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Exploring Technological Pedagogical Content Knowledge among Secondary School ESL Teachers in South Punjab, Pakistan

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Abstract: *The swift adoption of digital technologies in the educational environment has raised urgent concerns regarding teacher readiness and teaching efficiency, especially in the English as a Second Language (ESL) environment in Pakistan. Based on a convergent mixed-methods design, the research examined the degree of digital readiness among ESL teachers in secondary schools of South Punjab, Pakistan and examined the perceived barriers and facilitating factors that affect the integration of technology in language classrooms. One hundred and twenty-eight in-service ESL teachers were involved in the quantitative phase, where they were administered a survey questionnaire based on the Technological Pedagogical Content Knowledge (TPACK) framework. To supplement this, semi-structured interviews were carried out with 20 purposely chosen participants to give a detailed qualitative understanding. Descriptive statistics, Pearson correlation analysis, independent samples t-test and ANOVA were used to analyze quantitative data, and thematic analysis was used to analyze qualitative data. Results showed that teachers had sufficient content knowledge (CK) and pedagogical knowledge (PK) but their technological pedagogical content knowledge (TPACK) scores were much lower, indicating that there is still a gap in the use of technology in language-specific pedagogy in South Punjab, Pakistan. Qualitative themes identified the lack of institutional infrastructure, the lack of professional development, and low self-efficacy of teachers in the use of technology as the main limitations. The research adds to the CALL literature by preempting the necessity of TPACK-based teacher training programs and evidence-based digital literacy policies in ESL education.*

Keywords: digital transformation, ESL classrooms, TPACK, teacher readiness, technology integration, CALL.

Introduction

The twenty-first century has seen a rate of digital transformation in virtually all sectors of society and education is not an exception. In the context of English language teaching, the spread of digital tools, including learning management systems and interactive whiteboards, as well as artificial intelligence-based language applications, has radically changed the environment of teaching and learning (Wang, 2025; Chaudhry & Kazim, 2022; Kessler, 2018;

Selwyn, 2016). In the case of English as a Second Language (ESL) classrooms, in particular, these changes have far-reaching consequences, with digital technologies potentially improving language input, learner autonomy, authentic communication, and scale-based differentiated feedback (Amjad et al., 2020; Godwin-Jones, 2017; Blake, 2016).

Although the potential of educational technology is clear, the situation in most ESL classrooms is still marked by uneven and superficial use of technology especially in Pakistani context. Studies have always shown that the simple availability of digital resources does not lead to any significant pedagogical change (Zadorozhnyy et al., 2025; Selwyn, 2016; Ertmer & Ottenbreit-Leftwich, 2010). Instead, successful technology integration heavily relies on the knowledge, beliefs, attitudes, and competencies of the teacher-factors that together can be described as teacher digital readiness. This preparedness is not merely a question of having technical competence but a multifaceted, interwoven knowledge of content, pedagogy, and technology, as theorized by Mishra and Koehler (2006) in their seminal Technological Pedagogical Content Knowledge (TPACK) model.

Despite the growing literature on technology integration in general education settings (Koehler & Mishra, 2009; Voogt & Roblin, 2012), the literature that specifically examines teacher preparedness in ESL classrooms, especially in the secondary school setting in the developing contexts like South Punjab in Pakistan , is relatively sparse. The literature on CALL (Computer-Assisted Language Learning) has focused much on higher education or discrete elements of technology use, including mobile-assisted vocabulary learning or e-portfolio design, instead of providing a comprehensive analysis of how teachers negotiate the larger digital transformation of their practice (Chapelle, 2001; Thomas et al., 2013). This leaves a significant research gap, especially considering the multifaceted nature of contextual, institutional, and personal influences that determine technology integration in resource-constrained settings.

The current research thus seeks to fill this gap by exploring the digital preparedness of ESL teachers in secondary school classrooms of South Punjab, Pakistan. In particular, the research questions that the study aims to address are as follows:

RQ1: What are the levels of ESL teachers' Technological Pedagogical Content Knowledge (TPACK) among secondary school ESL teachers in South Punjab, Pakistan?

RQ2: How do individual TPACK dimensions relate to overall digital readiness among secondary school ESL teachers in South Punjab, Pakistan?

RQ3: What are the perceived barriers and facilitating factors influencing technology integration among secondary school ESL teachers in South Punjab, Pakistan?

Literature Review

The interaction between technology and language teaching has changed significantly in the last decades. The first stages of CALL, which appeared in the 1960s and 1970s, were marked by behaviorist methods of drill-and-practice activities provided through mainframe computers (Trumbore, 2025; Warschauer & Healey, 1998). These primitive systems, though primitive by modern standards, brought the initial concept that technology could be used as a means of individualized language practice. The 1980s and 1990s communicative turn introduced more interactive applications, and language learners were able to use word processors, email, and early internet applications to participate in real communication (Aslan, 2025; Bax, 2003).

Bax (2003) suggested a powerful taxonomy of CALL development: normalization, restricted, and open, and suggested that technology would indeed revolutionize language education only when it became normalized, i.e. when it became part of the daily pedagogical routine and was not a special occasion. The following decades were marked by a fast technological evolution, such as the introduction of Web 2.0 tools, social media platforms, mobile applications, and, more recently, artificial intelligence and natural language processing technologies. These advancements have greatly increased the affordances of language teachers and learners, allowing new types of collaborative writing, multimodal storytelling, automated feedback, and online intercultural exchange (Blake, 2016; Kessler, 2018).

This expanding technological change has also widened what CALL is understood to encompass. Levy's (1997) early idea of CALL as the study of how computers can be integrated into language learning already anticipated a field that would extend beyond drill-based learning software into more practical and learner-centered practices. Pegrum (2014) later extended this trajectory to mobile assisted language learning (MALL), the argument was that the mobile devices are portable allowing learners more flexibility as well as fluidity between the classroom and everyday life. Godwin-Jones (2019) developed this point even further by highlighting learners independently engaging in informal language learning. For teachers, integrating such tools meaningfully still depends on established pedagogical frameworks such as task-based approaches (Nunan, 2004) and the broader repertoire of methods catalogued by Richards and Rodgers (2014).

Although this is the trend of innovation, scholars like Selwyn (2016) and Shakil and Siddiq (2024a) have warned against blind techno-optimism, whereby the implementation of technology in classrooms does not necessarily lead to better learning outcomes. Sometimes the overreliance on digital tools also pose serious learning challenges for ESL learners (Shakil & Siddiq, 2024b).The quality of pedagogical design and implementation is the critical variable, according to a general agreement of researchers, which puts the teacher in the center of technology-mediated language education.

Teacher digital readiness is a set of interconnected constructs that have been discussed in the literature under different names, such as digital competence, ICT proficiency, technology self-efficacy, and TPACK. The initial theorization of the generational digital divide between digital natives and digital immigrants by Prensky (2001) provoked a discussion on whether familiarity with technology was more of an age and exposure issue. This dichotomy was mostly problematized in later scholarship, which showed that knowledge of consumer technology did not always lead to successful use of pedagogical technology (Hockly, 2012).

Ertmer (1999) made an influential distinction between first-order barriers to technology integration extrinsic constraints such as lack of equipment, time, and technical support and second-order barriers, which are intrinsic and include teachers' beliefs about teaching, their confidence, and their resistance to change. This model has been found to be persistent in later studies, where several studies have found that second-order barriers tend to be more challenging to address than infrastructural shortcomings (Ertmer & Ottenbreit-Leftwich, 2010). Notably, self-efficacy beliefs about technology among teachers, i.e. their belief in their capability to use technology effectively in teaching, have been identified as a particularly powerful predictor of technology integration behavior (Bandura, 1977; Ertmer & Ottenbreit-Leftwich, 2010).

The UNESCO (2018) ICT Competency Framework of Teachers offers a globally recognized standard of assessing and enhancing teacher digital preparedness in six dimensions: knowledge of ICT in education, curriculum and assessment, pedagogy, ICT applications, organization and administration, and teacher professional development. Although this framework is very comprehensive, its use in ESL-specific situations needs to be modified to accommodate the discipline-specific pedagogical knowledge of language teaching.

The TPACK framework by Mishra and Koehler (2006) has emerged as one of the most popular theoretical frameworks used to analyze teacher knowledge in technology-intensive learning settings. The TPACK model, based on the original formulation of Pedagogical Content Knowledge (PCK) by Shulman (1986), recognizes seven knowledge areas: Content Knowledge (CK), Pedagogical Knowledge (PK), Technological Knowledge (TK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and the integrative Technological Pedagogical Content Knowledge (TPACK). According to Koehler and Mishra (2009), TPACK is a special kind of teacher knowledge that is formed as a result of the interaction of all three underlying domains and cannot be broken down into any of its constituent elements.

When applied to ESL teaching, PCK is not only the knowledge of the English language but the knowledge of how to make the elements that make it up, phonology, grammar, lexis, discourse, etc., learnable to particular groups of students. Introducing technology into this equation, teachers should also take into account how specific digital tools mediate and possibly transform language learning processes. An example of this is that a teacher who is teaching collocation with the help of a corpus analysis tool must at the same time be able to draw on the knowledge of corpus linguistics as a content area, principles of data-driven learning as a pedagogical approach, and the technical affordances of the particular software being used (Chapelle, 2001). Schmidt et al. (2009) created and tested a survey measure of TPACK in preservice teachers, which has since been modified and used extensively across disciplines and educational settings. Studies using this and other tools have repeatedly established that although teachers usually report sufficient levels of CK and PK, their scores on more integrated TPACK dimensions, especially TPACK itself, are significantly lower (Koehler & Mishra, 2009; Voogt & Roblin, 2012). This trend indicates that disciplinary knowledge and general pedagogical skill, though required, are not adequate bases of effective technology integration.

There is a significant amount of literature that has reported the obstacles that hinder or hinder the integration of technology in ESL and EFL classrooms. The infrastructural constraints, such as poor internet connectivity, inadequate hardware, and outdated software, are especially acute in the developing and middle-income educational settings (Saleem et al., 2025; Sung et al., 2016; Thomas et al., 2013). In Pakistani context specifically, recent policy-focused research has documented on-going government efforts to expand digital infrastructure in public schools, while also cautioning that implementation remains uneven across provinces and regions (Sahito et al., 2025). But, as mentioned above, attitudinal and knowledge-based barriers are also important. Teachers with traditional, transmission-based views of language teaching might view technology as disruptive or peripheral to their practice (Duan et al., 2024). While the prior work in Punjab, Pakistan has examined higher education institutional shift towards blended learning (Siddiq & Hussain, 2022), teacher-level TPACK readiness in secondary ESL classrooms remains underexamined.

In several studies, professional development is a key mediating variable. Hubbard and Levy (2006) claimed that teacher training in CALL has traditionally been poor, and has been in the form of isolated workshops, which are technical skills based, as opposed to long term, pedagogically based program. This concern has been reflected in more recent scholarship, which has proposed collaborative, practice-based, and explicitly TPACK-theory-based models of professional development (Stockwell, 2012). Godwin-Jones (2017) also highlighted the significance of personalization in professional development, indicating that training program that are one-size-fits-all do not meet the heterogeneous needs and starting points of individual teachers.

The COVID-19 pandemic, which necessitated a sudden shift to remote and hybrid teaching on a worldwide scale, has offered a major natural experiment to study teacher digital preparedness. The existing patterns have been confirmed by numerous studies carried out during and after the pandemic, but they also identified new aspects of the challenge, such as the problem of digital equity, student engagement in online settings, and the emotional labor of technology-mediated teaching (Kessler, 2018).

Collectively, the literature provides a multifaceted view of teacher digital preparedness where knowledge, beliefs, resources, and institutional context interplay in a manner that is not yet well comprehended, especially in ESL-specific secondary school contexts. The present research adds to this literature in three main aspects. First, it uses a mixed-methods design to measure the magnitude and the texture of teacher digital readiness, beyond the survey data that prevails in the field. Second, it frames its investigation in a particular national and institutional setting, namely, Pakistani secondary ESL education particularly in South Punjab, thus adding to the geographical diversification of CALL studies. Third, its explicit foundation of the analytical framework on the TPACK theory allows it to be directly compared and contribute to the expanding body of TPACK literature in language education.

Methodology

The research design was a convergent mixed-methods design (Creswell & Creswell, 2018), where quantitative and qualitative data were gathered simultaneously, analyzed independently, and subsequently combined in the interpretation. The reason behind the choice of this design is that it will be possible to triangulate the findings and the statistical patterns that are found in the survey data can be contextualized, explained and enriched with the help of qualitative insight (Tashakkori & Teddlie, 2010). The convergent design is especially appropriate to studies of teacher cognition and practice, in which the interaction between quantifiable knowledge dimensions and subjective experience necessitates a multi-layered method of investigation especially in applied linguistics research (Dörnyei, 2007).

The research was carried out in 14 secondary schools in the Southern Punjab, Pakistan in the 2024-2025 academic year. Pakistan is a particularly relevant case study in this context, with English playing a special sociolinguistic role, as a second language, as a medium of instruction, and as a co-official language. The increasing use and demand of technology enhanced education have put ESL teachers under more and more pressure to incorporate technology into their practice, and the question of readiness is timely and policy relevant.

The quantitative phase involved stratified random sampling to recruit participants, where schools were stratified by district to be geographically representative. Schools were randomly sampled and all eligible teachers were invited to participate in the study. One hundred and

forty-two questionnaires were sent out using Google Form link ; 128 of them were returned by the participants (response rate: 90.1%). In the qualitative phase, 20 respondents were purposely chosen among the survey respondents to ensure that the sample is as varied as possible in terms of years of experience, frequency of technology use, and TPACK score quartile. The demographic profile of the survey participants is provided in Table 1.

Table 1

Demographic Profile of Survey Participants (N = 128)

Variable	Category	n (%)
Gender	Female	89 (69.5%)
	Male	39 (30.5%)
Age Group	25–34 years	51 (39.8%)
	35–44 years	47 (36.7%)
	45 years and above	30 (23.4%)
Teaching Experience	1–5 years	38 (29.7%)
	6–15 years	55 (43.0%)
	16 years or more	35 (27.3%)
Highest Qualification	Bachelor's Degree	74 (57.8%)
	Master's Degree	49 (38.3%)
	Doctoral Degree	5 (3.9%)

Note. Information gathered through self-report questionnaire. Percentages may not sum to 100 due to rounding.

The main quantitative tool was a 42-item survey questionnaire based on the validated TPACK survey by Schmidt et al. (2009) and complemented with questions by Koehler and Mishra (2009). The original tool was modified to fit the ESL context by substituting generic references to the subject matter with the ESL-specific content references (e.g., teaching grammar, building reading comprehension). The items were rated on a five-point Likert scale (1 (Strongly Disagree) to 5 (Strongly Agree)) with higher scores reflecting more knowledge or confidence in each area. The seven TPACK sub-scales (CK, PK, TK, PCK, TCK, TPK, and TPACK) were represented by 6 items each. A pilot test with 20 ESL teachers who were not part of the main sample produced satisfactory reliability coefficients of all seven sub-scales. The overall instrument reliability was $\alpha = .93$.

The qualitative tool was a semi-structured interview guide that included 12 open-ended questions to obtain detailed descriptions of the experiences of technology integration, perceived obstacles, support sources, and professional development requirements of the participants. Three applied linguistics and educational technology experts reviewed the protocol prior to finalization. The interviews were carried out in English and took between 40 and 65 minutes. All interviews were recorded on audio with the consent of the participants and transcribed verbatim.

Participants were guaranteed anonymity and confidentiality by assigning them participant codes. The questionnaires were distributed in digital form to ensure that the highest number of responses was obtained. The interviews were carried out within the school premises at the

convenience of the participants. The participants were reminded that they had the right to leave the study without any penalty.

IBM SPSS Statistics (Version 27) were used to analyze quantitative data. Descriptive statistics (means, standard deviations, and frequency distributions) were computed for each TPACK sub-scale. The correlation analysis used by Pearson was used to test the relationships between individual TPACK dimensions and an aggregated digital readiness composite score, which was operationalized as the mean of all 42 items. A t-test was used to compare the gender differences in TPACK scores, and a one-way analysis of variance (ANOVA) was used to compare the differences based on years of teaching experience.

Interview transcripts were analyzed using Braun and Clarke's (2006) six-phase framework for thematic analysis: familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. The data were coded by two researchers, and inter-rater reliability was determined by calculating Cohen's kappa (κ =.84) which is regarded as a satisfactory level of agreement (Landis & Koch, 1977). Five participants of the interview were subjected to member checking to increase the validity of interpretations. The qualitative data were managed and organized using QDA Miner lite software.

Results

TPACK Levels in ESL Teachers (RQ1):

Table 2 shows the descriptive statistics of each of the seven TPACK sub-scales. All sub-scales scores are presented as means on the five-point Likert scale, with higher scores reflecting greater knowledge or confidence. The scores of 1.0-2.4 are classified as low, 2.5-3.4 as moderate, and 3.5-5.0 as high according to the interpretive guidelines followed by Schmidt et al. (2009).

Table 2

Descriptive Statistics for TPACK Sub-Scales (N = 128)

TPACK Sub-Scale	M	SD	Range	Level
Content Knowledge (CK)	4.12	0.61	2.33–5.00	High
Pedagogical Knowledge (PK)	3.98	0.58	2.50–5.00	High
Technological Knowledge (TK)	3.41	0.74	1.83–5.00	Moderate
Pedagogical Content Knowledge (PCK)	3.77	0.63	2.17–5.00	High
Technological Content Knowledge (TCK)	3.02	0.79	1.50–5.00	Moderate
Technological Pedagogical Knowledge (TPK)	2.88	0.81	1.17–4.83	Moderate
TPACK (Integrative)	2.71	0.83	1.00–4.67	Moderate
Overall Digital Readiness	3.41	0.56	1.86–5.00	Moderate

Note. M = Mean; SD = Standard Deviation. Score interpretation: Low (1.00–2.49), Moderate (2.50–3.49), High (3.50–5.00).

Table 2 indicates that participants had high levels of CK (M = 4.12, SD = 0.61), PK (M = 3.98, SD = 0.58), and PCK (M = 3.77, SD = 0.63), which means that they had strong disciplinary

and pedagogical backgrounds. TK scores were moderate (M = 3.41, SD = 0.74), suggesting a functional but not advanced familiarity with digital tools. The knowledge domains that were technology-integrated, TCK (M = 3.02, SD = 0.79), TPK (M = 2.88, SD = 0.81), and especially the integrative TPACK domain (M = 2.71, SD = 0.83) were all moderate in nature, with the lowest mean score being TPACK. The overall digital readiness composite score was moderate (M = 3.41, SD = 0.56).

Correlations between TPACK Dimensions and Digital Readiness (RQ2):

Table 3 shows the Pearson correlation table of all TPACK sub-scales and the total digital readiness composite score. All the correlations were significant at p <.01.

Table 3

Pearson Correlation Matrix for TPACK Sub-Scales and Overall Digital Readiness

	CK	PK	TK	PCK	TCK	TPK	DR
CK	—						
PK	.61**	—					
TK	.38**	.42**	—				
PCK	.71**	.74**	.45**	—			
TCK	.52**	.48**	.68**	.57**	—		
TPK	.43**	.54**	.71**	.61**	.73**	—	
DR	.58**	.63**	.69**	.72**	.76**	.81**	—

Note. CK = Content Knowledge; PK = Pedagogical Knowledge; TK = Technological Knowledge; PCK = Pedagogical Content Knowledge; TCK = Technological Content Knowledge; TPK = Technological Pedagogical Knowledge; DR = Overall Digital Readiness. ** p < .01 (two-tailed).

The strongest correlate of overall digital readiness (DR) was TPK (r = .81, p < .01), followed by TCK (r = .76, p < .01) and PCK (r = .72, p < .01). The three technology-integrated knowledge domains were more strongly correlated with overall digital readiness than the underlying domains of CK, PK, and TK. As DR was computed from the same 42 items that constitute the seven subscales, these correlations partly reflect the compositional overlap between each subscale and the composite score, and should be interpreted descriptively rather than as evidence of independent predictive strength.

The independent-samples t-test showed that there were no statistically significant gender differences in any of the TPACK sub-scale scores (all p > .05). One-way ANOVA revealed that there were significant differences in TK scores based on years of teaching experience, F(2, 125) = 6.34, p =.002, η 2 =.09, with post-hoc tests (Tukey HSD) indicating that teachers with 1-5 years of teaching experience had significantly higher TK scores than teachers with 16 or more years of experience.

Barriers and Facilitating Factors (RQ3):

Thematic analysis of the 20 interview transcripts produced four general themes, each with a number of subthemes. Table 4 summarizes themes and representative quotations of participants.

Table 4

Themes and Sub-Themes from Qualitative Thematic Analysis (n = 20)

Theme	Sub-Theme	Representative Quotation
1. Infrastructural Barriers	Connectivity issues	"The internet drops every few minutes. I cannot do a listening activity using YouTube reliably." (P04)
	Insufficient devices	"We have one computer lab for 40 classes. Booking it is almost impossible." (P11)
2. Professional Development Gaps	Workshop irrelevance	"The training sessions are about software, not about teaching English with technology. They are not designed for us." (P07)
	Lack of follow-up	"They show us something once and expect us to use it. There is no coaching, no observation." (P15)
3. Low Technological Self-Efficacy	Fear of failure	"I am afraid something will go wrong in front of the students. That embarrassment stops me from trying." (P02)
	Perceived effort	"Preparing a technology lesson takes three times as long. With all my other responsibilities, it is not realistic." (P18)
4. Facilitating Factors	Peer collaboration	"When a colleague shares a lesson using Padlet or Kahoot, I feel motivated to try. We learn from each other more than from workshops." (P09)
	Student engagement	"When I used a digital story-building app, the students were more engaged than I had seen all year. That reaction pushes me to do more." (P13)

Note. Participant codes (P01–P20) are used to preserve anonymity.

Discussion

The observation that ESL teachers from south Punjab, Pakistan in this study scored high in CK and PK and moderate in TK and significantly lower in the technology-integrated domains (TCK, TPK, and TPACK) is a replication and expansion of trends found in previous studies. Koehler and Mishra (2009) also found that teacher preparation programs have traditionally been more effective in cultivating disciplinary expertise and general pedagogical skills than in cultivating the integrative knowledge that effective use of technology requires. Similar profiles were observed in a validation study by Schmidt et al. (2009), who reported that TPACK always received the lowest mean scores despite the reasonable proficiency in constituent domains.

The comparatively moderate TK scores in the current study are interesting in the Southern Punjab context. Although the government has continued to invest in digital infrastructure through various educational reform plans (Sahito et al., 2025), the self-reported technological knowledge of ESL teachers was still below the high level. This could be indicative of the disjuncture between access to digital devices and the creation of the type of purposeful, pedagogically oriented technological fluency that the TPACK framework outlines. The introduction of technology in the learning setting does not necessarily mean that it will become a part of the teaching process, as Bax (2003) suggested in his normalization hypothesis; instead, normalization takes time, experimentation, and reflection.

The comparatively higher correlation between the technology-integrated knowledge domains (TCK, TPK and TPACK) and overall digital readiness are worth noting, though they should be read with some caution given that the digital readiness composite was derived from the same

items pool as the subscales themselves. With that caution in mind the pattern is at least consistent with the broader argument that integrative knowledge rather than technological knowledge alone is central to teachers overall preparedness. A relationship future work using an independently constructed readiness measure could test more directly. The implications of this finding on the design of teacher professional development are discussed in the implications section below.

The obstacles that were identified during the qualitative analysis are similar to those that are reported in the general CALL and educational technology literature. The difference between first-order (extrinsic) and second-order (intrinsic) barriers as outlined by Ertmer (1999) is evident in the data. The first-order barriers include infrastructure shortages and access limitations to devices, which, although severe, can be addressed by institutional investment and policy intervention. The more profound and possibly more intractable obstacles, such as low self-efficacy, fear of failure in front of others, and the perceived inadequacy of professional development, are second-order constraints that need more subtle, long-term, and individualized intervention.

The observation that professional development workshops were often viewed as not relevant to ESL-specific teaching needs is echoed by Hubbard and Levy (2006) who argue that CALL teacher education has traditionally been disconnected with disciplinary pedagogy. Unless teachers who are trained to use software know how it relates to the particular issues of teaching English grammar, building reading fluency, or helping students to engage in spoken communication in a second language, they are unlikely to transfer that training into classroom practice. Similarly, Godwin-Jones (2017) stressed that the contextualization and pedagogical foundation of professional development in technology among language teachers should be based on the context.

The low technological self-efficacy theme supports the theoretical predictions of Bandura (1977) and reflects the results of Ertmer and Ottenbreit-Leftwich (2010) and Amjad et al. (2020), who found teacher confidence to be one of the strongest mediators of the technology integration process. The anxiety of technical breakdown in front of students became a particularly acute issue in the current data, which is consistent with the studies on teacher anxiety in technology-enhanced classrooms. Notably, a number of the participants reported that observing a colleague effectively adopt technology was a stronger motivator than formal training, a fact that resonates with the significance of vicarious learning experiences in influencing self-efficacy beliefs (Bandura, 1977).

The fact that peer collaboration has become one of the main facilitating factors is a discovery of significant practical value. The informal professional learning communities that the participants reported about, where colleagues exchanged digital lesson ideas, troubleshooted technical issues, and offered moral support, seem to serve as a type of distributed TPACK development that supplements, and in some instances outweighs the influence of formal training. This observation is consistent with the observation of Stockwell (2012) that technology integration in CALL situations is most likely to be sustained when it is integrated into collaborative professional cultures and not left to individual initiative.

Student engagement was a second significant facilitating factor, with teachers indicating that positive student reactions to technology-enhanced activities were a strong intrinsic motivation to persist and increase their use of technology. This relationship is in line with the larger body of research on teacher motivation that has found student learning outcomes to be one of the

strongest sources of professional satisfaction and renewed effort. The pedagogical affordances of digital tools, especially their ability to arouse student interest, enable authentic communication, and offer instant feedback, seem to act as a positive reinforcement loop that maintains technology integration in the long term.

Conclusion

This research examined the digital readiness of in-service ESL teachers in Pakistani secondary schools using a convergent mixed-method design based on the TPACK framework and self-efficacy theory. Quantitative results indicated a similar trend across TPACK dimensions: although teachers had high levels of content and pedagogical knowledge, their technology-integrated knowledge, especially the integrative TPACK dimension, was much lower, indicating a continuing gap in the ability to use technology in disciplinary, pedagogically informed practices. Correlation analysis indicated that technology-integrated knowledge domains were more strongly associated with general digital readiness than the foundational subscales, a pattern that is broadly consistent with the importance of programs that build these integrative competencies. Qualitative results added to and elaborated this image by revealing a network of obstacles, including infrastructural, professional development-related, and self-efficacy-related, and shedding light on the peer collaboration and student engagement processes that facilitate technology integration in practice.

This research contributes to the literature of CALL and applied linguistics in a number of ways. It offers empirical evidence based on TPACK in a secondary school ESL setting in South Asia, which is underrepresented in the literature. It emphasizes the need to pay attention not only to the technical aspects of teacher preparedness but also to the motivational, affective, and collaborative aspects. And it adds methodologically by showing the usefulness of convergent designs that are mixed-methods in investigating the multi-layered phenomenon of teacher digital readiness. These findings have direct implications to teacher educators, school administrators, and policymakers who are determined to improve the quality of ESL education in online settings.

The implications of the findings are significant to the pre-service and in-service ESL teacher education. Teacher preparation program must no longer be seen as an add-on module that includes technology training but must be developed as a part of the entire curriculum. In particular, the trainee teachers are to be instructed to create digital lesson plans that are clearly based on the principles of second language acquisition and ESL pedagogy, so that technology is used as a means of language learning, but not as a goal. TPACK development can be an effective process through mentoring program that match novice and experienced teachers in collaborative lesson design and critical reflection.

At the in-service level, professional development should be redesigned in accordance with principles of sustained, practice-based, and peer-collaborative learning. The contextual relevance, peer support, and continued accountability that isolated workshops do not offer would be provided by schoolwide professional learning communities centered on technology-enhanced ESL practice.

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