Online Conferences as Media Education Platforms: Enhancing Teacher Digital Competence through the DigCompEdu Framework

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Abstract

This study examines the role of online conferences as emerging media education platforms that enhance teachers' digital competence and professional growth in Pakistan. Grounded in the European DigCompEdu framework, the research investigates how mediated professional learning spaces enhance teachers' ability to integrate technology, foster media literacy, and engage in reflective pedagogical practices. A quantitative survey was conducted among 278 in-service teachers from public and private schools, examining six dimensions of digital competence. Descriptive analyses revealed high mean scores in Professional Engagement (M = 3.92) and Empowering Learners (M = 3.89), indicating strong benefits of online media-based learning for collaboration and inclusive pedagogy. Conversely, Facilitating Learners' Digital Competence scored lowest, reflecting ongoing challenges in guiding students' media literacy. ANOVA and regression analyses identified Professional Engagement, Teaching and Learning, and Empowering Learners as significant predictors of the perceived impact of professional development. A Structural Equation Model (SEM) further confirmed that digital competence mediates the relationship between these predictors and conference outcomes. The findings underscore that well-designed online media learning environments can serve as powerful catalysts for developing teacher digital competence, advancing media education, and promoting digital transformation in under-resourced educational contexts. The study recommends integrating structured media education frameworks like DigCompEdu into ongoing professional teacher development initiatives.

Keywords: digital competence, DigCompEdu, online conferences, teacher development, self-efficacy, professional learning.

1. Introduction

In the evolving landscape of 21st-century education, the integration of technology into teaching and professional development has become both inevitable and transformative. While global conversations around digital pedagogy were gaining momentum prior to 2020, the COVID-19 pandemic served as a pivotal point that compelled educators, institutions, and systems to make a sudden transition to remote teaching and virtual engagement. In this global shift, teachers, arguably the frontline actors of educational continuity, faced the dual challenge of adapting to new instructional formats while simultaneously developing the technological and pedagogical capacities needed to thrive in them (König et al., 2020; Trust, Whalen, 2020).

This sudden transformation highlighted critical gaps in teacher preparation worldwide. Even in technologically advanced nations, many educators reported feeling underprepared to conduct

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effective online instruction (Cutri et al., 2020; Gáliková Tolnaiová, Gálik, 2020; Gudmundsdottir, Hathaway, 2020). In countries like Pakistan, where digital access is unequal and institutional support for teacher training in educational technology is often minimal, the situation poses deeper and more structural challenges. Nevertheless, necessity also created innovation: virtual platforms became the site of rapid learning, experimentation, and professional exchange. Among the most impactful of these emergent formats were online academic conferences, spaces where educators could access new pedagogies, digital tools, expert panels, and collegial interaction in synchronous and asynchronous modalities (Rapanta et al., 2021; Seidenberg et al., 2021).

Online conferences differ fundamentally from traditional teacher training sessions. They are typically broader in scope, multidisciplinary in content, and informal in structure. Yet they offer powerful affordances: exposure to global educational trends, access to emerging technological tools, and opportunities to engage in reflective dialogue with practitioners and researchers alike. Importantly, these conferences bypass many logistical barriers that restrict participation in face-to-face events, such as cost, travel, and institutional gatekeeping, making them particularly attractive for teachers in remote or under-resourced regions (Roos et al., 2020; Niner, Wassermann, 2021).

In the context of Pakistan, these developments signal both possibility and complexity. The country's educational system is characterized by diversity across linguistic, regional, and socioeconomic lines. Access to digital tools and infrastructure is uneven, particularly between urban and rural areas and among public and private schools. Teacher training institutions are only beginning to integrate digital pedagogies into their pre-service and in-service frameworks. Within this backdrop, online conferences represent an underexplored yet promising mechanism for accelerating teacher development, especially when supported by culturally and contextually relevant frameworks.

Drawing from international literature, the potential of online conferences can be understood across three dimensions: technological competence, pedagogical transformation, and emotional readiness. First, digital competence is now widely acknowledged as a core requirement for teachers globally. According to the European Commission's DigCompEdu framework, educators must be able not only to use technology effectively but to embed it pedagogically, ethically, and inclusively (Redecker, 2017). Online conferences expose teachers to a range of tools and strategies that can enhance their ability to plan, deliver, and assess instruction in digital environments (Rapanta et al., 2021; Trust, Whalen, 2020).

Second, pedagogical development is often catalyzed by professional dialogue and modelled practices, both of which are central to well-designed conferences. The exposure to diverse teaching strategies, disciplinary approaches, and classroom technologies allows teachers to reflect on their methods and consider new perspectives. Literature shows that even short-term exposure to innovative practices in online environments can reshape teacher beliefs and enhance self-efficacy (Cutri et al., 2020; Gudmundsdottir, Hathaway, 2020). Third, and perhaps most critically, is the emotional and psychological dimension. Transitioning to unfamiliar digital spaces can trigger a range of emotions, anxiety, uncertainty, and even resistance, particularly among educators who lack prior experience or institutional support (Daumiller et al., 2021; Lund et al., 2021). However, supportive professional environments such as interactive conferences can reduce these stressors by providing a sense of community, validation, and agency. Emotional regulation and perceived self-efficacy are now understood as integral to successful professional learning, particularly in technology-mediated contexts (Artino et al., 2012; Boekaerts, Pekrun, 2016).

The situation in Pakistan reflects many of these global dynamics but also carries distinct challenges. Although smartphone penetration and internet access have grown significantly, many teachers, especially in rural or government schools, face systemic barriers to digital engagement. These include a lack of devices, unstable connectivity, limited technical support, and institutional inertia. Cultural attitudes toward technology and professional autonomy also vary significantly by region, gender, and school type. Consequently, the potential of online conferences as tools for teacher development must be assessed not just in terms of access, but concerning how teachers interpret, value, and integrate their experiences from these platforms into their instructional identities. Despite these challenges, the pandemic provided a unique window of opportunity. Pakistani educators, many of whom were thrust into digital teaching with little preparation, began engaging with online communities, attending webinars, and participating in virtual conferences organized by local universities, NGOs, and international networks. These events, often their first exposure to structured digital professional learning, offered not only technological skills but also

new pedagogical insights and collaborative confidence. Yet, the question remains: to what extent did these conferences truly contribute to their instructional competence, and how did teachers from different backgrounds experience these opportunities?

This study aims to investigate these issues in depth by examining the multifaceted impact of a national online conference on Pakistani teachers' professional development. Through empirical analysis, it seeks to capture how such events contribute to technological skill-building, pedagogical innovation, and emotional resilience. It also explores the socio-demographic factors, such as age, gender, digital literacy, and teaching experience, that shape the conference experience. In doing so, the study contributes to international understandings of digital professional development while offering contextually grounded insights that can inform the future design of more inclusive and responsive teacher training in Pakistan and comparable education systems.

Digital Competence and Teacher Readiness: The 21st-century education landscape demands that teachers acquire not only subject matter expertise but also digital fluency and the ability to integrate technology meaningfully into pedagogy. The concept of Digital Competence has evolved from basic ICT literacy to include pedagogical integration, ethical use, digital content creation, and professional collaboration (Redecker, 2017). According to the DigCompEdu framework, digital competence in teaching is multifaceted and encompasses six key areas: professional engagement, digital resources, teaching and learning, assessment, learner empowerment, and facilitating learners' digital competence. Numerous international studies emphasize the role of digital competence in teacher effectiveness. Gudmundsdottir and Hathaway (Gudmundsdottir, Hathaway, 2020) found that teachers with higher levels of digital fluency were more confident and adaptive during the COVID-19-induced shift to online education. Similarly, König et al. (König et al., 2020) reported that even experienced teachers lacked readiness for online instruction without prior exposure to blended teaching tools and environments. This was especially evident in systems where digital technologies had not been integrated into pre-service or in-service training programs.

In the context of low- and middle-income countries (LMICs), such as Pakistan, challenges to digital readiness are more acute. Studies from similar regions highlight how infrastructure gaps, limited access to devices, and lack of institutional support hinder the development of teacher digital skills (Lund et al., 2021). Moreover, digital competence is not evenly distributed among teachers due to factors such as age, gender, rural-urban divides, and socioeconomic status. Teachers in rural or government schools often face more barriers, including limited access to high-speed internet and digital hardware, thereby affecting their ability to participate in or benefit from online professional development opportunities (Rapanta et al., 2021).

Online Professional Development and Virtual Conferences: Online Professional Development (OPD) is gaining international recognition as a scalable, flexible, and cost-effective model for continuous teacher learning. Unlike traditional face-to-face workshops, OPD offers asynchronous and synchronous modalities, allowing educators to engage with professional learning on their terms (Trust, Whalen, 2020). Among the various OPD formats, online academic conferences have emerged as dynamic platforms where teachers are exposed to current research, digital tools, teaching models, and diverse pedagogical discourses. Research shows that online conferences can enhance teacher self-efficacy, foster reflective practices, and build professional learning networks (Seidenberg et al., 2021). These events often include live lectures, interactive breakout rooms, virtual posters, and hands-on workshops, all of which allow educators to explore new technologies and strategies within supportive peer environments (Roos et al., 2020). Importantly, the low-cost and remote access features of online conferences help democratize participation, enabling teachers from remote or underserved areas to engage with national and international education communities (Niner, Wassermann, 2021).

However, the effectiveness of online conferences is contingent upon multiple factors. According to Cutri et al. (Cutri et al., 2020), many educators initially experience "crisis teaching fatigue", wherein their first encounter with digital platforms is marked by survival-based engagement rather than deep learning. In such cases, professional learning environments must be intentionally designed to support scaffolding, emotional regulation, and skill development. Rapanta et al. (Rapanta et al., 2021) emphasized the need for structured pedagogical design in digital teacher education to ensure sustained engagement and meaningful learning outcomes. In the Pakistani context, the role of online conferences as OPD tools remains under-researched. While some local institutions and NGOs have begun offering webinars and virtual symposiums, the lack of formal evaluation makes it difficult to determine their actual impact. Given the digital

divide, cultural heterogeneity, and institutional disparities within the country, it is essential to analyze how Pakistani teachers perceive, experience, and benefit from these conferences, and whether these events translate into long-term pedagogical transformation.

Emotional Readiness, Self-Efficacy, and Online Learning: While cognitive and technical skills are central to digital learning, growing literature emphasizes the significance of emotional and psychological dimensions in online teacher development. Boekaerts, Pekrun (Boekaerts, Pekrun, 2016) argue that emotion is intrinsically linked to motivation, engagement, and learning outcomes. Teachers' willingness to engage with new digital environments is influenced by factors such as perceived ease of use, prior experience, and emotional self-regulation (Artino et al., 2012). Teachers unfamiliar with digital technologies often report feelings of anxiety, helplessness, or inadequacy during initial encounters with virtual learning environments (Daumiller et al., 2021). These emotions can hinder participation and reduce the perceived usefulness of OPD events. Conversely, educators who feel supported and empowered during these experiences are more likely to integrate new practices into their classrooms (Tyng et al., 2017). During the pandemic, emotional responses to online learning varied widely. In a multi-country study, König et al. (König et al., 2020) found that older teachers often demonstrated more confidence and resilience due to broader pedagogical experience, while younger teachers were more fluent with digital tools but experienced greater stress due to workload and lack of pedagogical autonomy. These findings highlight the need for differentiated support mechanisms that account for individual teacher profiles in professional development settings.

In the case of online conferences, the psychosocial environment plays a crucial role in determining their impact. Events that incorporate peer interaction, collaborative learning, and technical support are more likely to reduce stress and increase perceived self-efficacy. Seidenberg et al. (Seidenberg et al., 2021) found that the perceived value of virtual conferences was strongly associated with interactive features, social presence, and a sense of community, all of which enhanced participant engagement. For countries like Pakistan, where online learning is still emerging as a mainstream modality, the emotional readiness of educators must be acknowledged and addressed. The success of online conferences depends not only on content quality but also on creating emotionally responsive environments that help teachers feel capable, valued, and connected.

Theoretical Framework: This study is grounded in the Digital Competence Framework for Educators (DigCompEdu) developed by the European Commission, as shown in Figure 1 (Redecker, 2017). As digital technologies continue to reshape educational environments, DigCompEdu provides a comprehensive model to assess and support teachers' professional growth in technology-enhanced learning contexts. It views digital competence not as a single skill but as a multidimensional construct that encompasses pedagogical, technical, and reflective capacities. The framework is structured into six interrelated areas: professional engagement, digital resources, teaching and learning, assessment, empowering learners, and facilitating learners' digital competence.
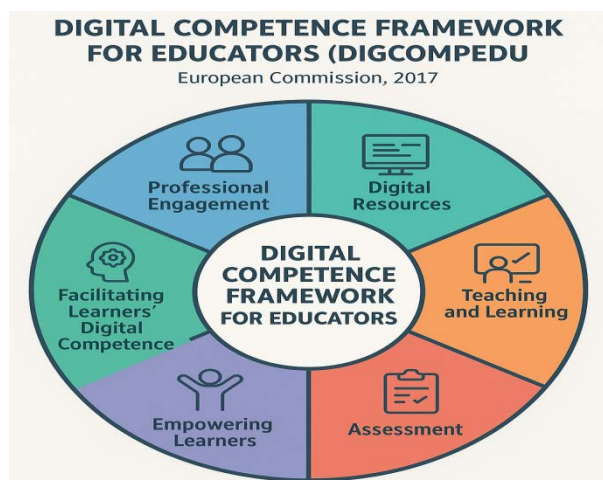

Fig. 1. Theoretical framework of the study

Each of these domains emphasizes the purposeful and pedagogically sound integration of technology in educational practices. For instance, professional engagement refers to how educators

use digital tools to collaborate, communicate, and engage in lifelong learning. The use of digital resources focuses on the ability to find, adapt, and create teaching materials. Teaching and learning involve designing and delivering instruction in digital formats, while assessment includes leveraging digital tools to evaluate learning outcomes. Additionally, empowering learners encourages personalized, inclusive, and differentiated teaching strategies, and the final domain addresses teachers' capacity to support students in developing their digital competencies. Within the context of this research, DigCompEdu serves as a relevant and flexible lens to evaluate how participation in online conferences contributes to Pakistani teachers' professional development. The framework's holistic view enables the study to capture not just improvements in technological use, but also deeper changes in pedagogical approaches and teacher identity. This is especially important in a country like Pakistan, where disparities in digital access, training opportunities, and institutional support make professional growth highly variable. By applying the DigCompEdu framework, the study is able to assess both the cognitive and affective impact of virtual conferences on teacher development in a structured and internationally benchmarked manner.

2. Materials and methods

This study is situated within the positivist research paradigm, which emphasizes objectivity, quantification, and empirical testing of hypotheses through observable and measurable data (Creswell, 2018). Positivism allows researchers to examine causal relationships using statistical procedures and generalize findings for a larger population. Given the study's goal, to assess the impact of online conferences on teachers' digital competence using standardized measurement tools, the positivist paradigm was most appropriate. It provides the philosophical foundation for employing structured instruments, ensuring replicability, validity, and statistical rigor in educational research (Mertens, 2014).

Research Design: This study followed a cross-sectional survey design, which involves collecting data at a single point in time from a predefined population. The survey design was selected due to its efficiency in capturing teachers' perceptions across multiple dimensions of digital competence after attending a national online teacher conference. Survey research is widely used in educational settings to measure attitudes, self-reported practices, and latent constructs such as competence and self-efficacy (Fraenkel et al., 2019). The design allows for the analysis of relationships among variables and comparisons across demographic subgroups.

Research Method: The research method used was quantitative and non-experimental. A structured questionnaire aligned with the DigCompEdu Framework (Redecker, 2017) served as the primary tool for data collection. The focus was to numerically assess teachers' perceived development in six competence domains: professional engagement, digital resources, teaching and learning, assessment, empowering learners, and facilitating learners' digital competence. The method enables a standardized approach for collecting and analyzing data on a large scale, thus enhancing the reliability of the findings (Bryman, 2016).

Population, Sampling Technique, and Sample Size: The target population consisted of in-service teachers in Pakistan who participated in a national-level online teacher development conference held in 2023. These teachers represented diverse geographical regions, school types (public/private), and subject areas. A stratified random sampling technique was employed to ensure proportional representation across key demographic variables, including gender, school sector, and teaching experience. Stratified sampling enhances the accuracy of parameter estimates and allows for subgroup analysis within heterogeneous populations (Etikan, Bala, 2017). Based on Cochran's (1977) sample size formula for a large population (with 95 % confidence level and 5 % margin of error), the minimum required sample was calculated as 217. However, to ensure robustness, the survey was distributed to 350 teachers, and 278 valid responses were received and analyzed.

Data Collection Procedure: Data was collected using a structured online questionnaire administered via Google Forms. The questionnaire included 36 items on a 5-point Likert scale (ranging from 1 = Strongly Disagree to 5 = Strongly Agree), based on the validated DigCompEdu framework. Items were adapted for contextual relevance to Pakistani educators and reviewed by three education experts to establish content validity. The instrument was pilot tested with 30 participants, yielding a Cronbach's alpha of 0.84, indicating high internal consistency. The final survey was shared through professional WhatsApp groups and institutional mailing lists with an informed consent form on the first page. Data was collected over two weeks immediately after the conclusion of the online conference.

Data Analysis Techniques: Data was analyzed using SPSS (Version 27) and AMOS. Descriptive statistics (means and standard deviations) summarized teacher responses across the six DigCompEdu domains. Independent-sample t-tests examined gender and school-type differences, while one-way ANOVA assessed differences based on digital literacy levels. Pearson correlations explored relationships between digital competence, self-efficacy, age, and experience.

To identify significant predictors of perceived impact, a multiple regression was conducted using DigCompEdu domains as predictors. Lastly, Structural Equation Modeling (SEM) in AMOS tested the theoretical model, confirming digital competence as a mediator. Fit indices such as CFI, TLI, RMSEA, and χ^2/df confirmed model adequacy. This multi-level analysis offered both descriptive clarity and theoretical validation (Kline, 2016).

Ethical Considerations: This study was conducted in strict adherence to ethical standards in educational research. Ethical approval was obtained from the Institutional Research Ethics Committee of the host university. Participants were informed about the study's purpose, the voluntary nature of participation, and their right to withdraw at any stage. Informed consent was obtained electronically before the survey began. Data was kept anonymous, and no personally identifiable information was collected. All digital data were stored in encrypted files accessible only to the principal investigator, ensuring participant confidentiality and data protection.

3. Discussion

This study sought to explore the impact of online conferences on teachers' professional development in Pakistan through the lens of the DigCompEdu framework. The findings reveal a nuanced understanding of how digital competence is developing among Pakistani educators and how online professional learning formats can serve as effective platforms for capacity building.

Interpreting the Descriptive Trends: The descriptive statistics showed that Professional Engagement and Empowering Learners were the most positively perceived domains, suggesting that online conferences may be particularly effective in enhancing teachers' participation in professional communities and encouraging inclusive, student-centered practices. These findings align with prior studies highlighting the transformative potential of digital tools in supporting teachers' collaborative learning and reflective practice (Trust et al., 2016; Zhang, Liu, 2022). Conversely, the lowest scores were recorded in the domain of Facilitating Learners' Digital Competence, reflecting limited confidence or training in guiding students' own digital skills. This is consistent with prior research in under-resourced educational settings, where teachers often lack structured opportunities or pedagogical models to foster digital literacy in students (Manca, Ranieri, 2016). The discrepancy underscores the importance of integrating digital citizenship and student-centered digital tasks into teacher training initiatives.

Variability by Digital Literacy and Institutional Context: The ANOVA findings demonstrated significant differences in digital competence based on teachers' self-reported digital literacy levels. Advanced users scored significantly higher across domains, confirming that baseline digital proficiency remains a strong predictor of professional confidence and competence (Koehler et al., 2013). The results also showed institutional disparity, where private school teachers outperformed public school teachers in Digital Resources and Teaching and Learning domains. This aligns with literature suggesting that private institutions in South Asia often provide more exposure to technology, training, and innovation-driven environments (Farooq et al., 2021).

Correlational and Predictive Patterns: Correlation analysis revealed moderate to strong positive relationships between self-efficacy and all digital competence domains, particularly with Professional Engagement, Teaching and Learning, and Empowering Learners. These findings are in line with Bandura's (Bandura, 1997) theory of self-efficacy, which posits that confidence in one's ability is central to the adoption of new practices. The regression model further solidified this association by showing that these three domains were significant predictors of the perceived professional impact of online conferences. Interestingly, digital resources and assessment, often emphasized in digital policy frameworks, did not emerge as significant predictors in the regression model. This suggests that access to tools alone is insufficient without strong pedagogical and affective engagement (Selwyn, 2016). Teachers who engage professionally and innovatively are more likely to translate conference content into meaningful change.

Theoretical and Practical Contributions: Framing the study within the DigCompEdu framework allowed a structured yet flexible interpretation of digital competence as both a technical and pedagogical construct. The SEM analysis supported a model in which Professional

Engagement, Teaching and Learning, and Empowering Learners positively predicted latent digital competence, which in turn predicted the perceived impact of the conference. The acceptable model fit indices strengthen the empirical robustness of this conceptual pathway. Practically, the study suggests that online conferences hold substantial promise as professional development tools in Pakistan, especially when they prioritize collaboration, pedagogy, and student empowerment. However, their effectiveness depends on addressing digital inequalities, institutional support structures, and teachers' initial readiness.

Contextual Challenges and Forward Recommendations: In the Pakistani context, challenges such as unequal internet access, limited professional development funding, and centralized curriculum frameworks can hamper the long-term effectiveness of virtual learning platforms. Hence, future policy should advocate for:

– Blended models of professional learning combining virtual and in-person training.

– Localized content development in online conferences reflects cultural and curricular needs.

– Mentorship and peer networks that support sustained engagement beyond the conference itself.

Furthermore, teacher education institutions should integrate DigCompEdu-aligned training modules into pre-service and in-service programs to systematically build competencies beyond tool-use, especially in assessment and learner facilitation.

4. Results

The descriptive statistics in Table 1 indicate that teachers reported the highest perceived competence in Professional Engagement (M = 3.92, SD = 0.61) and Empowering Learners (M = 3.89, SD = 0.63), suggesting strong confidence in collaborating professionally and supporting inclusive learning.

Table 1. Descriptive Statistics for DigCompEdu Competence Domains

DigCompEdu Domain	M	SD
Professional Engagement	3.92	0.61
Digital Resources	3.76	0.65
Teaching and Learning	3.85	0.59
Assessment	3.61	0.72
Empowering Learners	3.89	0.63
Facilitating Learners' Digital Competence	3.57	0.70

Notes: M = Mean; SD = Standard Deviation.

Conversely, the lowest mean was observed in Facilitating Learners' Digital Competence (M = 3.57, SD = 0.70), indicating a potential gap in teachers' ability to support students' digital skill development. Overall, responses across domains reflect moderate-to-high digital competence, with variation suggesting areas for targeted professional development.

Table 2. One-Way ANOVA for Digital Competence Domains by Digital Literacy Level

DigCompEdu Domain	F	p
Professional Engagement	4.28	.016
Digital Resources	5.36	.005
Teaching and Learning	3.89	.027

Notes: p < .05 indicates a statistically significant difference between groups.

The one-way ANOVA results in Table 2 indicate statistically significant differences in digital competence across self-reported digital literacy levels. Teachers with higher digital literacy levels scored significantly better in Professional Engagement ($F_{(2, 275)}$ = 4.28, p = .016), Digital Resources (F = 5.36, p = .005), and Teaching and Learning (F = 3.89, p = .027). These findings suggest that teachers with advanced digital skills perceive themselves as more competent in integrating technology into professional collaboration, instructional planning, and digital resource use.

Table 3. Independent-Sample t-Test Results by Gender and School Type

Comparison Group	Domain	t	p	Significant Difference?
Male vs. Female	All Domains	ns	>.05	No
Private vs. Public School	Digital Resources	2.14	.034	Yes
Private vs. Public School	Teaching and Learning	2.29	.023	Yes

Notes: ns = not significant; p < .05 considered statistically significant.

The independent-sample t-test of Table 3 revealed no significant gender-based differences in digital competence across any domain (p > .05). However, private school teachers scored significantly higher than public school teachers in both Digital Resources (t = 2.14, p = .034) and Teaching and Learning (t = 2.29, p = .023). These findings suggest that institutional context, more than gender, affects teachers' perceived digital competence, likely due to better access to technology and professional development in private schools.

Table 4. Pearson Correlation Matrix for DigCompEdu Domains and Self-Efficacy

Variable	1	2	3	4	5	6	7
1. Professional Engagement	1.00						
2. Digital Resources	0.62	1.00					
3. Teaching and Learning	0.67	0.63	1.00				
4. Assessment	0.51	0.50	0.54	1.00			
5. Empowering Learners	0.58	0.56	0.61	0.55	1.00		
6. Facilitating Learners' Digital Competence	0.53	0.49	0.52	0.48	0.60	1.00	
7. Self-Efficacy	0.52	0.46	0.49	0.38	0.43	0.41	1.00

The Pearson correlation matrix in Table 4 reveals moderate to strong positive correlations among all DigCompEdu domains, indicating a cohesive structure of digital competence. Notably, Self-Efficacy showed significant positive correlations with all domains, particularly with Professional Engagement (r = .52), Teaching and Learning (r = .49), and Digital Resources (r = .46). These results suggest that teachers who are more confident in their teaching abilities also perceive themselves as more digitally competent, reinforcing the importance of self-belief in digital pedagogy. The strong inter-domain correlations further validate the integrated nature of digital competence in teaching practice.

Table 5. Multiple Regression Analysis Predicting Perceived Professional Development Impact

Predictor Variable	B	SE B	β	p
Professional Engagement	0.41	0.08	0.28	< .001
Digital Resources	0.12	0.07	0.10	.098
Teaching and Learning	0.35	0.11	0.23	.002
Assessment	0.09	0.10	0.06	.341
Empowering Learners	0.29	0.11	0.19	.007
Facilitating Learners' Digital Competence	0.10	0.09	0.08	.267

Model Summary: R^2 = .48, Adjusted R^2 = .46, $F(6, 271)$ = 21.94, p < .001
Notes: B = unstandardized coefficient; SE B = standard error of B; β = standardized beta coefficient. Significant predictors are bolded.

The multiple regression analysis in Table 5 identified three significant predictors of perceived professional development impact: Professional Engagement (β = 0.28, p < .001), Teaching and Learning (β = 0.23, p = .002), and Empowering Learners (β = 0.19, p = .007). These domains significantly contributed to explaining variation in overall impact scores, suggesting that teachers

who actively engage with peers, employ digital pedagogy, and support learner-centered practices perceive greater benefits from online conferences. The model explained 48 % of the variance (R^2 = .48), indicating a strong overall fit. Domains like Assessment and Facilitating Learners' Digital Competence were not significant predictors, highlighting that practical engagement and pedagogical application are more influential than tool-based competence alone.

Table 6. Standardized Path Coefficients from SEM Analysis

Pathway	Standardized β	SE	CR	p-Value
Professional Engagement → Digital Competence (Latent)	0.28	0.06	4.67	< .001
Teaching and Learning → Digital Competence (Latent)	0.23	0.07	3.29	.001
Empowering Learners → Digital Competence (Latent)	0.19	0.07	2.71	.007
Digital Competence (Latent) → Perceived Conference Impact	0.41	0.05	6.98	< .001

Model Fit Indices

Fit Index	Value	Threshold
χ² (Chi-square)	112.35	—
df	48	—
χ²/df	2.34	< 3.00
CFI (Comparative Fit Index)	0.95	≥ 0.90
TLI (Tucker-Lewis Index)	0.93	≥ 0.90
RMSEA (Root Mean Square Error of Approximation)	0.058	≤ 0.08
SRMR (Standardized Root Mean Square Residual)	0.045	≤ 0.08

Notes: SE = standard error; CR = critical ratio; β = standardized regression weight. All present paths are statistically significant. Model fit indices indicate acceptable-to-good model fit based on recommended thresholds (Kline, 2016).

The SEM analysis in Table 6 confirmed significant pathways between key DigCompEdu domains and the latent construct of Digital Competence, which in turn strongly predicted Perceived Conference Impact (β = 0.41, p < .001). Among the predictors, Professional Engagement (β = 0.28), Teaching and Learning (β = 0.23), and Empowering Learners (β = 0.19) showed statistically significant contributions to digital competence. This suggests that teachers who are more engaged professionally, adopt innovative teaching strategies, and focus on learner empowerment are more digitally competent and perceive greater professional growth through online conferences, as shown in Figure 2 below.
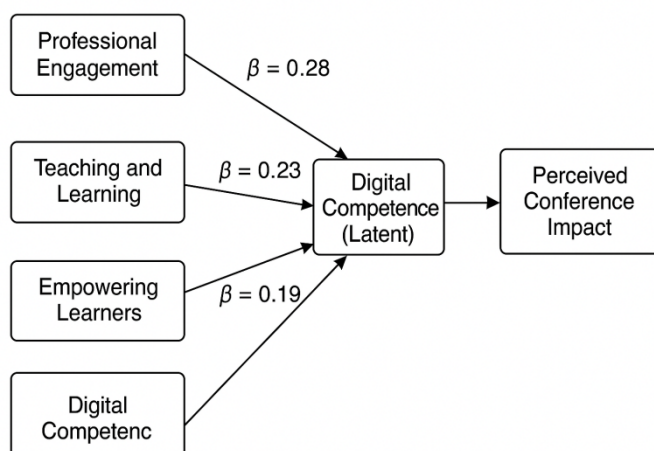

Fig. 2. SEM Path Diagram

The model demonstrated a good overall fit: χ²/df = 2.34, CFI = 0.95, TLI = 0.93, RMSEA = 0.058, and SRMR = 0.045, meeting accepted thresholds (Kline, 2016). These results validate the

conceptual structure and indicate that the model accurately captures the relationships among constructs in the context of teacher digital development, as shown in Figure 2.

5. Conclusion

The model demonstrated a good overall fit: χ^2/df = 2.34, CFI = 0.95, TLI = 0.93, RMSEA = 0.058, and SRMR = 0.045, meeting accepted thresholds (Kline, 2016). These results validate the conceptual structure and indicate that the model accurately captures the relationships among constructs in the context of teacher digital development, as shown in Figure 2.This study explored the multifaceted impact of online conferences on teacher professional development in Pakistan through the lens of the DigCompEdu framework. Using a quantitative methodology, the research provided compelling evidence that online professional learning spaces significantly contribute to enhancing teachers' digital competence, particularly in the domains of professional engagement, teaching and learning, and empowering learners. The findings highlight that teachers who actively participate in professional networks, adopt innovative pedagogical approaches, and prioritize learner-centered strategies are more likely to experience meaningful professional growth. Importantly, while technological access and digital tools are foundational, they are not sufficient on their own. Rather, the development of digital competence hinges on sustained pedagogical integration, self-efficacy, and collaborative learning environments. The study also revealed important disparities across digital literacy levels and school types, pointing to the digital divide that continues to affect public-sector education in Pakistan. Teachers in private schools and those with higher digital literacy reported more substantial benefits from online conferences. This reinforces the need for systematic investment in teaching digital upskills, particularly in under-resourced institutions. By utilizing the DigCompEdu framework, this research contributes to a more holistic understanding of teacher development in digital contexts and offers a roadmap for future research and policy. The results advocate for embedding competency-based digital education within teacher training programs and for scaling up online professional development platforms as a viable, cost-effective, and scalable model.

In sum, online conferences, when well-designed and pedagogically aligned, can serve as powerful catalysts for teacher development, educational innovation, and digital transformation in Pakistan's evolving educational landscape. However, sustained impact may depend on how well these initiatives are integrated into broader institutional and policy frameworks that support teachers not only as users of technology but as active agents of digital pedagogy.

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