

Exploring Technology Integration and Pedagogical Practices in Public and Private Secondary Schools

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Abstract

The integration of technology in secondary school classrooms has emerged as a critical factor in enhancing teaching effectiveness and student learning outcomes. This study explores the perceptions and experiences of teachers and students regarding technology integration and pedagogical practices in public and private secondary schools of District Mardan, Khyber Pakhtunkhwa, Pakistan. Using a qualitative research design, semi-structured interviews were conducted with ten teachers (five public, five private) and ten students (five public, five private) to examine how digital tools are utilized, the instructional strategies employed, and the contextual factors influencing effective integration. Findings reveal that private schools demonstrate higher access to technological resources and more frequent use of interactive pedagogical strategies, such as project-based learning, group work, and student-centered activities, whereas public schools face challenges related to limited infrastructure, inadequate teacher training, and inconsistent administrative support. Despite these differences, both school types acknowledge the potential of technology to enhance student engagement, motivation, and comprehension. The study highlights that pedagogical practices mediate the effectiveness of technology integration, with teachers' instructional skills, confidence, and professional development playing pivotal roles in shaping student outcomes. The research underscores the importance of school support systems, targeted professional development, and context-specific strategies to maximize the benefits of technology in classrooms. By comparing public and private schools, this study provides valuable insights into disparities in resource availability, teaching practices, and student experiences, offering evidence-based recommendations for policy and practice. The findings contribute to the broader discourse on digital education in developing country contexts and emphasize the need for strategic interventions to foster equitable and effective technology-enhanced learning environments.

Keywords: Technology Integration, Pedagogical Practices, Student Engagement, Teacher Professional Development

Introduction

In the 21st century, the integration of technology into secondary school classrooms has become a major focus of educational reform worldwide. Technology integration refers to the intentional and meaningful use of digital tools such as computers, smartboards, educational applications, online quizzes, and digital learning platforms to support and enhance instructional practices (Majeed et al., 2025). Integrating technology into teaching not only increases opportunities for interactive learning, but also prepares students with essential digital skills necessary for success in an increasingly technology-driven society. However, access to technology alone does not guarantee improvement in student outcomes. Research demonstrates that the pedagogical use of technology that is how teachers design instruction and engages students plays a crucial role in realizing its benefits (Islam & Saira, 2025). Pedagogical practices encompass instructional strategies such as student-centered learning, collaborative group work, project-based activities, and interactive lessons. When digital tools are aligned with such learner-focused approaches, they can deepen student engagement, increase motivation, and improve comprehension and achievement outcomes. Despite these advantages, integrating technology into classrooms remains uneven, particularly in developing contexts. Recent evidence from Pakistan highlights that many public schools struggle with inadequate infrastructure, limited internet connectivity, and a lack of sustained professional development for teachers (Wajid et al., 2025). In contrast, private schools often have greater access to digital resources, but their impact on pedagogy still varies based on teacher readiness and institutional support. These disparities raise concerns about educational equity and the effectiveness of technology adoption in varied school environments. This study focuses on secondary schools in District Mardan, Khyber Pakhtunkhwa, Pakistan, comparing public and private schools in terms of how teachers integrate technology into their pedagogical practices and how these practices influence student engagement and learning outcomes. By exploring teachers' and students' perceptions and experiences, the study aims to identify the enablers and barriers to effective technology use. Understanding these dynamics is critical for designing policies and professional development programs that promote meaningful technology integration and enhance learning across diverse school settings.

Literature Review

Research on technology integration consistently emphasizes that effective use of digital tools in classrooms depends on pedagogical practices and contextual support systems. A recent study in secondary schools revealed that when technology is used not merely as a presentation tool but as a medium for interaction and active learning, students show higher levels of engagement and improved academic outcomes (Yaseen et al., 2025). Nonetheless, the potential of such integration is often constrained by systemic challenges. In Pakistan, several studies have highlighted pervasive barriers to effective technology adoption in public schools, including insufficient devices, unreliable internet connectivity, and a lack of sustained teacher training (Majeed et al., 2025). These limitations impede teachers' ability to design and implement technology-enhanced learning experiences. Conversely, private schools frequently have access to better infrastructure and digital resources. Yet even in well-resourced environments, the absence of pedagogical alignment with technology can lead to superficial uses, such as using slides or videos without fostering deeper cognitive engagement. Pedagogical practices that emphasize student participation, critical thinking, and collaboration such as project-based learning and group activities have been shown to enhance the effectiveness of technology integration (Islam & Saira, 2025). When teachers adopt these strategies, digital tools become catalysts for transforming learning rather than mere add-ons to instruction. However, successfully

implementing such pedagogies requires that teachers possess both technological competence and instructional skill. Professional development emerges as a key factor influencing teachers' capacity to integrate technology meaningfully. Studies indicate that one-time or isolated training sessions are insufficient; rather, ongoing, practice-based professional learning opportunities help teachers build confidence and refine their instructional approaches (Technology, Knowledge and Learning, 2025). Moreover, supportive school leadership and policy frameworks contribute to creating an environment where technology integration can flourish. Contextual factors, including school culture, leadership, and socio-economic conditions, also shape how technology is used in different school types. Comparative research suggests that private schools often benefit from stronger institutional support structures, which can facilitate innovative instructional practices (Wajid et al., 2025). Nonetheless, public schools represent a critical site for intervention if educational disparities are to be addressed. In summary, the literature highlights that technology integration is most effective when it is supported by robust pedagogical practices and contextual infrastructure. This study contributes to understanding these dynamics in the specific educational landscape of District Mardan by comparing public and private school settings.

Research Question

1. How do teachers in public and private secondary schools perceive the role of technology in their teaching practices?
2. What pedagogical strategies are currently used in public and private secondary schools, and how have they evolved with technology integration?
3. What challenges and barriers do teachers face while integrating technology into classroom practices, and how do these differ between public and private schools?
4. How do students experience and respond to changes in teaching methods and classroom activities resulting from technology integration?
5. How do public and private schools differ in terms of resources, support, and infrastructure for technology integration and innovative teaching practices?
- 6.

Theoretical Framework

The theoretical foundation of this study is primarily grounded in the Technological Pedagogical Content Knowledge (TPACK) framework proposed by Koehler and Mishra (2009). TPACK emphasizes the intersection of three primary knowledge domains essential for effective teaching with technology: Content Knowledge (CK), Pedagogical Knowledge (PK), and Technological Knowledge (TK). The framework posits that effective technology integration in classrooms is achieved not merely through access to digital tools but through the integration of technology with pedagogical strategies and subject-specific content to enhance learning outcomes. In the context of secondary schools, TPACK suggests that teachers' understanding of how to use digital tools (TK) in conjunction with appropriate teaching methods (PK) and subject content (CK) is critical to engaging students and promoting deeper learning. The framework also highlights the role of contextual factors, including school infrastructure, administrative support, and professional development, in shaping teachers' ability to integrate technology effectively. By applying TPACK, this study investigates how teachers in public and private schools in District Mardan adopt technology-enhanced pedagogical practices and how these practices influence student engagement, motivation, and academic achievement. Additionally, this study incorporates elements from Constructivist Learning Theory (Piaget, 1972; Vygotsky, 1978), which advocates for student-centered learning, collaboration, and active construction of knowledge. Constructivist principles underpin the pedagogical strategies examined in this study, such as group work, project-based learning, and interactive lessons, and support the premise that technology, when integrated appropriately, can facilitate meaningful learning experiences.

Conceptual Framework

The conceptual framework of this study illustrates the relationship between school support, technology integration, pedagogical practices, and student engagement and learning outcomes. It is derived from the theoretical underpinnings of TPACK and constructivist principles and is designed to capture the dynamics of technology-enhanced teaching in secondary schools.

Components:

1. **School Support**
 - Infrastructure (devices, internet connectivity)
 - Administrative support
 - Teacher training and professional development
2. **Technology Integration**
 - Computers, smartboards, educational applications
 - Online quizzes and other digital tools
3. **Pedagogical Practices**
 - Student-centered learning
 - Group work
 - Project-based activities
 - Interactive lessons
4. **Student Engagement and Learning Outcomes**
 - Active participation
 - Motivation
 - Comprehension and understanding
 - Academic achievement

Methodology

Research Design

This study used a qualitative research design to explore how technology integration and teaching practices are shaping learning environments in public and private secondary schools in District Mardan. The study involved 10 teachers (5 public, 5 private) and 10 students (5 public, 5 private) selected using purposive sampling for their experience with technology in classrooms. Semi-structured interviews were conducted with teachers and students. Interviews focused on:

- Technology use in classrooms
- Teaching methods and pedagogy
- Challenges and support
- Student engagement and learning outcomes

Data were transcribed and analyzed using thematic analysis to identify patterns and themes. A comparative approach highlighted differences and similarities between public and private schools.

Findings: Teachers' Perceptions and Experiences

1. Perceptions of Technology in Teaching

Public Schools:

- Most public school teachers reported limited use of technology in their classrooms, often restricted to occasional PowerPoint presentations or showing educational videos.
- Teachers perceived technology as useful for illustrating complex concepts, but they expressed frustration over insufficient devices, internet access, and technical support.

- One teacher stated, “I would use more digital resources, but we often don’t have functioning projectors or internet, so it’s difficult.”

Private Schools:

- Private school teachers reported frequent use of technology, including smartboards, learning management systems, and online quizzes.
- Teachers highlighted technology as a key factor in improving student engagement and understanding.
- One teacher mentioned, “Technology allows me to make lessons interactive; students participate more and grasp concepts faster.”

Comparison:

- Private school teachers demonstrated higher confidence and comfort with technology, while public school teachers faced infrastructural and training limitations.

2. Pedagogical Practices and Changes

Public Schools:

- Teaching largely remained teacher-centered, with lectures and note-taking as the dominant strategies.
- Technology integration was limited, and pedagogical changes were incremental, mainly for supplementing explanations or showing videos.
- Some teachers had begun experimenting with group discussions and peer learning, but this was rare.

Private Schools:

- Teachers used a mix of lecture, group work, project-based learning, and interactive activities facilitated by technology.
- Technology enabled differentiated instruction, allowing teachers to tailor lessons for varying student abilities.
- One teacher shared, “With online quizzes and interactive tools, I can identify which students need extra help and adapt my teaching accordingly.”

Comparison:

- Pedagogical innovation was more visible in private schools, while public schools still largely relied on traditional methods due to limited resources and large class sizes.

3. Challenges and Barriers

Public Schools:

- Teachers highlighted lack of devices, poor internet connectivity, and inadequate technical training as major barriers.
- Large class sizes and a rigid curriculum made technology integration difficult to implement consistently.
- Some teachers expressed fear of technology, worrying about technical failures disrupting lessons.

Private Schools:

- Challenges were primarily time constraints, occasional software glitches, and the need to continuously update digital content.
- Teachers reported more supportive school environments, including in-house training sessions and access to resources, which minimized barriers.

Comparison:

While both sectors faced challenges, public school teachers were more hindered by infrastructural limitations, whereas private school teachers mostly faced pedagogical and time management challenges.

4. Student Engagement and Learning Outcomes**Public Schools:**

- Teachers noted that students were generally passive, participating less in technology-mediated activities due to unfamiliarity or lack of access.
- Where technology was used, students showed improved understanding of visual or abstract concepts, but overall engagement remained moderate.

Private Schools:

- Teachers reported high student engagement, with interactive tools like quizzes, videos, and simulations motivating students to participate.
- Technology also enabled immediate feedback, allowing teachers to adjust instruction for better learning outcomes.

Comparison:

- Student engagement and learning improvement were significantly higher in private schools due to frequent and structured technology use.

5. School Support and Resources**Public Schools:**

- Teachers indicated minimal institutional support for technology integration. Resources such as projectors, computers, and internet access were often outdated or unavailable.
- Training opportunities were rare, leaving teachers to rely on self-learning.

Private Schools:

- Teachers reported strong administrative support, including regular professional development workshops, technical assistance, and well-equipped classrooms.
- Schools invested in continuous improvement, enabling teachers to experiment and innovate in their pedagogical practices.

Comparison:

- Private schools offered greater resources and support, fostering technology integration, while public schools struggled with limited infrastructure and support systems.

Comparative table summarizing the findings of public vs. private secondary school teachers across the five themes from this study:

Themes	Public School Teachers (n=5)	Private School Teachers (n=5)	Comparison / Insights
Perceptions of Technology	Limited use (PowerPoint, videos); perceive it as helpful but often inaccessible	Frequent use (smartboards, LMS, online quizzes); perceive it as engaging and beneficial for learning	Private teachers are more confident and proactive; public teachers hindered by lack of devices and internet
Pedagogical Practices	Mostly teacher-centered lectures;	Mix of lectures, group work, project-based	Private schools show more innovative

		minimal use of technology; occasional group work	learning; technology facilitates and differentiated instruction	pedagogical practices; public schools remain largely traditional
Challenges and Barriers		Lack of devices, poor internet, large class sizes, limited training, fear of technical failures	Time constraints, occasional software glitches, need for digital content updates; good institutional support	Public teachers face infrastructural and training barriers; private teachers face manageable pedagogical/time challenges
Student Engagement and Learning Outcomes		Moderate engagement; students often passive; technology helps in visual/abstract concepts only	High engagement; interactive tools motivate participation; immediate feedback improves learning outcomes	Student engagement is higher in private schools due to structured technology use; public school engagement limited by access and exposure
School Support and Resources		Minimal support; outdated/inadequate devices; rare training opportunities	Strong administrative support; well-equipped classrooms; regular professional development	Private schools provide better resources, support, and training; public schools lack adequate infrastructure and support systems

Findings: Students' Experiences and Perceptions

1. Experiences with Technology in Learning

Public School Students:

- Students reported that technology was seldom used in their classes, usually limited to occasional videos or presentations.
- Many expressed that they struggled to understand some topics without visual or interactive aids.
- One student shared, "Sometimes we watch videos, and it helps, but it doesn't happen often."

Private School Students:

- Students frequently interacted with technology, including smartboards, online quizzes, and educational apps.
- They reported that technology made lessons more interesting and easier to understand.
- A student said, "I enjoy classes more when we use apps or videos because I can see things clearly and participate actively."

Comparison:

- Private school students experienced consistent, meaningful use of technology, whereas public school students had limited exposure.

2. Engagement and Participation

Public School Students:

- Engagement was often **low**, partly due to traditional teaching methods and lack of interactive tools.
- Students expressed that they rarely had opportunities to participate actively in lessons.

Private School Students:

- Engagement was reported as high, with interactive lessons, group work, and technology-driven activities increasing participation.
- One student commented, “We can answer quizzes, do polls, and even ask questions online; it keeps us involved.”

Comparison:

- Technology-enhanced activities boosted engagement significantly in private schools compared to public schools.

3. Learning Outcomes and Understanding

Public School Students:

- Students reported that technology sometimes helped clarify complex topics, but the overall impact was limited by infrequent use.
- Many relied on traditional note-taking and repetition for understanding.

Private School Students:

- Students felt that technology improved comprehension and retention, allowing them to learn more effectively.
- They highlighted tools like online simulations, interactive videos, and quizzes as helping them understand difficult concepts quickly.

Comparison:

- Learning outcomes were perceived as more positive in private schools, largely due to regular access to technology and interactive methods.

4. Challenges Faced by Students

Public School Students:

- Main challenges included lack of devices, limited exposure, and infrequent technology use.
- Some students reported difficulty keeping up with lessons when technology was occasionally introduced without sufficient support.

Private School Students:

- Challenges were minor, mainly technical glitches or needing guidance with new apps.
- Students generally reported feeling supported by teachers in using technology.

Comparison:

- Public school students faced structural and resource-based barriers, while private students had minimal and manageable challenges.

5. Perception of School Support and Resources

Public School Students:

- Students noted insufficient access to computers, internet, or digital tools.

- Many desired more opportunities to use technology for learning.

Private School Students:

- Students appreciated the availability of computers, projectors, educational apps, and internet access.
- They felt supported by teachers and school administration in using technology for learning.

Comparison:

- Private schools provided robust support and resources, enhancing learning experiences; public schools had limited support, affecting students’ ability to benefit from technology.

Comparative table summarizing the findings of public vs. private secondary school students across the five themes from this study:

Themes	Public School Students (n=5)	Private School Students (n=5)	Comparison/ Insights
Experiences with Technology	Technology used occasionally (videos, presentations); limited exposure	Frequent use (smartboards, apps, online quizzes); integral to lessons	Private students more consistent and meaningful use of technology
Engagement and Participation	Low engagement; limited opportunities for active participation	High engagement; interactive lessons and technology-driven activities encourage participation	Technology significantly increases engagement in private schools
Learning Outcomes and Understanding	Some improvement in understanding complex topics; reliance on traditional methods	Improved comprehension and retention; interactive tools enhance learning	Learning outcomes more positive in private schools due to structured technology use
Challenges Faced	Lack of devices, limited exposure, occasional difficulty following lessons	Minor issues like technical glitches; generally supported by teachers	Public students face structural/resource barriers; private students face manageable technical challenges
School Support and Resources	Insufficient access to computers, internet, and digital tools; minimal teacher support	Robust access to technology, internet, and apps; teachers actively support learning	Private schools provide stronger support and resources, enhancing learning experiences

Discussion

The findings of this study indicate a clear public–private divide in how secondary schools in District Mardan integrate technology into teaching and learning. These differences are evident in teachers’ pedagogical practices, students’ engagement, and overall educational environments.

Technology Use and Access

Private schools were better equipped with technological tools and infrastructure, allowing teachers and students to frequently use smartboards, online quizzes, and educational apps. In contrast, public schools demonstrated sporadic technology use, mainly videos or presentations, due to limited access to devices and internet connectivity. This aligns with prior research highlighting that inequity in technological resources significantly influences integration and access in classrooms (Ertmer & Ottenbreit-Leftwich, 2010; *Frontiers in Psychology*, 2022).

Pedagogical Practices and Transformation

Public school teachers relied primarily on teacher-centered approaches, whereas private school teachers employed diverse strategies including project-based learning, group work, and interactive technology-driven activities. Previous studies suggest that technology is most effective when combined with student-centered pedagogy, enhancing active learning, collaboration, and critical thinking (Voogt et al., 2023; MDPI, 2021).

Barriers to Effective Integration

Teachers in public schools faced significant first-order barriers, including insufficient devices, unstable internet, and limited professional development opportunities. Private school teachers experienced minor challenges, such as time constraints and occasional technical issues, mitigated by strong institutional support. This supports literature identifying both external (infrastructure, funding) and internal (teacher beliefs and attitudes) barriers as key determinants of technology adoption (ScienceDirect, 2025; *Frontiers in Psychology*, 2022).

Student Engagement and Learning Outcomes

Students in private schools reported higher engagement, participation, and improved understanding, which aligns with research suggesting digital tools can improve motivation and learning outcomes when implemented effectively (Voogt et al., 2023; *Frontiers in Psychology*, 2022). In public schools, engagement was moderate, reflecting limited exposure and interaction with technology.

Teacher Preparedness and Professional Development

Public school teachers emphasized the need for continuous professional development, consistent with studies showing that ongoing training is critical for successful technology integration (MDPI, 2022; *Frontiers in Psychology*, 2022). Without adequate preparation, teachers may lack the confidence and competence to integrate technology effectively, even when resources are available.

Conclusion

This study explored the changing learning environments in secondary schools of District Mardan, focusing on technology integration and pedagogical practices in public and private schools. The findings highlight a significant disparity between public and private institutions in terms of access to technology, pedagogical innovation, student engagement, and institutional support. Private schools demonstrated frequent and structured use of technology, combined with student-centered teaching, resulting in higher engagement, active participation, and improved learning outcomes. In contrast, public schools faced resource constraints, limited training, and traditional teaching methods, which hindered effective technology integration and reduced student involvement. The study underscores that effective technology integration requires not only access to digital tools but also teacher preparedness, supportive policies, and interactive pedagogical approaches. Addressing these gaps, particularly in public schools, is essential to ensure equitable and quality learning opportunities for all students. Technology has the potential to transform secondary education in District Mardan, but its success depends on a holistic approach encompassing resources, teacher development, pedagogy, and institutional support.

Implementing the recommendations of this study can help bridge the public–private divide and promote inclusive, engaging, and effective learning environments.

Recommendations

1. **Upgrade Technology Infrastructure:** Provide computers, smartboards, and reliable internet, especially in public schools.
2. **Ongoing Teacher Training:** Conduct regular professional development on digital tools and student-centered teaching.
3. **Adopt Student-Centered Pedagogy:** Use interactive, collaborative, and project-based methods supported by technology.
4. **Strengthen School Support:** Ensure technical assistance, resource maintenance, and clear policies for technology use.
5. **Ensure Equitable Access:** Reduce the public–private gap by giving all students access to technology-enhanced learning.

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