



Journal of Emerging Trends in Social Sciences and Humanities

A Double-Blind, Peer-Reviewed, HEC recognized [Y-category](#) Research Journal

E-ISSN: [3006-7898](#) P-ISSN: [3006-788X](#)

Volume 3, Issue 3, 2026, 53-63



Reimagining Faculty Development for the Digital Classroom: Teacher Educators' Constructions of Sustainable TPACK Growth in Punjab

Arooj Zaman¹ Ammara Chaudhry² Dr. Sadia Rauf³ Dr. Yaar Muhammad⁴

¹ MS Scholar, Department of Education, Government College Women University, Sialkot, Punjab, Pakistan.

² MS Scholar, Department of Education, Government College Women University, Sialkot, Punjab, Pakistan.

³ Senior Lecturer, Life and Living Department, Riphah University Lahore, Punjab, Pakistan.

⁴ Associate Professor, Department of Education, Government College Women University, Sialkot, Punjab, Pakistan.

Corresponding Author: Arooj Zaman, Email: aroorarif171990@gmail.com

Article Information

Received:

2026-06-02

Revised:

2026-07-03

Accepted:

2026-08-01

Keywords

TPACK; Faculty Development; Teacher Educators; Reflexive Thematic Analysis; Punjab; Pakistan; Sustainable Professional Growth; Digital Pedagogy.

ABSTRACT

While teacher education in Pakistan is generally faced with various limitations pertaining to technology infrastructure, teachers' continuous training, and institutional support, integration of technology in faculty development is an overlooked aspect in Pakistan. This study discusses how the meaning of sustainable growth is built by teacher educators in Technological Pedagogical Content Knowledge (TPACK) in the context of Punjab. The study uses a qualitative, descriptive approach with Reflexive Thematic Analysis, which involves semi-structured interviews with 25 teacher educators from public sector teacher education institutes. Interviews were transcribed using TurboScribe AI and coded using NVivo AI-assisted coding. Four themes emerged: institutional infrastructures - enabling or constraining; professional identity work in the process of a digital transition; mentoring and collegial learning as sustaining mechanisms; and disciplinary boundaries shaping technology uptake. The results indicate that ensuring the sustainable development of TPACK is not sufficient; it is more likely to be a type of continuous, situated, relationally embedded, and conscious process. The findings provide contextually situated insights into faculty development in a low-resource teacher education system and implications for teacher education policy, mentoring systems, and teacher education leadership. It represents a paradigm shift to view faculty development as a continuous and relational process rather than an event or a separate training session.



© 2026 by the authors. Licensee Zaman, Chaudhry, Rauf & Muhammad. This article is an open-access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license <https://creativecommons.org/licenses/by/4.0/>

Publisher: Institute for Educating Environmental Resilience and Governance

1. Introduction

The use of technology in teaching has been a key issue for teacher education institutions that aim to prepare preservice teachers for enabling digitally mediated classrooms (Mishra & Koehler, 2006). The Technological Pedagogical Content Knowledge (TPACK) framework is one of the most popular approaches for viewing teachers' and teacher educators' integration of technology, pedagogy, and content into effective instruction (Mishra & Koehler, 2006). Since its introduction, TPACK has influenced the development of teacher education and teacher development programs and research agendas in various countries (Koehler et al., 2013). The idea behind the framework is that the way technology is used in the teaching of a topic must go hand in hand with how teachers make pedagogical decisions and provide disciplinary content, which is supported by the increasing number of empirical works (Voogt & McKenney, 2017).

Faculty development has become the main approach for teacher educators to develop their TPACK (Jaipal-Jamani & Figg, 2015). The models that still hold sway are based on the workshop-style use of digital tools and pedagogical strategies (Jaipal-Jamani & Figg, 2015). However, there is growing recognition that to foster continued growth and TPACK development, we must go beyond stand-alone professional development opportunities and model the complexities of classroom practice through communities of practice, mentoring, and design thinking-based learning experiences (Çam & Koç, 2024). Leadership commitment and resource allocation, including institutional support structures, can profoundly impact the realisation of development (Erstad & Voogt, 2018). In South Asian settings, teacher education resources are significantly limited, raising questions about sustainability (Ghayyur & Mirza, 2021).

Despite multiple efforts to integrate technology in the teacher education process in Pakistan (and particularly in public sector teacher education institutions in Punjab), gaps can still be seen in the process. Teacher-educators are a key population in this chain, expected to serve as role models to prospective teachers with regard to technology-blended teaching approaches, and even many teacher-educators are not confident enough to do

this because of the lack of infrastructural and professional support in this regard. Because of this, it is critical to better understand with deep insight into the faculty's experience and meaning making of the faculty development activities.

Although much has been written in theory about TPACK and the aspects that make up the framework (Herring et al., 2016; Niess et al., 2018; Phillips et al., 2025), there has been relatively little research into how teacher educators make meaning of what facilitates teacher professional growth through technology in the context of their institutions. In many cases, TPACK is measured using self-report instruments, which provide a snapshot of the level of TPACK knowledge, rather than the lived and ongoing processes in which TPACK knowledge can emerge and/or be weakened. In Pakistan, infrastructural obstacles and skills gaps have been well documented in detail in various studies (Ghayyur & Mirza, 2021), but less has been written about what teachers themselves think should be done to ensure that development efforts are sustainable.

In addition, most existing research on faculty development considers disciplinary context as a background factor, even though there is increasing awareness that the use of technology is widely divergent and varies by discipline (Hora & Holden, 2013; Mercader & Gairín, 2020; Starkey et al., 2023). Some doubts persist regarding the practical working of relationality and mentoring in the particular context of Punjab with its strong social bonds and hierarchical institutional setting and a lack of resources. There has been little analysis in the existing literature of the ways in which the professional role of the educator becomes (and remains) different when the 'big demands' of the online environment are added on top of other, traditionally defined roles. This gap is important because pedagogical trainings without considering identity, relational learning, and disciplinary differences are likely to be enacted the same way as elsewhere and end up as a workshop that quickly gets lost (Jaipal-Jamani & Figg, 2015).

This study attempts to address these gaps by considering sustainable TPACK growth as a multilayered identity negotiated by teacher educators' perceptions of institutional life,

professional identity, and collegial relationships in the province of Punjab. How do teacher educators in Punjab claim that the institutional circumstances support or hinder the ongoing integration of technology? How do they tell the story of changes in what it means to be a professional in a more digital world? How do mentoring and collegial relationships contribute to sustaining TPACK development over a period of time? The results of this study provide a contextually informed interpretation of the themes that are not based on predetermined TPACK subcomponents and can be used to think about faculty development policy in resource-poor teacher education contexts. The paper continues by engaging in a thematic literature review, a methodological description of the Reflexive Thematic Analysis process, four themes that were constructed, and a discussion of implications for theory, practice, and future research.

2. Literature Review

2.1 TPACK as a Theoretical Framework

TPACK framework is based on Shulman's prior work on pedagogical content knowledge, which considers technology integration to be an emergent phenomenon of overlapping knowledge areas rather than a distinct skill (Harris et al., 2009; Koh et al., 2015; Schmidt et al., 2009). Content, pedagogy, and technological affordances are interdependent and in a constant process of negotiation to capitalise on the effective use of technology (Mishra & Koehler, 2006). Later theorising has further developed the layers of the context: the micro level that is the context of the classroom; the mezzo level of the context of the institution; and the macro level of the context of the policy (Porrás-Hernández & Salinas-Amescua, 2013). This multi-layered conceptualisation is helpful for comprehending faculty development because it sets the "landscape" in which the faculty member can materialise their knowledge.

The clear boundaries between the components of TPACK have been criticised as difficult to operationalise empirically, and thus some researchers have taken a holistic or narrative approach to studying TPACK in their work (Archambault & Barnett, 2010). This critique reinforces the value of qualitative, meaning-centred methods that avoid the a priori

determination of pre-specified categories of knowledge and provide an opportunity to define patterns of significance through participants' own words and experiences.

2.2 Faculty Development Models and Their Limitations

First, the difference between episodic training models, which are usually conducted as workshops, and sustained mentoring, communities of practice, and design-based collaboration (Çam & Koç, 2024) is investigated. Workshop-only interventions have been extensively reviewed for the lack of sustained impact on teacher implementation of the intervention, as they usually fall short of being met by teachers in their classrooms after the workshop (Jaipal-Jamani & Figg, 2015). Co-creating technology-integrated learning materials has proven more effective in embedding TPACK growth within authentic practice in a design-based professional development approach (Koehler et al., 2013).

However, faculty development and institutional support continuously come as a dominant factor, where the change in faculty development is transformed into the remaining practice. Motivation and capacity for continuous learning are influenced by leadership, allocation of resources, and recognition systems (Erstad & Voogt, 2018). However, much of this literature comes from systems with higher resources and is found in North America, Europe, and East Asian universities, which are less hierarchical and have a greater resource, and much of it remains unclear how it works with lower-resource teacher training systems like those in Pakistan's teacher training public institutions, which are hierarchically organised.

2.3 TPACK and Teacher Education in Pakistan

The majority of research on TPACK in Pakistan has investigated prospective and in-service school teachers instead of teacher educators per se. Using a qualitative study, Ghayyur and Mirza (2021) reported the presence of infrastructural obstacles, such as a lack of a well-equipped computer lab, unstable internet connectivity, and limited technical support among prospective teachers, as well as low motivation for learning due to

insufficient institutional recognition. Similar obstacles could also be identified in research on private secondary science teachers' technology use in their teaching, in which the majority of science teachers' use of technology only occurred at the substitution level, even when their institution invested in technology (AhmedEtal2023). These studies concur that there is a lack of integration of technology that goes beyond infrastructural limitations and underscores the importance of motivational, cultural, and relational aspects.

However, there are relatively few studies that have discussed teacher educators as a group, given that they are in a very special position as technology users and models for future teachers. This is important because educators' professional learning experiences impact their own technology-integrated pedagogy and interweaving practices with teacher candidates they train (Aslam et al., 2021; Zahid et al., 2022; Voithofer & Nelson, 2021). A gap in the literature was the lack of research related to teacher educators' faculty development processes, in particular in Punjab.

2.4 Professional Identity, Mentoring, and Disciplinary Difference

A smaller body of literature discusses the nexus between digital transition and professional identity in higher education and teacher education (Jonker et al., 2018). Some of these tensions exist between teachers' years-long constructed pedagogical identities and digital expectations, which is a common experience for educators as they gain the responsibilities of being digitally responsive (ZhouEtal2022). A few mechanisms have been suggested to alleviate this tension, such as mentoring relationships and communities of practice, where educators reconceptualise their identities through relations and gain new skills by participating in mentoring relationships (ZhouEtal2022). To complicate this further, technologies afford different forms of engagement depending on the discipline to be taught; therefore, classroom technology enhancements and orientations that are more generic in nature tend not to be as effective across disciplines (ScherbaumEtal2019). These threads—professional identity, mentor, and disciplinary variations—are less explored in the context of

teacher education in South Asia but serve as the conceptual foundation on which the themes in the present study are built.

3. Research Methodology

3.1 Research Design

This study used a qualitative design in line with the principles of reflexive thematic analysis (Reflexive TA) (Braun & Clarke, 2022). Reflexive TA was chosen over other approaches to qualitative analysis, including the construction of grounded theory or Interpretative Phenomenological Analysis, which aim to bracket off subjectivity and develop formal theory (Braun & Clarke, 2019) in favour of one that presents theoretical flexibility and foregrounds the researcher's active and creative role in interpreting and developing meaning from the dataset. Reflexive TA's cross-case and patterning perspective resonated with the aims of the study, which did not aim at idiographic case analysis of the research questions, but included a search for commonalities in the meaning-making of the 25 teacher educators. The design in Big Q qualitative values and sees knowledge as contextually located and co-constructed, not an objective reality to be discovered (Braun et al., 2019).

3.2 Philosophical Paradigm

This study adopts a contextualist ontological stance, where it assumes that there are multiple realities within the institutional and cultural environments rather than a single truth to "discover" (Braun & Clarke, 2022). Epistemologically, the study has a constructionist orientation, where knowledge is produced in the interplay between the participants' accounts and the researcher's interpretive exercise (Braun & Clarke, 2022). The theory of language used is constructionist, rather than reflective, which sees the participants' words actively involved in the construction of meaning, not as transparently reflecting predetermined internal states. The analytic orientation involves experiential and mildly critical sensibilities, allowing for empathetic connection with educators' own tasks of meaning-making while also providing a way to attune to and consider the influence of the institutional discourses on what is said and thought.

3.3 Analytic Approach

Data analysis was predominantly inductive; that is, the meaning of the theme emerged from the data, but was informed by the theoretical discourses found in TPACK. Analytic work was conducted at both the semantic and latent levels, observing both explicit and implicit comments on infrastructure and training—but also on the professional value, competence, and institutional belonging. This dual concern connected with research questions that wanted to both describe conditions of institutions and gain a deeper understanding in an interpretative sense of identity and relationality.

3.4 Participants and Sampling

The type of sampling used was purposive criterion sampling (Patton, 2015). There were two inclusion criteria that participants had to meet: (1) teacher educator at any teacher education institute of Punjab with at least two years of experience, and (2) must have some experience in the technology integration initiative at the institutes of teacher education at Punjab (Creswell & Poth, 2023). Two and a half teacher institutes were involved, and the participants were 25 teacher educators from various institutes and in different subjects ranging from sciences to humanities and education studies, representing both young and old educators. The study was not based on saturation, but on "information power," in which the following factors contribute to the sample size adequacy: specificity of the research question, specificity of the sample, use of existing theory, quality of dialogue, and analytic strategy (Malterud et al., 2016).

3.5 Data Collection

Data collection employed a semi-structured interview approach, which is appropriate for exploring rich and reflective lived experiences (Kvale & Brinkmann, 2015). An interview guide covered institutional experience of technology-related training, perception of the change of profession, relational experiences, mentoring experiences, and disciplinary considerations (Braun & Clarke, 2013) and was used with the flexibility of following the participants' emphasis on subjects. Interviews were 45–70 minutes long and conducted in the language the participants chose (Urdu or English) in private institutional

meeting rooms and/or via video call when required. The interviews were all recorded and then transcribed by the TurboScribe AI speech-to-text software, and the transcripts were subsequently checked manually against the recordings for accuracy prior to analysis.

3.6 Data Analysis Procedures

We then analysed the data according to the six recursive phases described by Braun and Clarke (2022). During Phase 1, Familiarisation, the researcher read and reread all the transcripts, noting areas of interest and reflective observations about recurring issues that were institutional and/or relational in nature. The second phase of coding, initial coding, was a systematic line-by-line coding of the entire set of data, where coding was regarded as an active process of meaning-making, rather than just passive labelling of the data, with codes assigned such as "training as symbolic gesture" and "mentoring across hierarchy."

In Phase 3, themes were tentative, and codes with a similar concept were grouped together; the themes were not found in the data but were produced through an iterative process of engagement. Thematic maps were created to initiate relationships between candidate themes. During Phase 4, the development and review of these candidate themes provided significant revision, with an initial candidate theme, "technology anxiety," being broken down and the constituent codes redistributed into two main themes: Identity and Institutional infrastructure, as anxiety alone did not represent the shared organising concept across the candidate themes. Phase 5 was dedicated to the development of definitions of each of the four remaining themes to capture the central organising concept for each theme, with this process also supporting the process of naming each of the remaining themes. The writing up (Phase 6) brought together the analytic narrative and illustrative data extracts in a unified interpretative story, which was conceptualised as a form of storytelling, not merely a neutral reporting (Braun & Clarke, 2013).

3.7 Use of CAQDAS Software

Data management was performed using NVivo 15 software and NVivo's AI-assisted coding for

initial coding and coding organisation. The software was used to retrieve text, manage code systems, write memos, and perform visual thematic mapping. It was purely organisational, and all analytical, coding, and labelling decisions, and any interpretation of the themes, were made by the researchers, and the coding suggestions produced by the software were used as prompts to check and reflect upon (Jackson & Bazeley, 2019). The informative capability of the software was not a replacement for analysis.

3.8 Researcher Reflexivity

This study benefited from the author's insider perspective on the culture of teacher training institutes in Pakistan as a researcher already part of the higher education system and working with various teacher training institutions. This positioning is regarded analytically rather than as a bias or something to be eliminated (Finlay & Gough, 2003). Maintaining a reflexive journal during this data collection and analysis cycle was used to document assumptions, emotional reactions to specific stories, and changes in perceptions and interpretations as they arose, and then used to guide iterative revisions of themes and subthemes in Phase 4. As coding is an inherently subjective and interpretative process and not one for which the desirability of coding reliability as a quality mark is accepted by Reflexive TA (Braun et al., 2019), no inter-coder reliability checks have been undertaken.

3.9 Trustworthiness and Quality

Quality was judged based on the conceptual coherence of research questions, concepts, and data analysis and reporting process, and extensive documentation of the data analysis process in the form of research memos and journal entries. The depth of interpretation was achieved in that there was an extended contact point with data extracts throughout the iterative process, and that the inferences and judgements made at the level of the themes are illustrated throughout by specific items. These criteria are appropriate for Big Q qualitative research, with a focus on rich rigour and transparency, rather than procedural reliability measures (Tracy, 2010).

3.10 Ethical Considerations

Ethical clearance for the study was obtained before data collection. All participants provided

informed consent, were informed of the purpose of the study, informed that they could drop out at any time without any repercussions, and were told that what they said would not be shared with others and that confidentiality would be maintained. Taking participant identities as a priority, there were numerical identifiers, and details that would identify institutions were taken from the transcripts. Audio recordings and transcripts were kept securely on institutional computers that were password-protected and that were accessible only by the research team.

4. Findings

4.1 Theme One: Infrastructure as Symbol and Substance

This theme encapsulates the experiences of the teacher educators through institutional, not as limiting, but symbolic, of institutional interest in their professional development. Participants consistently tied constraints on materials, internet connectivity issues, old hardware, and lack of technical assistance to the lack of institutional care and consideration, rather than just inconvenience.

Subtheme 1.1: Resources as institutional messaging: Teachers saw investment in infrastructure as an indicator of valuing their development. Particularly training activities that resulted in nothing were described as "feeling empty..." Another participant said, "They had been to an organised training, but there was no long-term effect because nothing at the institute was the same as what we were seeing" (Participant 14). These accounts showed that there was a symbolic reading of infrastructural neglect, that is, it was portrayed as something that had to be done for policy reasons, but not as a priority in universities (Erstad & Voogt, 2018).

Subtheme 1.2: Improvisation as professional labour: Much of what was reported was detailed examples of a great deal of personal effort because of gaps in infrastructure and a portrayal of this improvisation as an extra, non-rewarded professional burden. One participant reported in detail the compounding effect of dealing with shortfalls in the system:

I have my own computer, pay for when the network goes down, and at times print out materials from my own pocket due to a lack of support. No one in our workload takes

responsibility for this labour, and without such labour, none of the things we learn in training would be of use to us in the classroom. (Participant 19)

Under this narrative, sustainability depends on individual behaviours and not the design of an institution, thus forming a fragile base for long-lasting changes.

4.2 Theme Two: Renegotiating Professional Identity

This theme focuses on the disruption of long-held and well-practiced professional identities as a result of the Digital – disrupting “what it means to be a competent, respected teacher educator.”

Subtheme 2.1: Competence under threat: Senior teachers indicated discomfort at being viewed as novices in digital contexts compared to younger colleagues and trainee teachers. One participant stated, "My 30 years of experience is irrelevant when compared to the tricks with Apps used by a 25-year-old" (Participant 3). Such a risk to the cumulative professional legitimacy helped form opposition to some development initiatives, not just technological, but rather from a fear of the displacement of status.

Subtheme 2.2: Reframing expertise as adaptability: However, some participants reported that they were in the process of actively reflecting and "reconstructing" their career identity, away from the notion of mastery to adaptability, to become more confident with this new way of thinking. One participant came to the realisation that they did not need to know all the answers and were "now a learner like my students" (Participant 11). This transformation expresses identity work in a generative and non-concluding manner instead of considering identity as identifiable end products of training activities.

4.3 Theme Three - Mentoring as Relational Infrastructure

Here, the theme was formed by the recurrent focus of the participants on informal mentoring and peer relationships as key factors that sustained technology-related learning, and which, in the participants' perception, had a larger impact than formal mentoring.

Subtheme 3.1: Horizontal learning across hierarchy: There were examples of informal

mentoring taking place between participants across the hierarchy, which is not normally present in institutions. The online grading system was valued by a junior educator who was requested to teach her department head how to use it: "My department head asked me to show her how she could use the online grading system; that was a sense of value that you don't get in the formal training" (Participant 22). Moments like these redefined mentoring as bidirectional and created an opportunity for mutual investment in ongoing learning.

Subtheme 3.2: Sustained relationships versus episodic events: In both cases, the participants were very aware of the difference between the value of a single workshop and the benefits of continued collegial relationships.

The workshop continues for 2 days, and then everyone forgets. However, when a co-worker joins your week after week throughout the month to support you in creating slides or troubleshooting an issue, then that is your impact on teaching. Training events feel more like a formality; these relationships feel like real learning. (Participant 8)

This reveals the need for mentoring as a relational infrastructure, which provides continuity to that which structurally cannot (Jaipal-Jamani & Figg, 2015).

4.4 Theme Four: Disciplinary Boundaries and Selective Adoption

This theme of TPACK shows that teachers' models depend on the discipline context, and that technology integration was not necessarily universally adopted.

Subtheme 4.1: Content-technology fit: The teachers' use of simulation and visualisation was generally found to be smooth, while the use of digital resources to support content was seen as more challenging, especially in the humanities subjects. One of the participants pointed out some disparities in the resources available in physics (Participant 16).

Subtheme 4.2: Selective resistance as professional judgement: However, instead of being universally overcome by resistance, a number of the participants were more concerned about the use of some parts of digital technology and focused their

resistance not on technology itself, but rather on it as a pedagogical choice, in which some technologies did not achieve their disciplinary aims. One participant stated, "I'm not against technology, but sometimes, when it comes to teaching poetry... a screen is in the way of what students need to feel" (Participant 5). This puts selective adoption in the light of being something that professionals know how to do, not an absence of the knowledge to do other things.

5. Discussion

5.1 Interpretation of Findings

These four themes stand together and build an account of TPACK growth as one that is particularly relational and symbolic, not just technical. Infrastructure was a relational device for communicating institutional care and attention; practice was not merely a matter of acquiring skills but involved ongoing renegotiation within a discipline; mentoring was a mechanism for maintaining relational continuity in the absence of the individual in the formal structure of the practice; and disciplinary context determined which technologies seemed to offer a sense of continuity and fit professionally. Together, all of these patterns point to the sociological, symbolic, and disciplinary environments that play a greater role than the frequency or level of sophistication of faculty development in sustainability.

5.2 Connection to Existing Literature

These findings not only support but also enhance previous research. It reiterates the well-known infrastructural barriers highlighted in Ghayyur and Mirza's (2021) work on documentation but also expands on this literature by showing implies inferiority for educators and accumulates meanings that are not simply pragmatic burdens but symbolic problems. This is in line with the importance of mentoring evident in the findings of (Jaipal-Jamani & Figg, 2015) and other researchers on collaborative learning communities (CLDs), but this finding also points to a nuance in the nature of mentoring relationships associated with the dynamics of the institutional culture in Punjab: mentoring was a relationship with a horizontal shift in usual seniority dynamics, which had particular relational significance.

Borrowing from both the school as a place of anxiety in digital transition and the identity renegotiation, this study demonstrates how such tension can be reframed and rendered productive; in short, a way of not just coping with it. Lastly, the results show that disciplinary variation with respect to technology adoption confirms the findings of Scherer and Teo (2019) on the unevenness of content-technology fit and highlights that selective resistance may be a kind of professional judgment, rather than a lack, with consequences on how resistance would be understood by policy actors.

5.3 Implications

In theory, this suggests that TPACK frameworks need to pay more to the relational and symbolic aspects of the professional learning contexts, beyond the models that represent mere compendia of knowledge. In practice, mentoring arrangements - specifically cross-hierarchy mentoring - should be made more formal by institutions as a faculty development activity rather than a natural consequence, if it does happen, of other initiatives. Policymakers need to understand that infrastructural investment goes beyond functional impact to symbolic impact - where part or full investment failures can undermine training investments, irrespective of pedagogical quality. In methodological terms, the study illustrates the usefulness of Reflexive TA in conjunction with AI tools for transcription and coding to produce thick and context-rich descriptions of work practice experience in an under-researched context.

5.4 Limitations

The results of this study are based on the narratives of 25 educators from public sector institutions in the province of Punjab and cannot be directly applied to institutions in other provinces or the private sector with varying resources. The researcher's lack of independence due to being an insider might have led him to miss valuable readings that an outsider researcher might have taken on. Although the interview information is rich, it presents a retrospective view that has been influenced by memory and the interviewee's self-image.

5.6 Future Research Directions

Future research would fruitfully explore the

themes created in this study from a longitudinal perspective, including a longer period of teacher educators' process of renegotiating an identity and the formation of mentoring relationships. Provincial comparisons or comparisons between institutions in different sectors might shed light on the different ways in which contextual differences impact the sustainable development of TPACK. Lastly, studies specifically focused on the perspective of institutional leaders overlaid with teacher educators' perspectives may provide a more comprehensive description of the symbolic and relational dynamics found here.

6. Conclusion

This study sought to gain insight into the creation of sustainable growth of teacher educators' professional knowledge on technology in Punjab. Four themes were developed: infrastructure as symbol and substance; renegotiating professional identity; mentoring as relational infrastructure; and disciplinary boundaries shaping selective adoption, via Reflexive Thematic Analysis of 25 teacher educators' interviews. As a whole, these themes address the research questions, ultimately indicating that sustainability is not so much about the form and shape of individual training, but rather about the relational, symbolic, and disciplinary context thereof.

What makes this account important is its 'situated specificity'. Specifically, this study draws insights that illuminate the process by which educators in one specific and resource-driven system make sense of the digital transition, negotiate their professional position, and continue an ongoing learning through relationships, not isolated occasions. This understanding is relevant for institutions and policymakers who want to develop faculty development that is relevant to the reality of life in the profession, not a mere product of policy requirements. This type of localised, qualitative knowledge provides something more than what more general surveys can provide: an inside, "felt," sense of what sustainability might be like.

Further research into the longitudinal nature of identity change, comparisons across institutions, and the perspectives of leadership could yield a much deeper understanding. It is clear from the stories of these teachers that meaningful technology integration in teacher preparation will not be achieved by infrastructure and training alone. It demands institutions that see professional development as a relationship in progress, respectful of the disciplinary, symbolic, and identity-framing aspects of educators' working lives.

Conflict of Interest

The authors showed no conflict of interest.

Funding

The authors did not mention any funding for this research.

References

- Archambault, L., & Barnett, J. H. (2010). Revisiting technological pedagogical content knowledge: Exploring the tpack framework. *Computers & Education*, 55(4), 1656–1662. <https://doi.org/10.1016/j.compedu.2010.07.009>
- Aslam, R., Khan, N., Asad, M. M., & Ahmed, U. (2021). Impact of technological pedagogical content knowledge on teachers' digital proficiency at classroom in higher education institution of Pakistan. *Interactive Technology and Smart Education*, 18(1), 119–130. <https://doi.org/10.1108/itse-11-2020-0222>
- Braun, V., & Clarke, V. (2013). *Successful qualitative research: A practical guide for beginners*. Sage.
- Braun, V., & Clarke, V. (2019). Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health*, 11(4), 589–597. <https://doi.org/10.1080/2159676X.2019.1628806>
- Braun, V., & Clarke, V. (2022). *Thematic analysis: A practical guide*. Sage.
- Braun, V., Clarke, V., Hayfield, N., & Terry, G. (2019). Thematic analysis. In P. Liamputtong (Ed.), *Handbook of Research Methods in Health Social Sciences* (pp. 843–860). Springer. https://doi.org/10.1007/978-981-10-5251-4_103
- Çam, Ş. S., & Koç, G. (2024). Professional development program to develop teacher educators' technological pedagogical content knowledge. *Sage Open*, 14(2). <https://doi.org/10.1177/21582440241242841>
- Creswell, J. W., & Poth, C. N. (2023). *Qualitative inquiry and research design: Choosing among five approaches* (5 ed.). Sage.
- Erstad, O., & Voogt, J. (2018). The twenty-first century curriculum: Issues and challenges. In *Second Handbook of Information Technology in Primary and Secondary Education* (pp. 19–36). https://doi.org/10.1007/978-3-319-71054-9_1
- Finlay, L., & Gough, B. (2003). *Reflexivity: A practical guide for researchers in health and social sciences*. Blackwell.
- Ghayyur, M., & Mirza, M. S. (2021). Exploring tpack skills of prospective teachers and challenges faced in digital technology integration in Pakistan. 2(4), 226–241. [https://doi.org/10.47205/jdss.2021\(2-IV\)19](https://doi.org/10.47205/jdss.2021(2-IV)19)
- Harris, J., Koehler, M., Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge. *Contemporary Issues in Technology and Teacher Education Journal*, 9, 60–70.
- Herring, M. C., Koehler, M. J., & Mishra, P. (2016). *Handbook of technological pedagogical content knowledge (TPACK) for educators*. Routledge.
- Hora, M., & Holden, J. (2013). Exploring the role of instructional technology in course planning and classroom teaching: implications for pedagogical reform. *Journal of Computing in Higher Education*, 25, 68–92. <https://doi.org/10.1007/s12528-013-9068-4>
- Jackson, K., & Bazeley, P. (2019). *Qualitative data analysis with NVivo* (3rd ed.). Sage.
- Jaipal-Jamani, K., & Figg, C. (2015). A case study of a TPACK-based approach to teacher professional development: Teaching science with blogs. *Contemporary Issues in Technology and Teacher Education*, 15(2), 161–200.
- Jonker, H., März, V., & Voogt, J. (2018). Teacher educators' professional identity under construction: The transition from teaching face-to-face to a blended curriculum. *Teaching and Teacher Education*, 71, 120–133. <https://doi.org/10.1016/j.tate.2017.12.016>
- Koehler, M. J., Mishra, P., Kereluik, K., Shin, T. S., & Graham, C. R. (2013). The technological pedagogical content knowledge framework. In J. Spector, Merrill, M., Elen, J., Bishop, M. (Ed.), *Handbook of Research on Educational Communications and Technology* (pp. 101–111).

Springer. https://doi.org/10.1007/978-1-4614-3185-5_9

- Koh, J., Chai, C., & Lee, M. H. (2015). Technological pedagogical content knowledge (TPACK) for pedagogical improvement: Editorial for special issue on TPACK. *The Asia-Pacific Education Researcher*, 24, 459–462. <https://doi.org/10.1007/s40299-015-0241-6>
- Kvale, S., & Brinkmann, S. (2015). *Interviews: Learning the craft of qualitative research interviewing* (3 ed.). Sage.
- Malterud, K., Siersma, V. D., & Guassora, A. D. (2016). Sample size in qualitative interview studies: Guided by information power. *Qualitative Health Research*, 26(13), 1753–1760. <https://doi.org/10.1177/1049732315617444>
- Mercader, C., & Gairín, J. (2020). University teachers' perception of barriers to the use of digital technologies: the importance of the academic discipline. *International Journal of Educational Technology in Higher Education*, 17. <https://doi.org/10.1186/s41239-020-0182-x>
- Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017–1054. <https://doi.org/10.1111/j.1467-9620.2006.00684.x>
- Niess, M. L., Gillow-Wiles, H., & Angeli, C. (2018). *Handbook of research on TPACK in the digital age*. IGI Global.
- Patton, M. Q. (2015). *Qualitative research & evaluation methods* (4 ed.). Sage.
- Phillips, M. D., Baran, E., Mishra, P., & Koehler, M. J. (2025). *Handbook of technological pedagogical content knowledge (TPACK) for educators*. Routledge.
- Porras-Hernández, L. H., & Salinas-Amescua, B. (2013). Strengthening TPACK: A broader notion of context and the use of teacher educators as a contextual influence. *Journal of Educational Computing Research*, 48(2), 223–244. <https://doi.org/10.2190/EC.48.2.f>
- Scherer, R., & Teo, T. (2019). Unpacking teachers' intentions to integrate technology: A meta-analysis. *Educational Research Review*, 27, 90–109. <https://doi.org/https://doi.org/10.1016/j.edurev.2019.03.001>
- Schmidt, D., Baran, E., Thompson, A., Mishra, P., Koehler, M., & Shin, T. (2009). What is technological pedagogical content knowledge (TPACK)? *Journal of Education*, 193, 13–19. <https://doi.org/10.1177/002205741319300303>
- Starkey, L., Yates, A., De Róiste, M., Lundqvist, K., Ormond, A., Randal, J., & Sylvester, A. (2023). Each discipline is different: Teacher capabilities for future-focussed digitally infused undergraduate programmes. *Educational Technology Research and Development*, 71, 117–136. <https://doi.org/10.1007/s11423-023-10196-2>
- Tracy, S. J. (2010). Qualitative quality: Eight "big-tent" criteria for excellent qualitative research. *Qualitative Inquiry*, 16(10), 837–851. <https://doi.org/10.1177/1077800410383121>
- Voithofer, R., & Nelson, M. J. (2021). Teacher educator technology integration preparation practices around TPACK in the United States. *Journal of Teacher Education*, 72(3), 314–328. <https://doi.org/10.1177/0022487120949842>
- Voogt, J., & McKenney, S. (2017). TPACK in teacher education: Are we preparing teachers to use technology for early literacy? *Technology, Pedagogy and Education*, 26(1), 69–83. <https://doi.org/10.1080/1475939X.2016.1174730>
- Zahid, A., Hidayat Ur, R., & Noor, U. (2022). Measuring university teacher educators' knowledge and skills using TPACK in teacher's education programs. *Research Journal of Social Sciences and Economics Review*, 3(3), 83–91. [https://doi.org/10.36902/rjsser-vol3-iss3-2022\(83-91\)](https://doi.org/10.36902/rjsser-vol3-iss3-2022(83-91))