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Designing Digital Learning Frameworks for Pakistani Schools: A Practical Approach

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ABSTRACT

The integration of digital technologies into education has emerged as a transformative strategy for addressing challenges in Pakistani private schools. This research investigates the effectiveness of digital tools in designing inclusive and impactful learning plans, employing theoretical frameworks such as TPACK, SAMR, and the 5E instructional model. The study examines how these tools enhance curriculum delivery and student engagement, with a specific focus on platforms like Padlet, Nearpod, and FigJam. This qualitative research utilised a sample of 20 Grade 2 students and 31 teachers from private schools, chosen for their established yet diverse technological infrastructure. The mixed-methods approach included surveys, semi-structured interviews, and classroom observations to evaluate the application and impact of digital technologies. The study also explored how these tools align with educational objectives and cater to varying learner needs. Key findings reveal that digital technologies significantly enhance collaboration, critical thinking, and differentiated learning experiences, particularly benefiting visual and auditory learners. However, challenges such as inconsistent internet access, limited resources, and varying teacher competencies were identified. The research proposes actionable strategies to address these barriers, including professional development for educators, improved infrastructure, and tailored digital solutions. This study highlights the critical role of digital tools in fostering scalable and inclusive learning environments. It underscores the need for sustained investment in technology integration and teacher training to ensure equitable access and maximise the potential of digital education in resource-constrained contexts. Future implications suggest adopting innovative models

and policies to bridge digital divide and enhance learning outcomes across diverse educational settings.

Keywords: *Digital Technologies, Inclusive Education, Pakistani Private Schools, SAMR Model, TPACK Framework*

INTRODUCTION

Education in Pakistan faces numerous challenges, including limited resources, diverse student needs, and unequal access to technology. These issues significantly hinder efforts to deliver quality education and meet global standards. In this context, digital tools are a powerful means to address these challenges. They enable teachers to create engaging lessons accommodating diverse learning styles and fostering critical thinking. Moreover, digital technologies provide a platform to integrate modern pedagogical approaches, promoting a culture of collaboration and innovation in the classroom (Mishra & Koehler, 2006).

Traditional teaching methods, constrained by outdated infrastructure and a lack of resources, often fail to cater to students' varied needs. However, educators can rethink their instructional strategies by incorporating frameworks like TPACK and SAMR (Kendon & Anselmo, 2022). This paper investigates the application of digital tools in two Pakistani schools, focusing on their potential to address systemic issues and improve educational outcomes.

This study was conducted in two branches of the Beaconhouse School System, which cater to early years and lower primary students. Both schools share similar technological infrastructure, including multimedia projectors, EyeRis interactive whiteboards, and netbooks. Enhanced Learning Environment (ELE) ambassadors support teachers by addressing technical challenges and providing continuous guidance, ensuring the seamless integration of digital tools into daily teaching practices (Ertmer & Ottenbreit-Leftwich, 2013).

Previous research in the Pakistani context has begun to map the terrain of educational technology, often highlighting the barriers to implementation. Studies such as those by Msambwa et al. (2024) consistently identify infrastructure deficits, inadequate teacher training, and socioeconomic disparities as primary impediments to digital integration. Their work confirms that merely introducing technology without addressing these foundational issues leads to limited and unsustainable outcomes. Similarly, research by Panigrahi et al. (2025) on primary schools in Punjab found that while teachers held positive attitudes towards technology, a significant gap existed between their perceived and actual technological pedagogical knowledge, often resulting in the use of digital tools for low-level substitution activities rather than transformative learning.

Building on this understanding, other studies have started to explore the potential of specific interventions. For instance, a study by Sain and Anggraini (2024) investigated a blended learning model in secondary schools and reported improved student motivation and retention of information. However, their research

also underscored the critical role of ongoing technical and pedagogical support, without which the initial gains diminished over time. These findings are instrumental as they move the discourse from identifying problems to proposing solutions, yet they often focus on older student cohorts, leaving a gap in understanding how these dynamics play out in early childhood education within private school systems, which represent a significant and growing sector in Pakistan.

The selection of these schools was intentional, as their infrastructure and support systems made them suitable for evaluating the impact of digital technologies (By & Ros, 2024). The study focused on a sample of 20 Grade 2 students from private schools to assess the effectiveness of digital tools on young learners. Additionally, 31 students and 21 teachers participated to provide a balanced perspective on how technology affects teaching and learning. The research explored the extent to which available tools aligned with curriculum objectives and student needs, ensuring that the findings could be contextualised for scalability across other private schools in Pakistan (Vygotsky & Cole, 1978).

The urgency of integrating technology in education has been further amplified by global shifts, particularly the COVID-19 pandemic, which exposed and exacerbated the digital divide in countries like Pakistan. Recent studies highlight that the pandemic acted as a catalyst, forcing a rapid, albeit uneven, adoption of digital tools and revealing both the potential and the profound disparities in technological access and pedagogical readiness (Abid et al., 2021). This recent context underscores the critical need for research that not only explores technological integration but also addresses the sustainability and equity of such initiatives in a post-pandemic era.

Moreover, while frameworks like TPACK and SAMR provide a solid theoretical foundation, their effective implementation in the Global South requires a nuanced understanding of local constraints. Contemporary research emphasises that successful technology integration is not merely about access to hardware but hinges on developing teachers' technological pedagogical knowledge (TPK) to design learning experiences that are both technologically sound and culturally relevant (Ahmed, 2024). This study responds to this call by examining the practical application of these frameworks within the specific socio-cultural and economic context of Pakistani private schools.

Consequently, this research aims to bridge a critical gap by moving beyond a simple evaluation of tool efficacy. It seeks to provide a contextualised model for designing digital learning plans that are inclusive, pedagogically robust, and scalable (Ros & Loeung, 2025). By investigating the interplay between technology, pedagogy, and local challenges, this study offers insights that are vital for policymakers and educators aiming to build resilient and equitable educational systems in resource-constrained environments.

LITERATURE REVIEW

The Pakistani education system is characterised by significant resource disparities, inconsistent technological access, and varying teaching quality, creating a pressing need for innovative solutions. To address these challenges, structured frameworks for technology integration are essential. Kendon and Anselmo's (2022) SAMR model offers a scaffold for educators to progress from using technology as a simple substitute for traditional tools (Substitution, Augmentation) toward leveraging it to transform learning experiences (Modification, Redefinition). This progression is critical for moving beyond superficial technology use to practices that significantly enhance student engagement and understanding. Complementing this, the Technological Pedagogical Content Knowledge (TPACK) framework emphasises the nuanced interplay between technology, pedagogy, and content knowledge (Mishra & Koehler, 2006). TPACK posits that effective technology integration requires teachers to synthesise these three knowledge domains to design meaningful and contextually appropriate learning experiences.

The theoretical underpinnings of these frameworks are supported by established learning theories. Vygotsky and Cole's (1978) sociocultural theory, which highlights the role of social interaction and collaborative learning, aligns perfectly with the functionalities of digital tools like Padlet and Nearpod. These platforms facilitate idea-sharing and cooperative knowledge construction, creating inclusive, interactive environments. Furthermore, tools like Nearpod's virtual reality features provide immersive experiences that help concretise abstract concepts, resonating with Bruner's (1977) theory of constructivism, which advocates for active, discovery-based learning.

The design of effective digital lessons is further informed by pedagogical models that structure cognitive and experiential learning. Bloom's (1956) Taxonomy provides a hierarchy for developing cognitive skills, encouraging lesson design that progresses from basic knowledge recall to complex analysis and evaluation. Similarly, Kolb's (2015) experiential learning cycle, which emphasises learning through concrete experience, reflective observation, abstract conceptualisation, and active experimentation, provides a robust model for creating hands-on, reflective digital activities. These frameworks collectively guided the development of the digital Scheme of Learning in this study, ensuring it was pedagogically sound and aligned with curriculum standards.

In the specific context of Pakistan, the application of these global frameworks must be tempered with an understanding of local realities. The digital divide is not merely a matter of hardware access but also encompasses disparities in digital literacy and pedagogical readiness. Recent studies by Msambwa et al. (2024) confirmed that infrastructural deficits and inadequate teacher training remain the most significant barriers, often leading to a reliance on rote-learning methodologies even when technology is available. This context necessitates a pragmatic approach

to technology integration, where ambitions for transformative learning are balanced with strategies to build foundational digital capacity.

Furthermore, the potential of technology to foster inclusive education is particularly salient in a country with diverse learner needs. Digital tools can provide scaffolding for students at different ability levels and offer alternative representations of content, which is a core principle of Universal Design for Learning (UDL) (Rose & Meyer, 2024). For instance, text-to-speech functions can support struggling readers, while interactive simulations can provide concrete experiences for students who struggle with abstraction. This potential to personalise learning pathways makes technology a powerful ally in addressing the wide variations in student preparedness often found in Pakistani classrooms.

The convergence of these pedagogical frameworks and contextual challenges informs the core problem this research addresses. While theoretical models like SAMR and TPACK provide a destination for technology integration, the journey in a resource-constrained environment requires a tailored roadmap. This study seeks to bridge this gap by exploring not only which tools are effective but also how the principles of constructivism, differentiated instruction, and UDL can be operationalised through technology within the specific infrastructural and cultural ecosystem of Pakistani private schools.

A central goal of integrating technology is to address learner diversity through differentiated instruction (Tomlinson, 2014). Digital tools offer unparalleled opportunities to cater to individual learning preferences; for instance, visual learners benefit from multimedia resources, while auditory learners can engage with podcasts. This approach aligns with Dewey's (1938) philosophy of experiential learning, which posits that education should involve active student participation and reflection. The capacity of digital tools to provide immediate feedback and facilitate visible learning processes also corroborates Yaseen et al. (2025) findings on the factors that significantly enhance student outcomes. By building upon these established theories and contemporary research, this study explores how digital technologies can be effectively adapted to overcome the specific constraints and leverage the unique opportunities within the Pakistani educational context.

RESEARCH METHODOLOGY

This study employed a convergent mixed-methods research design to comprehensively investigate the integration of digital technologies within classroom instruction. This approach was selected to triangulate data, allowing for the collection of both quantitative metrics and rich qualitative insights, thereby providing a holistic understanding of the phenomena (Creswell & Clark, 2017; Creswell & Creswell, 2023). The research was conducted within the natural setting of two private school branches, embracing a case study approach to yield context-dependent knowledge.

The pedagogical foundation for the intervention was the 5E instructional model, which structured all lesson plans into five distinct phases: Engage, Explore, Explain, Elaborate, and Evaluate. This model provided a consistent framework for integrating technology to foster active, inquiry-based learning. Specific digital tools, including Padlet, Nearpod, and FigJam, were strategically selected for their alignment with these phases. For instance, Padlet was utilized in the 'Engage' phase to capture student prior knowledge, Nearpod's interactive features facilitated 'Exploration' and 'Explanation,' and FigJam supported collaborative 'Elaboration' tasks.

The study sample was purposively selected to provide in-depth insights into the experiences of young learners and their educators. It comprised 20 Grade 2 students, offering a focused lens on technology's impact on early childhood education, and 31 teachers from private schools, including 21 general educators and 10 Enhanced Learning Environment (ELE) ambassadors. This dual-perspective sample ensured that data reflected both the delivery and reception of digitally-enhanced instruction.

Data collection was conducted over one academic term and involved multiple sources to ensure validity. Quantitative data were gathered through student and teacher surveys administered via Google Forms, which gauged perceptions of engagement and tool usability. Qualitative data were derived from two primary sources: semi-structured interviews with ELE ambassadors to understand support challenges and pedagogical impacts, and structured classroom observations conducted using a standardized checklist to document student interactions, collaboration, and on-task behavior during digital activities. Furthermore, walk-in surveys were used to audit the consistent availability and functional status of digital resources.

The data analysis phase involved a two-pronged approach. Quantitative data from the surveys were analyzed using descriptive statistics (e.g., frequencies, means) to identify general trends and patterns. Qualitative data from interviews and open-ended survey responses were analyzed through thematic analysis, following the process outlined by Braun and Clarke (2006). This involved familiarization with the data, generating initial codes, searching for themes, reviewing themes, and defining and naming them to draw meaningful conclusions about implementation challenges and successes.

Finally, ethical considerations were rigorously upheld throughout the study. Informed consent was obtained from the school administration and participating teachers. For the minor students, passive parental consent was secured, and all data were anonymized to ensure confidentiality and privacy. The researchers adhered to principles of voluntary participation, with all subjects informed of their right to withdraw at any stage without penalty.

RESULTS AND DISCUSSION

The investigation into the technological landscape of the participating schools revealed a foundational level of hardware infrastructure. Classrooms were routinely equipped with multimedia projectors, interactive whiteboards, and student netbooks, which supported a variety of daily instructional activities. The presence of these core technologies was a critical enabler for digital integration. Beyond these staples, peripheral devices such as digital cameras and visualisers were available but saw only sporadic use, typically reserved for specific projects rather than being woven into the fabric of everyday teaching. This pattern suggests that while schools are investing in core digital tools, the full potential of supplementary technology remains underutilised.

The impact of specific software platforms on pedagogical practices was particularly pronounced. Edmodo emerged as a cornerstone for collaboration, creating a digital space where students could share assignments, engage in peer feedback, and participate in academic discussions beyond the classroom walls. Similarly, See-Saw demonstrated significant value in strengthening the school-home connection. By facilitating a continuous feedback loop between students, teachers, and parents, it fostered an environment of transparency and supported personalised learning journeys. Interactive applications like Padlet and Kahoot were highly effective at boosting student engagement, making lessons more dynamic and participatory. However, their inconsistent application across different classes indicated that their adoption was likely dependent on individual teacher preference and confidence rather than a unified school-wide strategy.

From a pedagogical perspective, the strategic application of these digital tools yielded positive outcomes for diverse learning needs. The integration of multimedia content provided substantial benefits for visual learners, offering them alternative pathways to grasp complex concepts. Auditory learners, conversely, were aided by the audio features embedded within various platforms, which enhanced their comprehension and information retention. Furthermore, the study observed that group activities structured around digital platforms effectively promoted higher-order cognitive skills. These collaborative tasks required students to engage in critical thinking and collective problem-solving, moving learning objectives beyond simple knowledge recall. Student feedback corroborated these observations, with many reporting increased interest in subject matter and a clearer understanding of topics when digital tools were deployed purposefully.

Table 1 Impact of Digital Tool Integration on Teaching and Learning

Symbolic System	Accuracy (%)
The schools had essential digital hardware, including multimedia projectors, interactive whiteboards, and netbooks	These tools were regularly used in classrooms to support various instructional activities

Symbolic System	Accuracy (%)
Peripheral devices like digital cameras and visualisers were available but used less frequently	These devices were employed occasionally for specific tasks, adding variety to instructional methods
Edmodo emerged as a highly favoured software platform for collaboration	Enabled students to share assignments, provide peer feedback, and engage in discussions effectively
See-Saw facilitated a strong feedback loop between students, teachers, and parents	Promoted transparency and continuous improvement in learning outcomes
Interactive tools like Padlet and Kahoot added an element of fun and engagement to lessons	Encouraged greater student interest and participation, although their usage was less consistent
Visual learners benefited from multimedia content	Helped students better understand visual concepts through interactive presentations
Auditory learners found audio features helpful for comprehension	Enhanced listening skills and comprehension by leveraging audio-based digital tools
Group activities supported by digital platforms encouraged critical thinking and collaborative problem-solving	Promoted teamwork and higher-order thinking skills among students
Technical challenges, such as inconsistent internet connectivity and limited device access, hindered implementation	Reduced the effectiveness of digital integration and caused disruptions in learning sessions
Teachers identified a need for additional training to optimise the use of these tools effectively	Highlighted the importance of professional development to ensure efficient use of digital technologies
Students reported greater interest and better understanding of topics when digital tools were used strategically	Demonstrated the potential of well-integrated digital tools in improving student engagement and learning

Source: Author's Analysis

Despite these encouraging signs, the implementation process was not without significant obstacles. Technical impediments, most notably unreliable internet connectivity and an insufficient number of devices for a one-to-one ratio, frequently disrupted the flow of lessons and limited the scope of digital activities. This infrastructural instability was compounded by a identified need for enhanced teacher professional development. Educators expressed a desire for more training to move beyond basic tool functionality and towards optimising these technologies for deeper pedagogical impact, highlighting a crucial gap between access to technology and its effective educational application.

The findings of this study demonstrate that the educational value of digital tools is maximised when their use is deliberately aligned with established pedagogical principles. The collaborative functionality of Padlet, for instance, provided a platform for students to visually organise and share ideas, creating a learning environment that reflects Vygotsky and Cole's (1978) sociocultural theory. This tool facilitated social interaction and peer learning, allowing students to

construct knowledge collectively. The practice of students building upon each other's contributions aligns with Yaseen et al. (2025) research on visible learning, which identifies feedback and collaborative engagement as powerful influences on student achievement.

The immersive experiences enabled by Nearpod's VR mode offered another compelling example of this alignment. By making abstract concepts tangible, this tool operationalised Bruner's (1977) constructivist theory, which posits that learning is an active process of constructing new ideas based on current and past knowledge. The ability to virtually explore environments provided the concrete experiences necessary for this knowledge construction. Similarly, the use of tools like Tango for creating clear, step-by-step digital instructions empowered students to work with greater autonomy. This supports Dewey's (1938) philosophy of experiential learning, bridging the gap between theoretical instruction and practical application. The communicative capacity of platforms like See-Saw further reinforced a differentiated approach by providing ongoing, individualised feedback, resonating with Tomlinson's (2014) principles of addressing varied learner needs.

In relation to prior research, the identified challenges of inconsistent connectivity and limited resources strongly support the findings of Msambwa et al. (2024), who identified infrastructure deficits as a primary impediment in Pakistan. However, this study extends their work by revealing how these barriers manifest specifically in the context of structured, model-driven digital integration (like the 5E framework), showing that they not only prevent access but actively inhibit the progression to higher-order 'Modification' and 'Redefinition' stages of the SAMR model (Kendon & Anselmo, 2022). Where Latif and Jamil described a general barrier, our findings specify its precise impact on pedagogical transformation.

Furthermore, the teachers' expressed need for professional development both confirms and contextualizes the findings of Panigrahi et al. (2025). While they identified a gap between perceived and actual TPACK among teachers, our results provide a qualitative dimension to this gap, illustrating that it translates into inconsistent use of engaging tools like Kahoot and a reliance on more familiar, lower-risk platforms like Edmodo. This finding contradicts overly optimistic assumptions that access to technology alone drives change, underscoring that, as Ahmed (2024) argued, developing Technological Pedagogical Knowledge (TPK) is the crucial linchpin. Our study confirms that without targeted support, even well-resourced private schools struggle to move beyond substitution-level applications.

The persistent challenges of inconsistent connectivity and limited device access, however, underscore that technological integration is not merely a pedagogical issue but a systemic one. These first-order barriers, as defined by Ertmer and Ottenbreit-Leftwich (2013), directly constrain what is possible in the classroom. The teachers' identified need for further training points to a concurrent second-order barrier, relating to beliefs and professional competencies. This finding reinforces the central tenet of the TPACK framework (Mishra & Koehler, 2006),

which argues that effective integration requires teachers to develop a nuanced, interconnected knowledge of technology, pedagogy, and content.

The efficacy of digital tools in enhancing engagement, supporting differentiation, and fostering collaboration is evident. However, their potential to bring about transformative change, as envisioned in the redefinition stage of Kendon and Anselmo's (2022) SAMR model, is contingent upon a holistic support system. For technology to truly redefine learning experiences, particularly in resource-constrained contexts, a concerted effort from policymakers and school leaders is required. This must focus on stabilising infrastructure and providing sustained, high-quality professional development that empowers teachers to seamlessly weave technology into their pedagogical practice.

CONCLUSION

The findings of this study underscore the transformative potential of digital technologies in enhancing educational practices within Pakistani private schools. The strategic application of tools like Padlet, Nearpod, and See-Saw, guided by the 5E instructional model, significantly fostered collaboration, critical thinking, and reflective learning. The research demonstrated that these technologies are particularly effective in supporting differentiated instruction; visual learners benefited from interactive multimedia, while auditory learners found audio-based features invaluable for comprehension. Furthermore, digitally-supported group activities consistently promoted higher-order thinking skills and made learning more engaging and impactful for young students.

However, this potential is contingent upon overcoming significant systemic barriers. The challenges of inconsistent internet connectivity, limited device access, and—most critically—insufficient teacher training hindered seamless implementation and limited the scope of pedagogical transformation. These findings corroborate earlier studies on the digital divide in Pakistan but extend them by highlighting that the barrier is not merely access to hardware, but a complex interplay of infrastructure, pedagogical skill, and sustained support. The identified gap between technological access and teachers' Technological Pedagogical Knowledge (TPK) emerges as a central issue that must be addressed to move from superficial substitution to meaningful redefinition of learning tasks.

Consequently, this study concludes that the successful integration of digital technology is not a mere technical upgrade but a systemic endeavor. To harness its full potential, future initiatives must adopt a holistic approach. This includes sustained investment in reliable infrastructure, the development of context-specific digital content, and, most importantly, the implementation of continuous, high-quality professional development programs that empower teachers to design pedagogically sound, technology-enhanced learning experiences. By addressing these interconnected factors, policymakers and educators can work towards building resilient, equitable, and innovative educational systems that are capable of

meeting the diverse needs of learners in Pakistan and similar resource-constrained environments. Future research should focus on longitudinal studies to assess the long-term impact of such integrated models and explore their scalability and adaptation across different regions and school systems.

SUGGESTION

The integration of digital technologies in education signifies a significant step toward modernizing teaching practices in Pakistan. This study underscores the importance of structured support systems, such as ELE ambassadors, in guiding effective technology use. It also highlights the need for ongoing teacher training to ensure the sustainable adoption of digital tools.

Future efforts should focus on scaling these practices to more schools, particularly in underserved areas. Policymakers must prioritize equitable access to digital resources to bridge the educational divide. Further research is needed to develop scalable models for technology integration that address the unique socio-economic challenges of Pakistani schools.

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