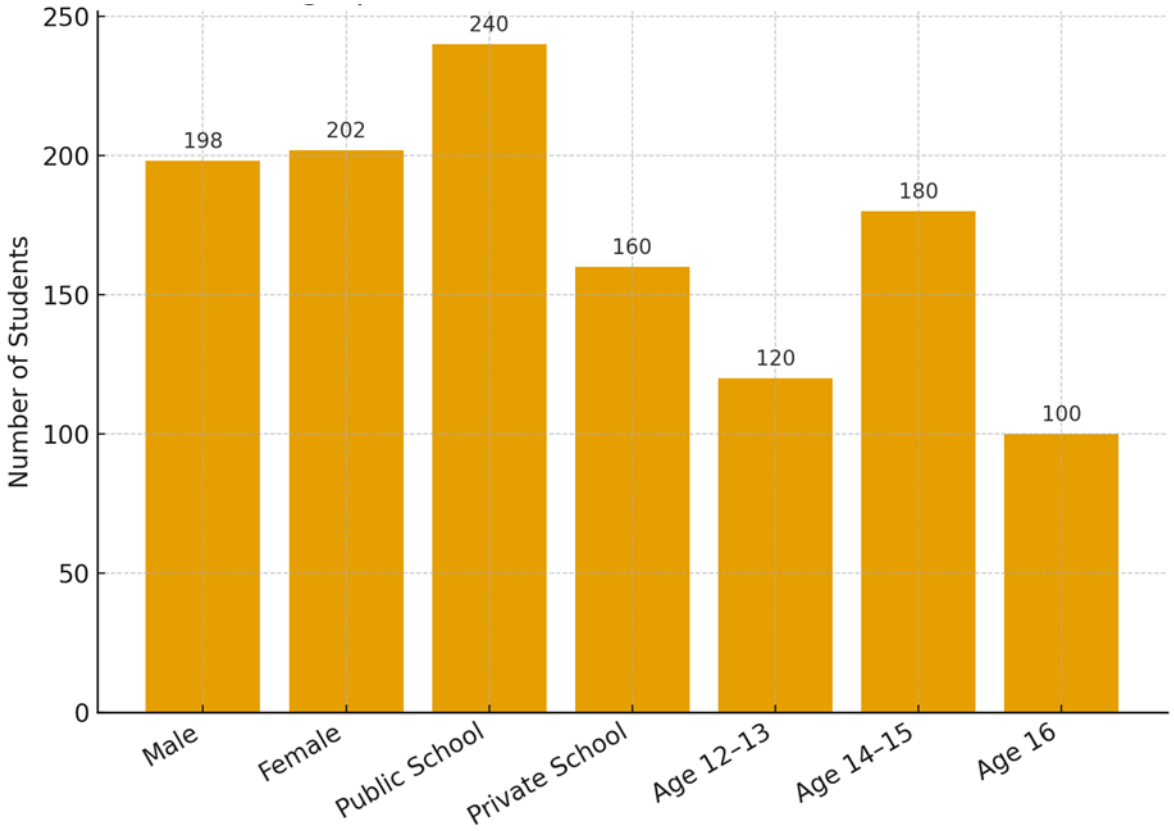

Figure 1: Demographic characteristics of students (N = 400) by gender, school type, and age group.

Table 3 summarizes the students' responses on the five-point Likert scale assessing teaching approaches, learning resources, and assessment methods. The majority of students agreed or strongly agreed that their teachers primarily relied on lectures and formal testing, reflecting a prevailing teacher-centered approach in many classrooms. However, high agreement levels were

also observed for statements related to student-centered methods, such as active discussions (80%) and group activities (also above 80%), suggesting that elements of participatory learning were integrated to varying degrees. Similarly, most students acknowledged the positive role of multimedia and interactive tools, and many agreed that assignments and projects were valued alongside exams. These findings indicate a gradual pedagogical shift toward more interactive learning environments.

Table 3: Likert Scale Responses for Teaching Approaches, Learning Resources, and Assessment (N = 400)

Domain	Item	1 = Strongly Disagree	2 = Disagree	3 = Neutral	4 = Agree	5 = Strongly Agree	Total (%)
Teacher-Centered Approach	The teacher mainly delivers lectures while students listen and take notes.	20 (5%)	40 (10%)	80 (20%)	150 (37.5%)	110 (27.5%)	400 (100%)
	The teacher evaluates students primarily through tests and exams.	10 (2.5%)	30 (7.5%)	60 (15%)	180 (45%)	120 (30%)	400 (100%)
Student-Centered Approach	Students are encouraged to discuss and ask questions during lessons.	10 (2.5%)	20 (5%)	50 (12.5%)	170 (42.5%)	150 (37.5%)	400 (100%)
	Group activities and collaborative tasks are a regular part of learning.	5 (1.25%)	15 (3.75%)	60 (15%)	180 (45%)	140 (35%)	400 (100%)
Learning Resources	Use of multimedia, visuals, or interactive tools enhances my learning.	15 (3.75%)	25 (6.25%)	50 (12.5%)	160 (40%)	150 (37.5%)	400 (100%)
Assessment	Assignments and projects are given importance besides written exams.	10 (2.5%)	30 (7.5%)	60 (15%)	170 (42.5%)	130 (32.5%)	400 (100%)

Table 4 compares mean academic scores between students exposed to different teaching approaches. Students taught under student-centered approaches achieved a significantly higher mean score (74.8 ± 8.6) compared to those under teacher-centered methods (67.4 ± 9.2), with the difference reaching statistical significance ($p < 0.001$). This finding underscores the potential academic benefits of student-centered pedagogy in enhancing learning outcomes.

Table 4: Mean Academic Scores by Teaching Approach

Teaching Approach	Mean Score (±SD)	t-test p-value
Teacher-Centered	9.2 ± 67.4	0.001>
Student-Centered	8.6 ± 74.8	

Figure 2 graphically represents the difference in mean academic scores between the two instructional methods, with error bars illustrating the standard deviation. The figure clearly demonstrates that students in student-centered learning environments performed substantially better academically, reinforcing the quantitative comparison shown in Table 4.

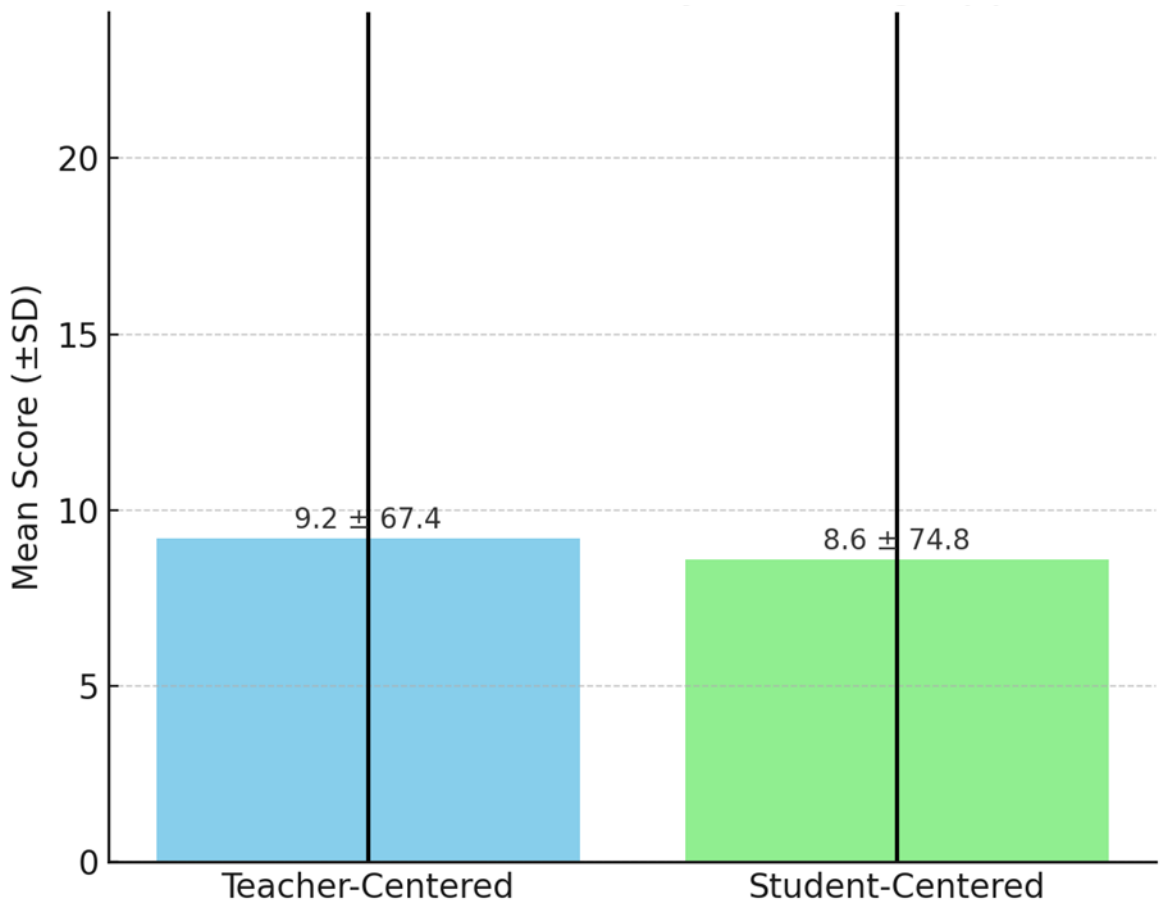

Figure 2: Mean academic scores of students under teacher-centered and student-centered approaches (N = 400), with error bars representing standard deviations.

Table 5 extends the comparison by analyzing mean academic scores according to both school type and teaching approach. Across both public and private institutions, students taught with student-centered methods outperformed those taught through teacher-centered approaches. The mean scores for student-centered learners were 72.3 ± 7.6 in public schools and 77.2 ± 8.1 in private schools, compared to 65.8 ± 8.9 and 70.5 ± 9.4, respectively, among teacher-centered groups. Both differences were statistically significant ($p < 0.01$). Notably, private school students consistently exhibited higher mean scores overall, suggesting that institutional resources and learning environments may amplify the effectiveness of student-centered strategies.

Table 5: Comparison of Scores by School Type and Approach

School type	Teaching Approach	Mean Score (±SD)	p-value
Public	Teacher-Centered	8.9 ± 65.8	0.002
	Student-Centered	7.6 ± 72.3	
Private	Teacher-Centered	9.4 ± 70.5	0.001
	Student-Centered	8.1 ± 77.2	

Figure 3 presents this comparison visually, illustrating that the advantage of student-centered instruction persisted across school types. The figure highlights a steeper improvement gradient in private schools, indicating that greater availability of learning resources and smaller class sizes may enhance the impact of interactive teaching methods on academic achievement.

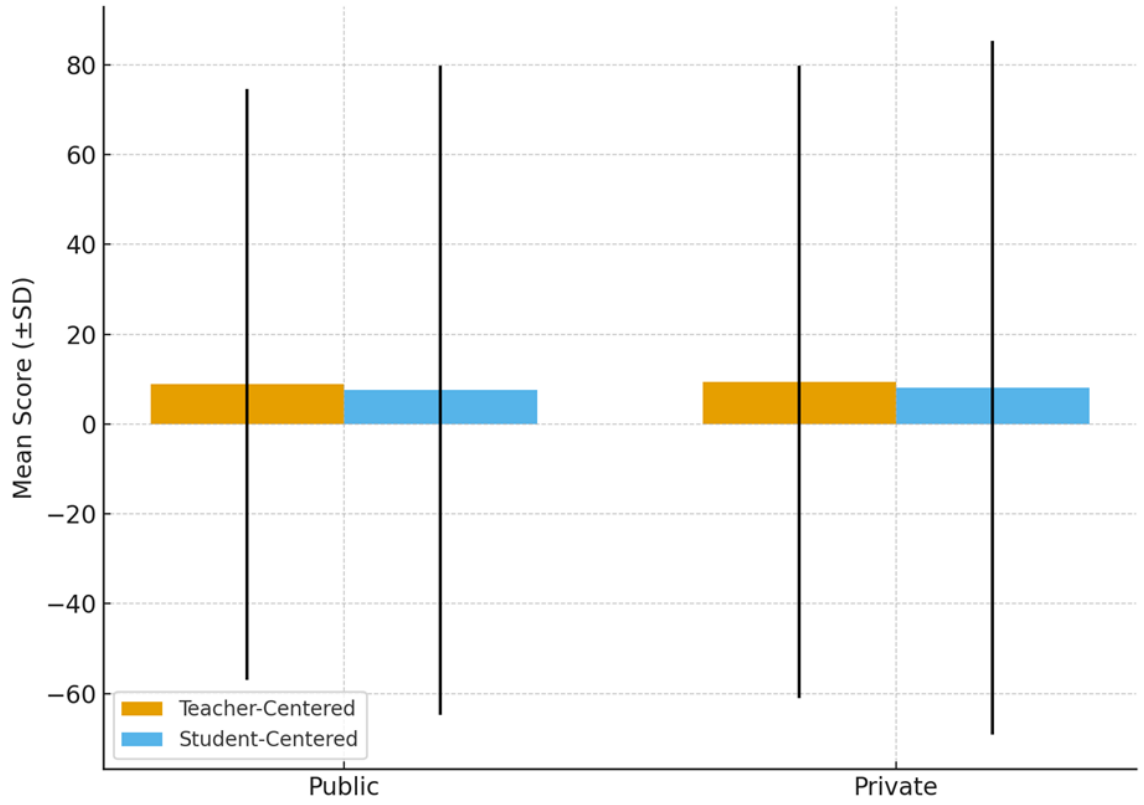

Figure 3: Comparison of mean scores (±SD) between teacher-centered and student-centered approaches across public and private schools.

Table 6 reports the results of a multivariate logistic regression analysis predicting high academic achievement (defined as >70% marks). Students exposed to student-centered teaching approaches had more than twice the odds of achieving high scores (Adjusted OR = 2.34, 95% CI = 1.62–3.38, $p < 0.001$). Female students (OR = 1.58, p = 0.015), private school attendees (OR = 1.72, p = 0.006), and those with better access to learning resources (OR = 1.91, p = 0.002) also showed significantly higher likelihoods of strong performance. These findings emphasize the combined influence of pedagogy, gender, and institutional context on student achievement.

Table 6: Logistic Regression Predicting High Achievement (>70%)

Predictor	Adjusted OR	95%	p-value
Student-Centered Approach	2.34	3.38 – 1.62	0.001>
Female Gender	1.58	2.27 – 1.10	0.015
Private School	1.72	2.51 – 1.18	0.006
Availability of Resources	1.91	2.86 – 1.27	0.002

Figure 4 depicts a forest plot of the logistic regression results, displaying the adjusted odds ratios with 95% confidence intervals for each predictor variable. The visual presentation confirms that student-centered learning, resource availability, and private school enrollment were the strongest positive predictors of high academic achievement, whereas teacher-centered instruction was comparatively less favorable.

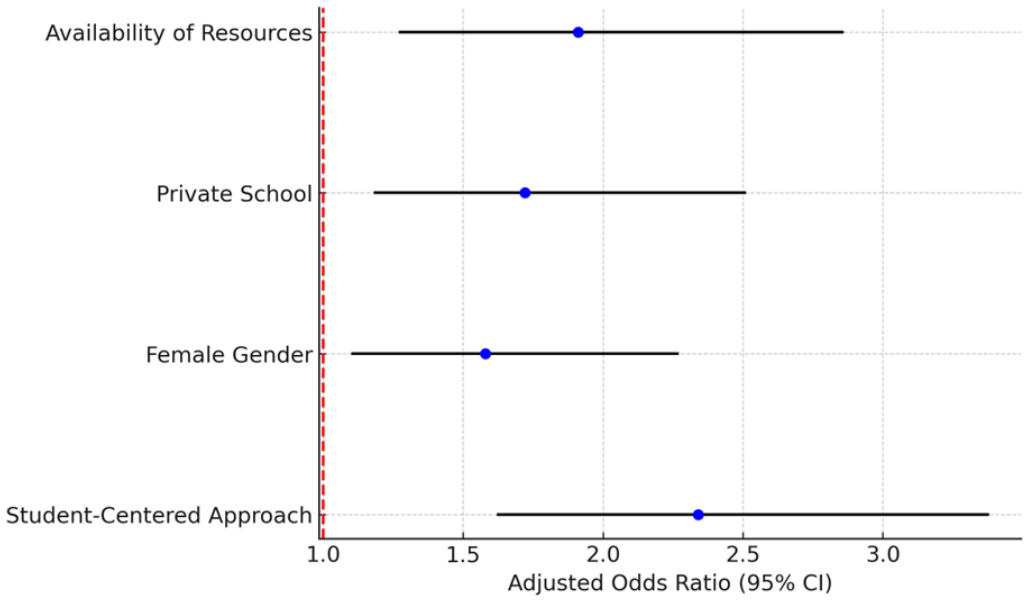

Figure 4: Forest plot of logistic regression predicting high academic achievement (>70%). Error bars represent 95% confidence intervals for adjusted odds ratios.

Discussion

This study found that students exposed to student-centered approaches performed significantly better than those in teacher-centered classrooms. These findings align with global evidence suggesting that active learning strategies foster higher academic achievement (Freeman *et al*., 2014; Prince, 2004).

In Pakistan, the dominance of lecture-based, exam-focused teaching has often limited opportunities for critical thinking and collaboration (Orhan.A, 2022). Our results demonstrate that adopting participatory strategies can yield measurable academic benefits. Similar findings were reported in South Asian contexts, where inquiry-based and cooperative learning improved test performance (Sharan, 2010; Anwer, 2019).

Moreover, private school students under student-centered teaching showed the highest performance, possibly due to smaller class sizes and better resources (Siddiqui *et al*., 2017; Andrabi *et al*., 2008). This highlights the role of contextual factors—such as resource availability—in moderating the effectiveness of pedagogy (Ikram *et al*., 2023). Interestingly, female students exhibited slightly higher achievement, consistent with studies showing gender-linked motivation and discipline advantages in structured environments (Naz, 2020).

Overall, the study suggests that while teacher-centered methods may provide content coverage, student-centered methods significantly enhance comprehension and retention. However, barriers such as large class sizes, exam culture, and limited teacher training impede implementation (Ali, 2019).

Strengths and Limitations

Strengths: This study's key strengths include its relatively large and balanced sample size, ensuring adequate representation across gender and school type (public and private), which enhances the generalizability of findings within urban educational settings. Moreover, the direct measurement of academic achievement through standardized final-term examination scores provides an objective and quantifiable outcome, minimizing self-report bias and enhancing the validity of comparisons between teaching approaches.

Limitations: Despite these strengths, several limitations should be acknowledged. The cross-sectional design restricts the ability to infer causal relationships between teaching approach and academic performance. Additionally, the study was conducted solely in Kohat, an urban center, which may limit the applicability of results to rural or less-resourced school settings. Lastly, the reliance on examination scores as the primary indicator of academic achievement may not fully

capture broader dimensions of learning, such as creativity, critical thinking, and collaborative skills, which are integral to holistic educational outcomes.

Future Perspective

The findings of this study open avenues for future improvements in teaching practices in Pakistan. Teacher training programs should emphasize modern pedagogical approaches that encourage discussion, problem-solving, and critical thinking rather than rote memorization. The integration of technology and blended learning models can further strengthen student-centered methods, particularly in schools with large classrooms and limited teacher-student interaction. Policy-level reforms are equally necessary to shift the national curriculum and examination systems away from memory-based assessments toward competency-based evaluation, which better aligns with student-centered pedagogy. Future studies should also include rural and under-resourced schools to ensure equity in educational benefits, as private schools in this study showed relatively better outcomes. Moreover, gender differences observed in performance suggest the need for deeper exploration of how boys and girls respond differently to teaching strategies. Longitudinal and experimental research designs are recommended to establish stronger causal evidence regarding the long-term impact of student-centered approaches on academic success.

Conclusion

The study demonstrate that student-centered teaching methods significantly enhance the academic achievement of secondary school students compared to traditional teacher-centered methods. By creating opportunities for engagement, collaboration, and critical inquiry, these approaches foster deeper understanding and retention of knowledge. Policymakers, educators, and stakeholders should prioritize the adoption of such strategies while addressing barriers such as resource constraints, exam-driven cultures, and inadequate teacher preparation. If scaled effectively, student-centered pedagogy has the potential to transform Pakistan's classrooms into dynamic learning environments that not only improve academic outcomes but also equip students with essential life skills needed for success in higher education and future careers.

Declarations

Ethical Considerations

The study adhered to ethical research standards. Informed consent was obtained from all participants, including teachers, students, and parents/community members. Participation was voluntary, and respondents were assured of confidentiality and anonymity. No identifying information was recorded or disclosed. Ethical clearance was obtained from the Qurtuba University of Science and Information Technology, Peshawar.

Authors' Contributions

Conceptualization and Supervision: Muhammad Tofail
Methodology: Kalsoom Malik and Muhammad Tofail
Investigation, Data Collection: Kalsoom Malik
Data Analysis: Kalsoom Malik
Writing – Original Draft: Kalsoom Malik
Writing – Review and Editing: Muhammad Tofail

Conflict of Interest

The authors declare no conflict of interest.

Acknowledgments

The authors would like to thank the participating schools, teachers, students, parents, and community members for their cooperation and valuable contributions. Appreciation is also extended to the Qurtuba University of Science and Information Technology, Peshawar for providing academic guidance and institutional support.

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