

Teachers' Perceptions of Digital Technology Integration in Public and Private Sector Elementary Schools: An Exploratory Pilot Study

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ABSTRACT

Digitization in education has become a strategic move of the 21st century in the need to make education more effective and learning more effective. In this exploratory pilot study, the researcher compares and examines the perceptions of public (n=39) and private (n=29) sector elementary school teachers in Islamabad, Pakistan, about the use of digital technology in teaching practice. The study uses the PEAU-T (Perceptions of Ease of Access and Use of Technology) paradigm and Technological Pedagogical Content Knowledge (TPACK) framework to explore perceived effectiveness of technology by teachers and barriers to integration, institutional support, and pedagogical benefits of digital tools using a 20-item self-report questionnaire. Analysis using an independent t-test and Pearson correlation revealed that teachers across both sectors are generally positive toward the use of digital technologies ($m = 4.04/5$); there are major disparities regarding infrastructural issues, training opportunities, and institutional support. Teachers of the public school, especially, complain of time constraints as the only statistically significant difference ($t = 2.351$, $p = 0.022$; Cohen's $d = 0.58$). School type correlated weakly and non-significantly with overall perception ($r = -0.163$, 95% Confidence interval $-0.387, 0.078$). The findings tentatively suggest that the public-private perception gap is narrower than assumed, shedding light on the necessity of specific policy responses from fair distribution of resources, to structural factors (workload, time management). Considering the pilot nature and small sample, these results are provisional and recommend time audits, peer coaching, TPACK-aligned training and replicating the study with larger sample.

Keywords: Digital technology, teachers' attitudes, public-sector versus private-sector schools, education in primary schools, PEAU-T, TPACK, instructional innovation.

INTRODUCTION

The educational environment of the 21st century is becoming more and more digitalized, and digital technologies change the age-old instructional strategies and alter the pattern of teaching and learning. Digital tools, such as interactive whiteboards, tablets, and computers, educational software, and even through Internet education, are being used to add additional engagement to the classroom, allow differentiation of instruction and developing interactive learning settings. Especially in the elementary grade where basic cognitive learning and student development are the main focus, the opportunities of technology to enhance student learning and the performance of teachers cannot be undermined.

The introduction of digital technologies in education, though, is not merely a resource availability feature. The perceptions, competencies, and readiness of teachers is fundamental in determining the successful implementation of these tools. Teachers do not only play the role of facilitators of learning but also agents of change in education. The pedagogical use of technology is significantly influenced by their beliefs, attitudes, and comfort with technology.

Pakistan is one of the countries where the binary system of determining between public and private post-secondary schools and colleges is deep-seated, especially in terms of entry to technological resources, management services, and professional growth. Whereas in private schools, more autonomy, greater financial investment and access to innovation usually exist, bureaucracies, and systemic barriers usually plague the public schools. This difference makes it necessary to have a closer insight into how educators in the two sectors both perceive and experience digital technology in teaching.

Given the limited comparative research in Pakistan, this exploratory pilot study has examined and contrasted the views of society on the adoption of digital technology in elementary schools in Pakistan among both teachers of publicly and privately-run schools. Relying on the PEAU-T and TPACK models, the research explored various perception dimensions, such as effectiveness, challenges, institutional support, and perceived benefits, and aims to provide some insights into the factors in the classroom setting that enable or constrain classroom technology adoption.

RESEARCH OBJECTIVES

The research objectives are:

1. To compare the ideas of teachers, who work in public and private schools about the effectiveness and value of digital technologies in classroom instruction.
2. To investigate the problem and obstacles teachers encounter in adopting digital tools in their instruction.
3. To examine the level and type of institutional support that the school authorities offer to enable digital adoption.
4. To determine the perceived pedagogical role of digital technologies in promoting student engagement and delivery of instruction.

HYPOTHESES OF THE STUDY

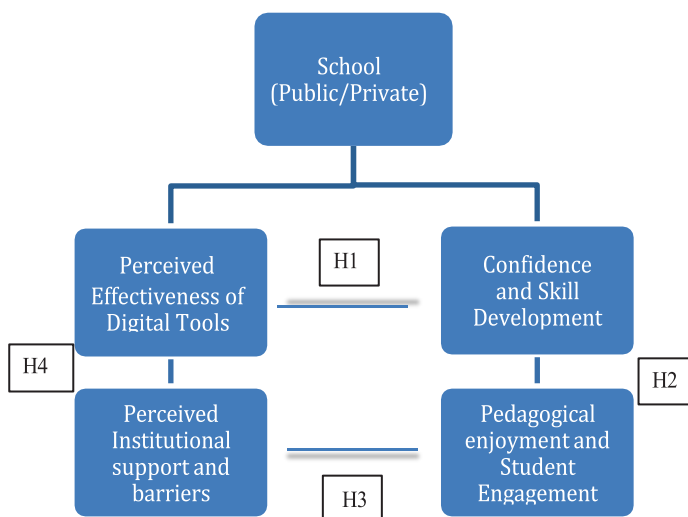
The following hypotheses guide the study were formulated

H1: The perception of the effectiveness of digital technologies in fostering teaching and learning in the public and the private elementary schools is statistically significantly different between the teachers in those schools.

H 2: The differences in the challenges faced by the teachers in public and private schools as far as integrating digital technologies are concerned are statistically significant.

H3: The difference between public and private sector teachers in their perceptions of the institutional support they receive to carry out the digital integration is statistically significant.

H4: The visibility of a statistically significant difference between the perception of pedagogical usefulness of a digital tool by teachers working in a public and a private school.



SIGNIFICANCE OF THE STUDY

The study is of significance to educators, policymakers, school leaders and education reformists in Pakistan and other developing settings. In the study of the perceptions of teachers in the public and private schools, the exploratory study points out the systemic inequalities and institutional loopholes that impede the effective application of technology in education. The results provide empirical information to be used in developing:

- Programs of professional development in sectors.
- Planning and investment in digital infrastructure.
- Policy provisions of inclusive digital education.
- School cultures that are supportive promote novelty.

More so, the paper is an addition to the body of research on the integration of educational technology based on the application of the well known theoretical models (PEAU-T and TPACK) to socio-cultural and institutional environment of Pakistan.

LITERATURE REVIEW

Digital technology is an unwanted aspect but a persistent element of modern learning processes worldwide. It entails a wide range of tools such as computers, tablets, interactive whiteboards, learning management systems, education application, and online resources (OECD, 2021). Such technologies have revolutionized conventional teaching

methods by facilitating learner-centered pedagogies, allowing real-time feedback, endorsing multimedia content delivery, and flexible and differentiated instruction (Prusakova-Forland, 2021). Besides, digital tools provide personalization of learning opportunities, particularly through adaptive systems which react to the development of learners individually (Hilton, 2016). A number of researches have given emphasis to how online learning platforms have the potential to substantially increase engagement and motivation among students due to interactive and gamified learning practices (Rogers et al., 2020; Balasko et al., 2021). Nevertheless, the effective importation of these tools is very dependent on the situational issues like infrastructure, teacher competence, institutional preparedness and the socio-cultural reinforcement (Delgado et al., 2015; Awan et al., 2018). Another important economic factor that is thoroughly acknowledged by researchers on the implementation of technology in classrooms is the perception of the teachers. Attitudes that are positive towards digital tools are connected to a higher degree of experimentation, integration, and pedagogical innovation (Koenig et al., 2020). Teachers who perceive the digital technology to be useful, manageable, and in line with the curricular objectives have high chances of integrating effective digital technology within their teaching methods (Hsu et al., 2019). On the other hand, resistance to integration of technology is usually associated with lack of confidence, inadequate

training, past bad experiences or feeling of irrelevance to subject matter (Ertmer & Ottenbreit-Leftwich, 2010). Timotheus et al. (2023) emphasize that, until teachers are sufficiently competent and authorized, they might be reluctant to see the pedagogical worth of digital tools, despite the presence of the infrastructure. This is especially true in the context such as in Pakistan where institutional inequalities between state and non-state institutions can powerfully influence the ways and attitudes of teachers. Recent studies in low- and middle-income countries emphasize that teacher perceptions are often more favorable than actual implementation, highlighting the need for pilot studies to bridge this gap (Ahmad & Khan, 2023; UNESCO, 2023).

Timotheus et al. (2023) offer a multidimensional framework of perception of ease of access and use of technology in PEAU-T, which can enhance comprehension of how teachers perceive and use technology. It consists of four major dimensions:

- Worthiness, indicating the perceived value and utility of digital tools in enhancing the result of teaching (Koenig et al., 2020);
- Skill Acquisition, which refers to self-estimated competence of teachers, access to training and professional development (Delgado et al., 2015);
- Concerns, which sum up worries about constraint technology malfunctions, time wastage, and adverse effects on students (Yee et al., 2020); and
- Enjoyment means the satisfaction and motivation influencing the teachers using digital tools (Awan et al., 2018).

This model highlights that only a combination of technical, psychological, and emotional technology adoption can be successful, with beliefs, past experiences, and the support systems provided to teachers being determining factors.

Mishra and Koehler (2006) in the Technological Pedagogical Content Knowledge (TPACK) highlight that successful teaching with technology needs an integrated knowledge of content (CK), pedagogy (PK), and technology (TK). When teachers have high TPACK, they will be able to choose and use technological resources in a significant manner that matches the subject and instructional strategies (Koehler et al., 2013). There is empirical data indicating that teachers who

are enrolled in specific professional development programs that provide practical activity and ongoing guidance tend to have higher TPACK competences (Voogt et al., 2013; Harris et al., 2009). Nonetheless, a considerable number of teachers in the public-school setting claim that they do not have access to such programs, which results in a lack of confidence in their skills to make effective use of technology (Ertmer and Ottenbreit-Leftwich, 2010; Mouza and Karchmer-Klein, 2013). In comparison, the access to technology training by the teachers of a private school is higher and the TPACK integration is also higher (Kurt et al., 2014).

The supplementary information can be provided by the Substitution-Augmentation-Modification-Redefinition (SAMR) model (Hamilton et al., 2016) and the Diffusion of Innovations (DOI) theory (Rogers, 2003). The SAMR model classifies technological use in four levels: substitution, augmentation, modification, and redefinition, with the emphasis on a transformative and not a superficial use. Although this is not the primary framework in this study. According to the research by Hilton (2016), the teachers tend to exist at the bottom (substitution and augmentation) without support and pedagogical training. DOI theory describes the process of adoption of new technologies by consumers according to five adopter types, including innovators, early adopters, early majority, late majority, and laggards, depending on perceived characteristics, such as relative advantage, compatibility, complexity, trialability, and observability (Sahin, 2006; Hsu, 2019). In Pakistan, public school teachers are predominantly in the late majority, and the institutional factor causes teachers of private schools to be more often early adopters, since they are more likely to receive institutional support (Naseem and Anwar, 2020).

Empirical studies on differences in technology uptake in both the public and private sector schools show a lot of difference. The autonomy, financial investment, and flexibility in organization generally allow private schools to have a fluid digital transformation (Wahab and Ismail, 2021; Scherer et al., 2019). The educators of privates indicate a higher level of access to more recent hardware, internet availability, and specialized IT assistance which makes it easy to rely and use digital tools (Murray & Olcese, 2011). By contrast, in a typical public school,

the teachers have to work within a set of limitations, including the use of outdated equipment and unstable Internet data, a lack of professional development opportunities, and bureaucratic restrictions (Delgado et al., 2015; Farooq et al., 2019). These issues adversely affect the attitudes of teachers towards digital technology and slower the pace of pedagogical innovation. Moreover, inflexibility in the curriculum and excessive scheduling of classes also diminish the chances of public school educators to experiment with digital strategies (Awan et al., 2018).

When trying to incorporate the digital technology in their teaching, teachers commonly face a number of obstacles. Studies also note infrastructural constraints like the absence of devices, incompatible software, and inadequate internet connectivity (Koenig et al., 2020; European Commission, 2020). In most instances, the form of professional development offered is insufficient, irregular, and over theorized, and teachers are not provided with a long-term support in classroom implementation (Hsu et al., 2019). These issues are further complicated by a lack of proper technical support which results in frustrations among the teachers and their unwillingness to use digital tools (Farooq et al., 2019). Furthermore, social cultural resistance in the form of skepticism of screen time and favoring conventional approaches to teaching pose extra challenges (Balasko et al., 2021). Meaningful innovation is also blocked by policy and administrative barriers, including inflexible procedures and funding access that is vicious in public schools (Awan et al., 2018).

Regardless of these shortcomings, the advantages of online integration are well-recognized in the literature. Student engagement and motivation may be greatly promoted with the use of digital tools that provide interactive and multimedia-rich content (OECD, 2021; Rogers et al., 2020). They also assist in personalized and differentiated learning aimed to address the needs of students (Hilton, 2016), enhance the effectiveness of classroom management and assessment by automating and receiving feedback in real-time (Yee et al., 2020), as well as enhance teacher creativity and satisfaction in the context of aligning with pedagogical objectives (Voogt et al., 2013; Hsu, 201). This evidence indicates that structural, cultural and institutional obstacles may still exist but the pedagogical

benefits of digital technology presents its increasing needs in contemporary classroom.

Research also shows that equitable access to digital technology, as well as sufficient services and training, can substantially reduce gaps in achievements and can facilitate equal learning outcomes (European Commission, 2020).

RESEARCH METHODOLOGY

The research methodology section provides details on the approach, procedure, and instruments employed in the research to conduct the investigation on perception of elementary school teachers about the use of digital technology in public and private sector of Islamabad. The research methodology is supposed to provide the research with validity and reliability and at the same time respond to research objectives and hypothesis. The research presented in this exploratory pilot study utilized a comparative quantitative research design to generate hypothesis and identify potential patterns, rather than to confirm causal relationships between the views of both public and private elementary school teachers towards the use of digital technology in classroom. The study concentrated on the major dimensions such as teacher attitudes, institutional support, perceived challenges, and perceived benefits to find out the pattern and the difference with the help of structured data collection and statistical analysis of the data.

Population and Sample

The target population included teachers at the Elementary school level in urban schools in Pakistan, both in the government and private schools. The sample of 68 teachers from public and private sector was recruited through direct outreach to school principals via email and phone calls. Willing teachers received an online survey link through Google Forms. Data collection occurred over 4 weeks (April 2025 and May 2025). The sample size of 68 teachers was determined based on accessibility, financial constrictions, time constraints and the exploratory nature of this study. A post-hoc power analysis using G*Power 3.1 (Faul et al., 2009) for an independent samples t-test (two-tailed, $\alpha = 0.05$) revealed that this sample provides 80% power ($1 - \beta = 0.80$) to detect a large effect size (Cohen's $d = 0.80$), but only 54% power for a medium effect ($d = 0.50$) and 27% power for a small effect ($d = 0.20$), in this

study, The absence of statistically significant differences on 19 of 20 items should not be interpreted as evidence of equivalence; small-to-moderate differences may exist but could not be reliably detected.

A convenience sampling method was used to choose 68 respondents (39 in public schools and 29 in private schools. This sampling technique is used due to 1) lack of a complete sampling frame of elementary teachers in Islamabad, 2) logistical barrier (school closures, restricted access), and 3) the exploratory nature of this comparative study. While this limits external validity, convenience sampling is widely accepted in initial comparative studies of teachers' perceptions of educational technology (Scherer & Teo, 2019).

SCOPE AND DELIMITATIONS

This study is delimited to elementary school teachers (grades 1–5) from public and private schools in urban Islamabad, focusing solely on self-reported perceptions of digital technology integration. It excludes rural schools, other educational levels (middle/high), and direct observation of classroom practices or student performance outcomes.

Research Instrument

The structured questionnaire was used to gather data based on PEAU-T and TPACK framework. The questionnaire had 20 Likert-scale questions (the scale ranges 1 = Strongly Disagree to 5 = Strongly Agree) that deal with the following domains:

- Beliefs/attitudes of teachers regarding digital technology
- Institutional support and training
- Imagery Roadblocks to integration.
- Interaction and value of digital technology.

The instrument showed good internal consistency, and its content validity was established through an expert review. The questionnaire was piloted thoroughly to ensure its reliability and validity. During the first stage, the questionnaire was reviewed by two educational experts and resulted in changes to the order of questions, the addition of three and the deletion of two questions. The second phase involved piloting the questionnaire with teachers to ensure that it was clear and effective and no additional changes were made. This study

assessed teachers' self-reported perceptions, beliefs, and barriers, not functional performance or observed teaching competence. No standardized performance tests were administered.

Data Collection

The data were gathered in person, using an online form of survey (Google), by the researchers themselves. The sample of the study was given questionnaires to provide information on the elementary school teachers employed in Islamabad in the public and private sectors. In data collection, the respondents were provided with a link to the questionnaire which they completed and sent to the researcher. Data obtained was systematized, tabulated and analyzed using statistical software SPSS to examine the attitude of teachers towards the usage of digital technologies. The summary of group perceptions was done using descriptive statistics (mean, SDs). The independent samples t-test was used in order to compare the responses of the teachers of public and private schools. To evaluate the relationship between school type and overall perception, Pearson correlation is involved. Inferential statistics to test the hypotheses and ascertain the statistical significance (maximum value of 0.05) were used.

RESULTS AND ANALYSIS

Table 1. *Descriptive Statistics*

	School Type	Mean	Std Deviation	N
School Average	Public	1.41	.524	39
	Private	4.0435	.55399	29

There was a slight overrepresentation of the public institutions as the proportion of teachers in the public schools was slightly higher ($M = 1.41$, 1 = Public, 2 = Private).

On the whole, educators of both state and independent schools had positive attitudes towards the application of digital technologies. The overall mean of the perception scale was 4.04 (with a scale of 5 points), which showed that there is the general agreement on the usefulness and effectiveness of digital tools in teaching.

Table 2 Teacher Beliefs and Attitudes about Digital Technology

Statement	School	N	Mean	Std. Deviation	Std. Error Mean
Digital technologies improve the effectiveness of my teaching.	Public	39	4.41	.595	0.095
	Private	29	4.21	1.013	0.188
I feel confident using digital tools in my classroom.	Public	39	4.13	1.031	0.165
	Private	29	4.03	1.117	0.208
Technology makes learning more engaging for student and improves my teaching	Public	39	4.46	0.643	0.103
	Private	29	4.14	1.217	0.226
I believe digital technology is essential in modern education.	Public	39	4.33	0.869	0.139
	Private	29	4.10	1.205	0.224
Parental support impacts my willingness to use digital technology in the classroom.	Public	39	3.90	0.940	0.151
	Private	29	3.79	0.902	0.167

Table 2 contains comparative data on beliefs and attitudes of teachers towards digital technology in the middle schools of the public and the private school. Teachers in public school were always rated as slightly higher in mean scores which meant that they were more in agreement with the positive influence of digital technologies. They felt more confident in the potential of technology in improving teaching ($M = 4.41$) compared to the private school teachers ($M = 4.21$), and were more confident about using digital tools ($M = 4.13$ vs. 4.03). Digital technology was also viewed more engaging and useful to students by teachers in the public schools ($M = 4.46$) than by teachers in the private schools ($M = 4.14$) and were more variable in their responses. Concerning the crucial nature of the use of technology in contemporary education, the agreement between the public teachers was higher ($M = 4.33$) than that of the private teachers was ($M = 4.10$). Parental support was considered having a moderately significant effect in both groups, but was rated to have a higher effect among teachers in public schools ($M = 3.90$ vs. 3.79). These results indicate that the overall attitude of the teachers to using digital technology is more positive and consistent in public schools.

Table 3 *Digital Teaching Practices and Usage*

Statement	School	N	Mean	Std. Deviation	Std. Error Mean
I like to take opportunities of training in using digital tools for skill acquisition	Public Private	39	4.10	0.641	0.103
		29	3.93	1.193	0.222
Support from school administration encourages me to use digital technology	Public Private	39	4.21	0.767	0.123
		29	3.83	1.136	0.211
Peer collaboration helps me improve my digital technology skills.	Public	39	3.97	0.811	0.130
	Private	29	4.07	0.842	0.156
The curriculum design motivates me to integrate digital tools into my lessons.	Public Private	39	3.72	1.146	0.183
		29	3.90	0.976	0.181
I find digital technology easy to integrate into my teaching practices.	Public	39	4.18	0.970	0.155
	Private	29	4.17	0.928	0.172

Table 3 discusses the involvement in digital teacher practice and professional growth of teachers. Teachers of public schools expressed a more favorable orientation to receive training opportunities to acquire digital skills ($M = 4.10$) than teachers of private schools ($M = 3.93$). The standard deviation in the case of the lower responses of the public is an indication of more homogeneous interest in the field of professional development. The implication is that not only are teachers working in a public school more open to digital tools than their counterparts, but also more regularly encouraged to enhance their competencies with training.

Table 4 *Institutional and Environmental Support*

Statement	School	N	Mean	Std. Deviation	Std. Error Mean
I feel challenges due to lack of training in the use of digital tools	Public	39	3.56	1.165	0.187
	Private	29	3.21	1.082	0.201
Limited access to digital resources in my school is a barrier in my teaching strategy.	Public	39	3.90	1.119	0.179
	Private	29	3.52	1.122	0.208
Technical issues often hinder the effective use of digital technology.	Public	39	4.00	.889	0.142
	Private	29	3.72	1.032	.0192
Time constraints make it difficult to integrate digital tools into lesson.	Public	39	3.95	.686	0.110
	Private	29	3.48	.949	0.176
The infrastructure in my school is insufficient to support digital technology.	Public	39	3.51	1.023	0.164
	Private	29	3.41	1.150	0.214

Table 4 brings to light the importance of institutional and environmental facilitation of digital integration. Whereas teachers in private schools scored administrative support as a little bit less ($M = 3.83$), the more varying responses among them imply the inconsistent experiences of support. The two groups attached importance to peer collaboration, and the mean of the importance of the collaboration is reported as slightly higher among the teachers in the private schools ($M = 4.07$ vs. 3.97). Curriculum design was viewed as a moderate motivator again with the agreement of the private teachers being a bit higher ($M = 3.90$ vs. 3.72). Teachers of both private and public mentioned that they felt comfortable implementing digital tools ($M = 4.18$ and 4.17 , respectively).

Nonetheless, the teacher of a public school reported more significant obstacles, such as restricted access to online studies ($M = 3.90$ vs. 3.52), time ($M = 3.95$ vs. 3.48), and a little more worry about infrastructure. These findings suggest that despite the same setbacks taken by both of these groups of people, public school teachers might experience more systemic and resource related limitations.

Table 5 Barriers and Challenges to Digital Integration

Statement	School	N	Mean	Std. Deviation	Std. Error Mean
Investments in digital tools will lead to significant improvements in teaching and learning outcomes.	Public	39	4.38	0.847	0.136
	Private	29	4.45	0.572	0.106
I am willing to learn more about advanced digital tools for teaching.	Public	39	4.28	0.826	0.132
	Private	29	4.28	0.528	0.098
I find it rewarding to see students actively engage with digital technologies in the classroom.	Public	39	4.41	0.595	0.095
	Private	29	4.10	0.900	0.167
I feel satisfied to make my teaching methods creative and interactive by using digital technologies	Public	39	4.13	1.005	0.161
	Private	29	3.90	1.319	0.245
The use of digital technologies has made teaching more exciting and dynamic for me.	Public	39	4.34	0.669	0.109
	Private	29	4.33	0.734	0.141

Table 5 focuses on motivation, engagement, and perceived benefits of digital technology. There was a high agreement between the teachers (public and private school) over the ability of investment in the digital tools to improve level of education, though the teachers indicated a slight more accordance on the issue ($M = 4.45$ vs. 4.38). The two groups current with each other in their eagerness to acquire more sophisticated digital tools ($M = 4.28$) showed a commitment to technological improvement. Teachers of public schools more naturally thought engagement with digital tools to be fulfilling ($M = 4.41$ vs. 4.10), and expressed more satisfaction with the opportunities to make their teaching more creative and interactive ($M = 4.13$ vs. 3.90). Lastly, the eagerness in both groups was also virtually the same when it comes to the dynamic and exciting quality of digital teaching (Public $M = 4.34$; Private $M = 4.33$). These answers affirm that teachers, irrespective of the type of institution, are very intrinsically motivated and full of potential to embrace change through digital integration in classroom teaching.

Table 6 Independent t-Test (Group Comparison)

Statement	T	df	P (2tailed)	Mean Difference	Significant Difference
Digital Tech Improves Teaching	1.037	66	0.303	0.203	No
Confidence Using Tools	0.358	66	0.722	0.094	No
Engaging Learning with Tech	1.418	66	0.161	0.324	No
Tech is Essential in Education	0.915	66	0.364	0.230	No
Parental Support Impacts Use	0.460	66	0.647	0.104	No
Training Opportunities	0.763	66	0.448	0.172	No
Admin Support for Tech	1.635	66	0.107	0.378	No
Peer Collaboration Improves Skills	-0.468	66	0.641	-0.095	No
Curriculum Motivates Tech Use	-0.676	66	0.501	-0.179	No
Ease of Integrating Tech	0.030	66	0.976	0.007	No
Lack of Training Challenges	1.289	66	0.202	0.357	No
Limited Access is a Barrier	1.384	66	0.171	0.380	No
Technical Issues Hinder Use	1.182	66	0.241	0.276	No
Time Constraints Limit Use	2.351	66	0.022	0.466	Yes
Insufficient Infrastructure	0.374	66	0.709	0.099	No
Investment Improves Outcomes	-0.350	66	0.728	-0.064	No
Willingness to Learn More	0.035	66	0.972	0.006	No
Rewarding Student Engagement	1.691	66	0.096	0.307	No
Creative Teaching with Tech	0.823	66	0.414	0.232	No
Teaching is More Dynamic	0.050	66	0.960	0.009	No

The independent samples t-test was chosen to compare mean scores between two independent groups (public vs. private). Among the 20 statements that were tested, a single statement revealed significant difference between the teachers in the public and private schools, which showed that there was time constraint that prevented the use of technology to be integrated ($t = 2.351$, $p = 0.022$). Cohen's d was calculated as 0.58, indicating a medium effect size (Cohen, 1988).

Teachers in public schools reported that there was greater difficulty as they had limited time to plan and implement the less on.

There were no statistically significant differences in all other statements, such as confidence in the use of technology, belief in the usefulness of technology in pedagogy, and readiness to get acquainted with learning ($p > 0.05$). This shows that teachers in the two sectors have positive attitude towards digital tools.

Table 7 Pearson Correlations

		School	Average
School	Pearson Correlation	1	-0.163
	Sig. (1-tailed)		0.090
	Sum of Squares and Cross-products	18.638	-3.217
	Covariance	0.274	- 0.47
	N	68	68
	Pearson Correlation	-0.163	1
Average	Sig. (1-tailed)	0.090	
	Sum of Squares and Cross-products	-3.217	20.870
	Covariance	-0.047	0.307
	N	68	68

Pearson correlation assessed the direction and strength of the linear relationship between school type (dichotomous) and overall perception scores ($r = -0.163$, $p = 0.090$) revealing a weak but not significant negative relationship. The 95% confidence interval for $r = -0.163$ was $[-0.387, 0.078]$. School type does not significantly correlate with the teacher perceptions toward technology. This is why, although there can be slight variations in perception, the types of schools do not have a great influence upon attitudes or experiences regarding digital devices in the classroom.

DISCUSSION

As an exploratory pilot study, with a limited sample size, the findings tentatively show that there has been a general agreement between the elementary teachers in the public and private schools on the beneficial impact of digital technology in promoting the quality of teaching and the students. This provide empirical support for the PEAU-T model (Timotheus et al., 2023)

in a non-western, lower middle income country context. The strong endorsement of "worthiness" and "enjoyment" dimensions by Pakistani teachers may indicate the model's cross-cultural applicability, while the salience of "worries" (particularly time constraints) reveals context-specific stressors (overcrowded public school schedules, rigid curricula) not emphasized in Western validations (Timotheus et al., 2023).

These findings are also supported by TPACK framework (Mishra and Koehler 2006) where teachers indicated that they had the understanding that they should integrate content, pedagogy and digital tools. Both were very appreciative of the role of digital technology in education in the 21st century and were eager to be involved in innovative and active learning.

The only notable difference is the time constraints at the public schools highlight situational issues. Public institutions generally have bigger classes, tight schedule and do not allow much flexibility to teachers who cannot effectively integrate technology. This demonstrates the worries aspect of the PEAU-T model and backs the previous research by Farooq et al. (2019) and Yee et al. (2020).

This study challenges the prevailing assumption in Pakistani educational research that private school teachers hold systematically more favorable technology perceptions than public school teachers. Prior literature (e.g., Farooq et al., 2019; Naseem & Anwar, 2020) tends to describe a higher level of digital advancement of private schools, but interestingly, our findings suggest that, except for time constraints, the gap between the two sectors may be narrower in terms of perception than in infrastructure. This can be because of increasing government activity in online training or inconsistency in the policies of the private sector as the Diffusion of Innovations theory proposed by Rogers (2003) suggests.

Although no significant correlation was found between the type of school and the perception, challenges simplistic public vs private oppositions. This suggests that factors such as principal leadership, individual teacher motivation, and localized peer support networks may be stronger predictors of technology integration than sector affiliation alone.

This exploratory pilot study tentatively concludes that time constraints may appeared as the only significant barrier for public school teachers, shifting policy focus from hardware to structural factors (workload, class size, curriculum pacing), aligning with OECD (2021) findings that planning time is a more binding constraint than device access.

CONCLUSION

This paper comes to the conclusion that elementary school educators in Pakistan, both in the public and in the private sector, appreciate digital technologies and consider them part of the necessary skills of enhancing effectiveness in teaching and engaging students. Nevertheless, structural and situational issues and most especially in state schools are still barriers to integration.

The difference that was found to be statistically significant is the perception of time limitation that was more evident among the teachers in the public schools. These results support the fact that institutional barriers must be overcome and that teacher training should be sustained, especially according to the TPACK framework, so that the teachers are not merely prepared to use technology but empowered to make the meaningful use of the technology.

Comprehensively, the findings provide an evidence-based information to education planners and school administrators to create context-sensitive, inclusive, and sustainable digital policies and practices.

LIMITATIONS

There are a number of limitations which may be admitted:

- Study nature and Sample Size: The exploratory and pilot nature the study and small convenience based sample (N = 68) restricts the applicability of results
- Limited Statistical Power: This exploratory pilot study is sufficiently powered only for moderate-to-large effect sizes. The absence of statistically significant differences on 19 of 20 items should not be interpreted as evidence of equivalence between public and private school teachers. Small but educationally meaningful differences may require replication with larger samples (N > 200).
- Sampling Bias Risk: Convenience sampling and self-reported data may overrepresent teachers with stronger opinions (either positive or negative) about digital technology. No classroom observations validated the data. Furthermore, social desirability could have affected the answers.

- **Geographic Scope:** It involved schools in urban areas, which differ substantially from rural and suburban, or provincial contexts in infrastructure, teachers' training and administrative support. The findings should be interpreted with caution and are not generalizable to Pakistan's all contexts.
- **Demographic data by sex and experience:** This study did not collect demographic data by sex and experience. This limits the description of the sample and prevents examination of sex-based differences in technology perceptions. This should be addressed in future research.
- **Cross-Sectional Design:** The study is at a single time and does not say anything about long-term transformation that may appear with policy changes, new training programs or infrastructure upgradation.
- **The absence of Qualitative Data:** The likert scale items gathered data about what teachers think but did not include interviews or classroom observations, which may provide opportunity responses for a deeper understanding of how time limitations obstruct, what specific administrative support teachers need, or how peer collaboration actually works.
- **Instrument Limitations:** The questionnaire measured views of teachers about the need for technology (perceptions), but not actual use of technology (behavior). The TPACK framework was used conceptually but not measured through validated TPACK instruments.
- **Parental support, administrative encouragement, and peer collaboration** were measured via single-item self-reports without established psychometric validation. Future studies should adopt validated instruments (e.g., the Technology Acceptance Model scales) to enhance reliability.

RECOMMENDATIONS

The results suggest the following recommendations:

For Policymakers and Administrators.

- Provide equal access of computer resources, especially in the poorly resourced state schools by creating school clusters (3-5 nearby schools) sharing a pool of 30 tablets/laptops, with weekly rotation and centralized maintenance.
- Conduct a "Time Audit" over one typical teaching week: Document all non-instructional tasks (attendance, grading, meetings, lesson planning). Identify 2-3 tasks that can be streamlined (e.g., automated attendance digital tools, reduced meeting frequency) to recover 60-90 minutes weekly for technology planning.

For Professional Development

- Redesign training of teachers sustained micro-learning by providing 15-minute video modules biweekly via WhatsApp (Pakistan's most accessible platform) covering one specific skill per module (e.g., "Creating a Kahoot quiz in 10 minutes," "Finding Urdu-medium science videos on YouTube").
- Explicitly address how to integrate digital tools within existing 35-40 minute lesson periods. Provide sample lesson plans showing technology use within tight timeframes, not idealized "full-period digital" scenarios.

For Further Research

- Replicate with a larger and probability-based sample ($n \geq 250$) across rural/urban, provincial and socioeconomic strata for the generalizability of the findings.
- Implement longitudinal and mixed research to investigate the changes throughout the time and to specify more complex information.
- Conduct time-use diary studies with 30 public school teachers to document exactly how planning time is currently spent and where technology integration interruptions occur (technical failures, student management, administrative interruptions).
- Investigate the outcomes of students and parental attitudes to have an all-embracing standpoint of digital education.

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