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Assessing the Quality of Teaching Methodology in Secondary School Physics: Evidence from Bahawalpur, Pakistan

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Abstract

Quality teaching is a cornerstone of effective education and a central determinant of students' achievement worldwide. In developing countries such as Pakistan, science education—especially Physics—faces critical challenges due to traditional teaching methods, limited resources, and lack of professional training for teachers. This study investigates the quality of teaching methodology in Physics classrooms across public-sector secondary schools of Bahawalpur, Pakistan. Drawing upon a stratified proportionate random sample of 115 principals, 139 teachers, and 800 students, data were collected through a validated questionnaire grounded in internationally recognized indicators of quality teaching. Confirmatory factor analysis established the reliability and validity of the instrument (Cronbach's α = 0.85). Findings highlight stark differences in perceptions: while teachers rated their practices highly, both students and principals reported dissatisfaction, particularly regarding activity-based learning, student-centered pedagogy, questioning strategies, and formative assessment. The study stresses the immediate need for reforms in teacher professional training, integration of modern pedagogies, and provision of resources to align Physics teaching with constructivist and student-centered paradigms. The paper concludes with recommendations for policy makers, curriculum developers, and teacher training institutions.

Keywords Quality Teaching, Physics Education, Secondary Schools, Teaching Methodology, Pakistan

Introduction

Education reduces poverty, improves living conditions and civic sense, enhances productivity, and helps ensure sustainability. Quality of education is directly linked with quality of classroom teaching (Munawar & Malik, 2024) . It has positive impact on students' learning interest, self-efficacy and academic achievement (Zhu & Kaiser, 2022). Quality teaching has emerged as a global priority in education reform agendas. International agencies such as UNICEF (2000), UNESCO (2015), and the OECD emphasize learner-centred approaches, formative assessment, and engaging classroom environments as hallmarks of quality (Henard & Leprince-Ringuet, 2008). In Pakistan, the National Education Policy (2009) and Vision 2025 also stress the improvement of teaching quality as essential for national progress. New national curriculum (2022-23) based on the Next Generation Science Standards (NGSS) has been introduced up to the college level, still the classroom teaching continues to rely on traditional methods (Khan & Choudhary, 2025). Despite these commitments, secondary education in Pakistan remains the weakest link in the educational chain (Imran, 2008). Akhtar et al. (2024) and Shah and Khan (2015) observed that unproductive teaching methodologies, in Pakistan, result in deficits in critical thinking and problem-solving abilities among students. Science education, particularly Physics, suffers from reliance on rote memorization, outdated teaching strategies,

overcrowded classrooms, and inadequate teacher preparation (Soomro, Qaisrani, & Uqaili, 2011; Afridi, 2018). This has resulted in declining student interest in Physics, poor conceptual understanding, and limited application of knowledge to real-life contexts.

Several studies have investigated aspects of teaching quality in Pakistan (Dilshad & Saeed, 2015; Bhutto et al., 2018), yet few have systematically analysed classroom practices in Physics at the secondary level using multiple stakeholder perspectives. Moreover, the most of the previous studies relied on survey method only and collected data only from teachers or administrators or from students and did not address triangulation. The present research study bridges this gap by assessing the quality of teaching methodology in Physics classrooms in Bahawalpur district, drawing on the opinions and perceptions of principals, teachers, and students. It not only identifies current practices but also highlights the gaps between teacher-reported methods and student experiences.

Following objectives guided the current study:

1. To investigate the perceptions of physics teachers, principals, and learners about the quality of classroom teaching.
2. To compare these perceptions across stakeholder groups.
3. To analyse the extent to which effective teaching methodologies are applied in Physics classrooms.

The hypotheses tested include whether significant differences exist between stakeholder perceptions and whether these perceptions align with internationally recognized indicators of quality teaching methodology.

Theoretical Framework

Behaviourism, constructivism and Vygotsky's theory of Zone of Proximal Development (ZPD) underpin the present study. Constructivism views students as active learners who construct knowledge through experience, reflection, and social interaction (Mishra, 2023; Mohammed & Kinyo, 2020). Behaviorist and constructivist theories of feedback mechanism promotes students' awareness about their learning (Rabbani et al., 2023). These teaching strategies based on the theories of constructivism and behaviourism support engaging learners with content in more meaningful way through corrective feedback (Cakir, 2022). The theory of Zone of Proximal Development (ZPD) highlights the importance of scaffolding, cooperative and collaborative learning, both of which are central to effective science instruction (Margolis, 2020; Rahman, 2024). Bloom's taxonomy further underscores the need for higher-order thinking—analysis, synthesis, and evaluation—beyond rote memorization.

The above mentioned learning theories provide the theoretical framework to the effective quality teaching learning process, encompassing on activity-based student-centered teaching approaches.

Review of Related Literature

Teaching practices that supported by differentiated and individualized instructions, higher order questioning, develop critical thinking (Nurlaela et al., 2025; Salar & Turgut, 2021).

Student-centered activity-based differentiated instructions promotes quality learning (Dairo et al., 2024; Goodwin, 2024; Sulemanoski, 2022). However, in Pakistan, Activity-based teaching support higher order performance and problem solving abilities. It also promotes 21st century skills. Krishan and Al-Rsa'i (2023) observed that need based technology-integrated differentiated instructions are superior and outperform conventional method of instructions in teaching science. Differentiated instructions enable teachers to adjust teaching methodology and teaching styles according to students' learning styles, background prior subject knowledge, motivation and learning abilities. There is no single teaching strategy fit for all learners. Al-Shehri (2020) observed that the theory of differentiated instructions provides activities that enables all learners to learn according to their level and needs. Student- centered instructions are based on the theory of constructivism and promote active and effective learning. According to Tang (2023), both students and teachers perceive student-centered instructions more effective than teacher-centered instructions but designing of such learning environment is challenging for both teachers and school administration. Quality teaching requires addressing individual learning needs and styles (Kharb et al., 2013). Yet, most teachers in Pakistan apply uniform instructional strategies, neglecting the diverse needs of students (Farooq & Regnier, 2011).

Formative assessment practices support learning to large extent. Formative assessment provides effective feedback to improve students' learning and motivation (Karaman, 2021;

Leenknecht et al., 2021; Morris et al., 2021). This is assessment as and for leaning. Although formative assessment motivate students, due to certain barriers, it is not successful in Pakistan (Shabana et al., 2024). The nature of formative assessment is not well understood as the educator perceives it just a test after the completion of a chapter (Khalid, 2024; Muzamil et al., 2024). It does not help stakeholders to the extent it should be (Khalid, 2024).

Research indicates that Physics is often perceived as difficult due to abstract concepts, mathematical content, and lack of contextual examples (Khan et al., 2012). Teachers' overreliance on lecture methods further alienates students (Nafees, 2011; Tanenbaum & Gallagher, 2024). International studies (Bogador et al., 2024; Kotsis, 2024; Mathaha, 2024) highlight the significance of inquiry-based teaching-learning in promoting critical thinking, conceptual understanding, creativity, collaboration, communication and problem-solving skills.

The literature suggests a consistent gap between recommended practices and classroom realities, particularly in Pakistan. This study contributes by empirically investigating these gaps through the perspectives of multiple stakeholders.

Study Framework

Although most of the frameworks address particular aspect related to teaching quality they flop to capture the interconnected, cohesive and synthetic nature of classroom teaching quality. The literature indicated the 'perception-practice gap' in classroom teaching and support the need for a structured model that defines quality and outlines the conditions for its implementation. The 'Constructivist-Aligned Physics Teaching Quality Framework (CAPTQF) synthesizes empirical findings, theoretical foundations, and practical recommendations into a unified model to bridge the gap between policy aspiration and classroom reality. The CAPTQF is a holistic framework that integrates 'Theory and Practice', addresses 'Systemic Barriers', provides a measurable set of practices and promotes 'Reflective Practices'. The CAPTQF stresses that effective teaching is a reflective and adaptive process. The conceptual flow of the framework is illustrated below:

Component 1: Foundational Theories. Behaviourism, Social Development Theory (SDT), Constructivism and Bloom's taxonomy provide major philosophies and theoretical underpinnings to the framework. SDT highlights collaboration, scaffolding, and the Zone of Proximal Development (Rahman, 2024), behaviourism appreciates timely feedback to shape learning (Mokaya & Natade, 2024), constructivism points out the active role of learners in knowledge construction (Jaleel & Verghis, 2015), and whereas Bloom's taxonomy highlights that target of quality teaching is addressing the higher-order thinking skills (Ragab et al., 2024; Zaidi et al., 2018).

Component 2: Enabling Conditions. These are the systemic prerequisites for quality teaching. Teacher's competence & their continuous professional development (CPD), resource provision (access to AV aids, laboratory equipment, and activity-based learning materials), structural support (manageable class sizes and curricula that support formative assessment).

Component 3: Core Teacher Practices. These are measurable indicators of quality. It includes Student-Centered Pedagogy (SCP), Effective Questioning (EQ), Activity-Based Learning (ABL), Differentiated Instruction (DI), Contextualization & Activation (CA).

Component 4: Formative Processes: Formative assessment includes the use of ongoing assessments, descriptive & timely feedback and reflective practice.

Component 5: Student-Centered Outcomes: These are the key metrics for success. These includes 'Enhanced Conceptual Understanding (ECU)', Development of Critical Thinking (DCT) & Problem-Solving Skills (PSS)', 'Increased Student Engagement & Motivation (ISEAM)' and 'Improved Scientific Literacy'(ISL).

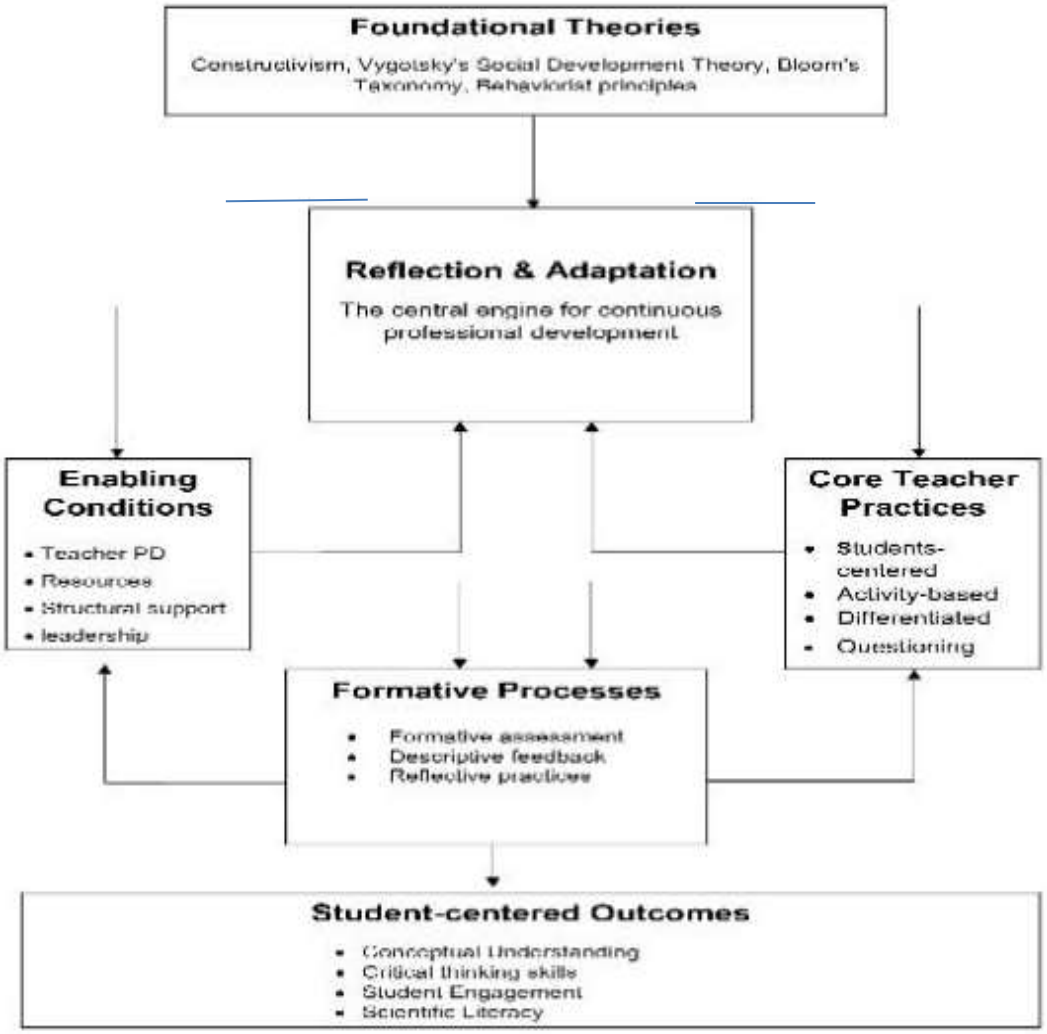

Figure 1. Study Framework

Methodology

The study employed a quantitative survey design. The population consisted of principals, Physics teachers, and Grade 10 science students from public-sector secondary schools in Bahawalpur. Using stratified proportionate random sampling, 800 students, 115 principals and 139 Physics teachers were approached to ensure representativeness across urban and rural schools.

A 5-point Likert type scale was developed based on international indicators of quality teaching methodology, including: addressing individual differences, activity-based teaching, use of audio-visual aids, activation of prior knowledge, questioning strategies, student-centered learning, and content knowledge. The instrument was validated by a panel of experts and pilot-tested. Confirmatory factor analysis confirmed construct validity. Reliability, estimated for the subscales and overall was as follow:-

Table 1 **Estimated Reliability Co-Efficient of Scale**

S. No.	Subscale	No .of statements	Cronbach (α)
1.	Core Teaching Practices Scale (CTPS)	06	0.89
2.	Enabling Conditions Scale (ECS)	06	0.86
3.	Formative Process Scale (FPS)	05	0.88
	Overall	**29**	**0.87**

Data were collected directly from respondents with informed consent. Statistical analyses included descriptive statistics, ANOVA and Scheffe' tests for comparing group perceptions. Participation was voluntary. Anonymity and confidentiality were maintained, and results were reported without identifying individuals or schools. Only public schools, located in district Bahawalpur, were approached. Therefore, results may not generalize to private schools or other regions.

Results

The results reveal significant differences among stakeholder perceptions of teaching methodology quality. Teachers consistently rated their practices more favourably compared to principals and students. The results indicate the perception-practice gap clearly. Following are the Key findings.

Table 2 **Perceptions of CAPTQF-Aligned Teaching Practices**

Indicator	Principals (M)	Teachers (M)	Students (M)	F	Sig.	Scheffé's Test (Significant Differences)
Differentiated Instruction (C3)	3.15	3.84	2.41	54.7	p<.001	All three groups differ significantly
Activity-Based Learning (C3)	2.31	3.45	2.40	49.2	p<.001	All pairs significantly different
Use of AV Aids (C2)	2.12	4.04	2.27	62.5	p<.001	Principals–Teachers, Teachers–Students
Student-Centered Pedagogy (C3)	2.37	3.96	2.03	56.8	p<.001	All pairs significantly different
Activation of Previous Knowledge (C3)	2.66	3.89	3.12	42.3	p<.001	Principals–Teachers, Teachers–Students
Higher-Order Questioning (C3)	2.70	3.86	2.29	58.4	p<.001	All pairs significantly different
Wait Time (C3)	2.68	4.14	3.22	46.9	p<.001	All pairs significantly different
Content Knowledge (C3)	4.06	4.49	3.22	31.8	p<.001	Students differ significantly from both Principals and Teachers
Use of Practical Examples (C3)	3.19	4.22	2.62	39.4	p<.001	All pairs significantly different
Learning Environment	28.63	32.79	28.50	41.6	p<.001	Teachers differ significantly from both
Classroom Assessment	38.73	50.92	33.16	59.7	p<.001	All pairs significantly different

The ANOVA results confirm statistically significant differences between groups ($p < .05$), indicating that stakeholders perceive teaching methodology differently. Teachers' self-assessments were markedly higher than evaluations from principals and students.

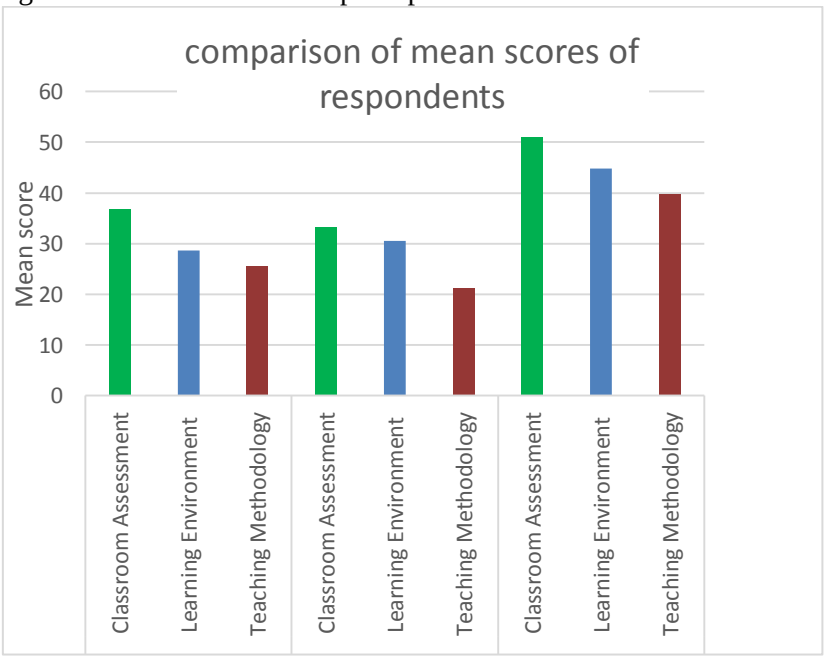

Figure 2. Comparison of mean scores of the respondents

The comparison, as shown in the figure 2, indicated the disparity in the perspectives of the respondents regarding the quality of different dimensions of classroom teaching.

Discussion

The findings discloses the misalignment within the CAPTQF model. The findings reveal a critical mismatch between teachers' perceptions and those of students and principals. Teachers reported frequent use of modern strategies such as AV aids and student-centered approaches, yet these practices were not consistently observed or experienced by students. This discrepancy may reflect social desirability bias in self-reporting by teachers. This disagreement suggests that while teachers may be aware of these methodologies, their implementation is either infrequent, ineffective, or perceived differently (Kaymakamoglu, 2018).

The results align with earlier studies in Pakistan (Dilshad & Saeed, 2015; Bhutto et al., 2018), which noted that teachers possess strong subject knowledge but rely heavily on lecture-based instruction. Similar patterns have been reported internationally, where systemic challenges—overcrowded classrooms, insufficient resources, and examination pressures—limit the adoption of constructivist teaching methods (Chand, 2025; Goodrum et al., 2001; Ogunmade, 2005).

The limited use of higher-order questioning and formative assessment found in this study echoes concerns raised by Shabana et al. (2024). Without opportunities for inquiry and feedback, students are left with surface-level understanding and rely on rote memorization. Quality learning will remain a dream without this.

There is a need to overhaul the whole system on the modern dimensions to address above-mentioned concerns. Examination system, overall curriculum and use of modern technologies in teaching system. Teachers should be trained keeping the teaching standards in mind, emphasizing on the fact that mere mastery of subject content is not enough. Focus of teachers' professional development should be on their pedagogical skills and use of modern technologies in teaching-learning process. Adequate resources should be provided for quality instructions. There is impact of class strength on students' achievement (Abid & Saeed, 2022). Quality teaching in the subject of physics will definitely enhance students' problem-solving abilities, communication, collaboration, creativity and critical thinking.

Conclusion and Recommendations

A mismatch was found among the respondents regarding the quality teaching in the classroom. The study concluded that various indicators of quality teaching like learner-centered differentiated instructions, activity-based teaching, formative assessment and effective questioning for critical thinking are not practiced in Physics teaching practices. There is a need to explore why there is a practice-perception gap.

Recommendations

1. Adequate resources like provision of multimedia, physics lab, AV aids etc. are required to ensure quality teaching practice. Therefore, provision of these resources be prioritized.
2. Examination system should be improved to shift the focus of the stakeholders on quality teaching.
3. In teacher training programs, focus should be given on pedagogical skills.
4. Teachers should be trained how to use formative assessment practices.
5. Teacher should focus on the 'process aspect' of learning.
6. There is a need for activity-based learner-centered teaching.

By addressing these areas, quality of Physics education can be improved to large extent.

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