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Research Article

A Mixed-Methods Study on the Impact of Technology-Mediated Mentoring and Peer Scaffolding on Iranian EFL Teachers' Professional Development

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Abstract

In the rapidly changing educational context, technology offers new opportunies to address challenges in language teacher training. This mixed-methods study investigated the impact of technology-mediated mentoring and peer scaffolding on the professional development of Iranian EFL teachers. Using a mixed-methods design, 200 lower-secondary EFL teachers were purposively sampled and assigned to four groups: three experimental groups (mentoring, scaffolding, and combined mentoring and scaffolding) and one control group. Quantitative data were collected through two adapted questionnaires that assessed teachers' participation in professional development activities and the extent of their application in classroom practice. Qualitative data were obtained from semi-structured interviews with 20 teachers and reflective journals from all participants. The results of Multivariate Analysis of Variance and Scheffé's post-hoc tests revealed that the combined mentoring and scaffolding group significantly outperformed others in creativity, reflective practice, and peer collaboration, with large effect sizes for creativity. Qualitative findings underscored the role of personalized mentor feedback and collaborative peer environments in fostering teacher growth, enhancing self-reflection, critical thinking, and teaching efficacy. Teachers emphasized the flexibility of digital platforms as a key facilitator of professional development, though they noted occasional connectivity issues. These findings support the effectiveness of technology-mediated interventions for enhancing teacher learning in resource-constrained contexts. Implications include adopting blended, context-sensitive strategies that integrate mentoring and scaffolding, promoting sustainable teacher growth and pedagogical innovation.

Keywords: EFL teachers, peer scaffolding, reflective practice, sociocultural theory, technology-mediated mentoring, teacher professional development, TPACK framework

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1. Introduction

Teacher Professional Development (TPD) is a cornerstone of educational reform, driving improvements in teaching quality and student learning outcomes (Guskey, 2002). In the EFL context, TPD is critical because language instruction requires teachers to adapt continually to evolving pedagogical approaches, technological advancements, and diverse learner needs (Richards & Farrell, 2005). In Iran, despite ongoing efforts to implement pre-service and in-service TPD programs, systemic challenges remain, including outdated curricula, limited integration of digital technologies, and insufficient opportunities for peer collaboration (Ganji et al., 2020; Rastegar et al., 2013). These shortcomings hinder teachers' ability to engage in reflective practice and adopt innovative strategies, constraining educational progress in EFL settings.

Given these challenges, technology- mediated strategies offer potential solutions for improving TPD in Iran. Grounded in Vygotsky's (1978) Sociocultural Theory (SCT) and the Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler, 2006), technology-mediated mentoring and peer scaffolding provide flexible, collaborative, and scalable platforms for teacher development. Mentoring provides personalized guidance that fosters critical reflection and professional growth, whereas peer scaffolding supplies structured, collaborative support tailored to teachers' evolving competencies (Kleickmann et al., 2016). When integrated with digital tools, these approaches increase accessibility, foster collaborative learning communities, and strengthen reflective practice, particularly in resource-constrained contexts (Hennessy et al., 2022). By leveraging online platforms, including video conferencing and asynchronous discussion forums, these interventions help overcome logistical barriers and enable teachers to engage in sustained and meaningful professional development (Dill & Røkenes, 2021).

To address these challenges, this study examines the effectiveness of technology-mediated mentoring and peer scaffolding to support the professional development of Iranian EFL teachers using a mixed-methods approach. Hence, it combines quantitative measures of professional growth (i.e., self-development, collaboration, teaching competencies, content knowledge, and creativity) with qualitative insights into teachers' experiences and perceptions. This study draws on two complementary theoretical frameworks: Vygotsky's (1978) SCT and the TPACK framework (Mishra & Koehler, 2006). SCT emphasizes learning as a socially mediated process in

which interactions within the Zone of Proximal Development (ZPD) enable individuals to achieve higher levels of competence through guidance and collaboration. In this context, mentoring offers expert guidance and peer scaffolding fosters collaborative learning, both supported by digital platforms (Lave & Wenger, 1991; Vygotsky, 1978). The TPACK framework guides the design of technology-mediated interventions to align with EFL teaching demands (Mishra & Koehler, 2006). Together, these frameworks provide a robust lens for examining the support that technology-mediated mentoring and scaffolding offer teacher development. They foster reflective, collaborative, and contextually relevant learning experiences (Tseng & Yeh, 2022).

Despite advances in TPD research, gaps remain in applying technology-mediated mentoring and scaffolding in EFL contexts, particularly in resource-constrained settings like Iran. Few studies examined their combined effects or employ mixed-methods designs, limiting nuanced understanding. Therefore, this study examined the synergistic effects of technology-mediated mentoring and scaffolding on Iranian EFL teachers, focusing on practical and context-sensitive outcomes that can inform global and local TPD practices. This study is significant because it addressed key gaps in Iran's EFL teacher professional development research. It is relevant for policymakers, educators, and teacher trainers in Iran, as it offers evidence-based insights into effective TPD strategies that may improve teaching quality and student outcomes. Furthermore, the findings contribute to global discussions on technology-enhanced teacher development, particularly in low-resource settings where digital interventions can help address systemic gaps (Farrell & Jacobs, 2023).

Overall, this research aims to explore how these two interventions address the systemic gaps in Iran's TPD programs and to offer actionable recommendations for educators and policymakers. Specifically, it evaluates the comparative effectiveness of mentoring, scaffolding, and their combination, proposing a model for sustainable, technology-driven TPD in resource-constrained EFL contexts (Hennessy et al., 2022; Atai & Mazlum, 2024). Building on the above gaps, the study addresses the following research questions:

> **RQ1**: How do technology-mediated mentoring and peer scaffolding impact the professional development of Iranian EFL teachers in terms of self-development, collaboration, teaching competencies, content knowledge, and creativity?
>
> **RQ2**: What are the differences in professional development outcomes among Iranian EFL teachers receiving technology-mediated

mentoring, scaffolding, combined mentoring and scaffolding, and no intervention?

RQ3: How do Iranian EFL teachers perceive the effectiveness of technology-mediated mentoring and peer scaffolding in supporting their professional development?

2. Literature Review

2.1. Teacher Professional Development in ELT

TPD is a dynamic process that strengthens teachers' capacity to reflect, learn, and apply new knowledge in classroom settings to improve student outcomes. In ELT, TPD is essential due to the complexities of language instruction, which require adaptability to diverse learner needs, evolving pedagogical approaches, and cultural contexts (Johnson, 2009). Desimone (2009) identified five core features of an effective TPD program. These principles are particularly relevant for EFL teachers, who must navigate linguistic, cultural, and technological challenges. Reflective and collaborative TPD models, such as inquiry-based approaches (Ackland, 2000; Bambino, 2002), encourage teachers to critically analyze their practices and student outcomes. These models foster communities of practice (Farrell & Jacobs, 2023; Lave & Wenger, 1991), essential in the ELT context.

Building on these theoretical perspectives, empirical studies provide further insight into the integration of technology into TPD, particularly in resource-constrained settings. Digital platforms, such as online mentoring systems, virtual communities, and asynchronous modules, provide flexibility, scalability, and accessibility, overcoming barriers such as time and location (Hennessy et al., 2022). Technology-mediated mentoring provides personalized feedback, while peer scaffolding supports structured, collaborative activities that enhance teacher learning (Kim & Hannafin, 2011). Studies such as Erdoğan et al. (2022) demonstrated that e-mentoring enhances pedagogical knowledge and classroom practice, while others highlighted digital scaffolding's role in promoting teacher agency (Dill & Røkenes, 2021). However, challenges such as technology access, digital literacy, and mentor quality must be addressed to ensure equitable outcomes (Hennessy et al., 2022). These findings underscore the potential of technology to create dynamic TPD environments, particularly when grounded in frameworks like TPACK, which emphasizes integrating technological, pedagogical, and content knowledge (Mishra & Koehler, 2006).

Although global research highlights the potential of technology in TPD, Iranian programs face significant challenges that limit their effectiveness for EFL teachers. Pre-service training often prioritizes theoretical knowledge over practical skills, leaving teachers unprepared for classroom demands (Rastegar et al., 2013). In-service programs are criticized for their lack of relevance, limited technology integration, and absence of peer collaboration, exacerbated by the centralized education in Iran, which restricts teacher autonomy (Birjandi & Derakhshan Hesari, 2010; Ganji et al., 2020). These constraints make Iran a critical case for studying technology-mediated TPD, as digital interventions can address systemic barriers through accessible, collaborative, and context-sensitive learning opportunities. In contrast to decentralized systems, where teachers have greater autonomy, Iran's centralized structure necessitates scalable solutions such as e-mentoring and digital scaffolding to foster reflective practice and innovation, enabling teachers to meet diverse student needs (Atai & Mazlum, 2024). This underscores the urgency of exploring technology-driven TPD to bridge gaps in Iran's EFL teacher professional development.

Mentoring and scaffolding are well-established strategies for promoting teacher growth, often framed through Vygotsky's (1978) SCT, which emphasizes learning through social interactions. Mentoring provides emotional and instructional support, fostering reflective practice and critical thinking through personalized guidance (Harwell-Kee, 1999). Scaffolding offers structured support tailored to teachers' needs, promoting skill acquisition, and autonomy (Kleickmann et al., 2016). When delivered through digital platforms, these strategies enhance accessibility and collaboration, particularly in centralized systems such as Iran's (Kahraman & Abdullah, 2016). For instance, Handrianto et al. (2022) found that mentoring fosters collaboration and knowledge exchange, while Rahman et al. (2015) showed that scaffolding improves instructional quality. Combining these approaches with technology creates dynamic, supportive learning environments, aligning with the TPACK framework (Bragg et al., 2021; Mishra & Koehler, 2006; Tseng & Yeh, 2022).

2.2. Empirical Studies

Empirical research on technology-mediated mentoring and scaffolding in TPD highlights their efficacy and limitations, organized here by thematic contributions to the field. Digital mentoring has been shown to enhance pedagogical knowledge and reflective practice. Harwell-Kee (1999) emphasized mentoring's role in fostering critical reflection, a finding echoed by Kahraman and Abdullah (2016), who demonstrated the effectiveness of e-

mentoring in centralized systems, improving teacher collaboration and pedagogical skills. Erdoğan et al. (2022) also found that e-mentoring significantly enhanced preschool teachers' professional development, though its impact was limited by the quality of mentors and access to technology. Bragg et al.'s (2021) systematic review confirmed that digital mentoring fosters pedagogical knowledge however, they noted inconsistent outcomes due to variations in mentor training. These studies, which are grounded in Vygotsky's (1978) SCT, highlight mentoring's role in guiding teachers within their zone of proximal development (ZPD), while underscoring the need for standardized mentor training to ensure consistent outcomes.

Digital scaffolding supports structured, collaborative learning, promoting teacher agency and problem-solving. Kim and Hannafin (2011) showed that digital scaffolding enhances collaboration, though its effectiveness depends on teachers' digital literacy. Rahman et al. (2015) found that scaffolding improves instructional quality, with technology increasing scalability, while Kleickmann et al. (2016) demonstrated its impact on teachers' beliefs and practices, particularly in science education. Dill and Røkenes (2021) confirmed the role of digital scaffolding in fostering teacher agency in online communities; however, they noted challenges in sustaining engagement without structured facilitation. These studies, often aligned with the TPACK framework (Mishra & Koehler, 2006), suggest that scaffolding is effective but requires careful design to address diverse teacher needs.

Research in resource-constrained and centralized systems highlights technology's potential to overcome systemic barriers. Hennessy et al. (2022) found that digital TPD is effective in low- and middle-income countries, offering scalable solutions despite connectivity challenges. Tseng and Yeh (2022) demonstrated that technology-mediated mentoring enhances EFL teacher development in Taiwan, a context with some similarities to Iran's resource constraints. However, these studies note that technological infrastructure and teacher digital literacy can limit outcomes, emphasizing the need for context-sensitive interventions. In Iran, Ganji et al. (2020) highlighted the dominance of traditional TPD, underscoring the potential of digital mentoring and scaffolding to address the constraints of the centralized system in Iran, though few studies have explored their combined impact in this context.

2.3. Research Gaps

Despite advances, significant research gaps remain. First, limited evidence exists on the synergistic effects of combining mentoring and scaffolding in technology-mediated settings, particularly in EFL contexts (Bragg et al., 2021). Second, few studies have explored these interventions in resource-constrained environments such as Iran, where centralized curricula and limited technology integration restrict teacher autonomy (Ganji et al., 2020). Finally, mixed-methods approaches are scarce in this domain, limiting a holistic understanding of TPD's impact. Therefore, this study addresses these local and global gaps by examining the combined impact of technology-mediated mentoring and peer scaffolding on Iranian EFL teachers, focusing on self-development, collaboration, teaching competencies, content knowledge, and creativity within Iran's centralized education system.

3. Method

3.1. Design

This study employed a convergent parallel mixed-methods design (Creswell & Plano Clark, 2018) to investigate the impact of technology-mediated mentoring and peer scaffolding on the professional development of Iranian EFL teachers. The quantitative component utilized a quasi-experimental design with three experimental groups and one control group. Self-development, collaboration, teaching competencies, content knowledge, and creativity were the dependent variables, while the group type (i.e., mentoring, scaffolding, combined, control) was the independent variable. This enabled the comparative analysis of intervention outcomes.

The qualitative component involved semi-structured interviews and reflective journals to capture in-depth insights into teachers' experiences and perceptions. This design was chosen to triangulate data by combining statistical evidence of professional development outcomes with nuanced qualitative perspectives to ensure robust findings (Teddlie & Tashakkori, 2009). This design facilitated simultaneous data collection and analysis, allowing to address the complexity of TPD in the Iranian context while providing a holistic exploration of the research questions.

3.2. Participants

The study included a sample of 200 Iranian EFL teachers at the lower-secondary level, purposive sampled to ensure alignment with the research objectives. The participants were required to have at least two years of teaching

experience and active involvement in English instruction to ensure sufficient classroom exposure to benefit from and reflect on the interventions. The sample size was determined through a power analysis for MANOVA, targeting a medium effect size ($f^2 = 0.25$), power of 0.80, and alpha of 0.05, which indicated a minimum of 180 participants; 200 were recruited to account for potential attrition. The sample was evenly distributed across the four groups (50 participants each), ensuring balanced comparisons. Table 1 presents the demographic characteristics of the participants.

Table 1
Demographic Characteristics of Participants

Group	**N**	Gender (M/F)	25–29 Years	30–39 Years	40–49 Years	50–59 Years	Under 25 Years
Mentoring	50	22M / 28F	14 (28%)	16 (32%)	12 (24%)	5 (10%)	3 (6%)
Scaffolding	50	23M / 27F	13 (26%)	16 (32%)	13 (26%)	5 (10%)	3 (6%)
Combined Mentoring & Scaffolding	50	22M / 28F	14 (28%)	16 (32%)	12 (24%)	5 (10%)	3 (6%)
Control	50	23M / 27F	14 (28%)	16 (32%)	13 (26%)	5 (10%)	2 (4%)
Total	200	90M /110F	55 (28%)	64 (32%)	50 (25%)	20 (10%)	11 (5%)

Table 1 summarizes participants' demographic profiles, showing a balanced distribution across the four groups. The demographic composition included 110 females (55%) and 90 males (45%), with ages ranging from 22 to 59 years. The largest age group was 30–39 years (32%), followed by 25–29 years (28%), 40–49 years (25%), 50–59 years (10%), and under 25 years (5%). Age and gender distributions were balanced across groups to minimize bias, with the participants drawn from urban and semi-urban schools in Iran to reflect diverse teaching contexts.

3.3 Instrumentation

Quantitative data were collected using two researcher-developed questionnaires adapted from the Teaching and Learning International Survey (TALIS) by Ainley and Carstens (2018) to measure professional development outcomes. The Professional Development Activities (PDA) Questionnaire comprised 18 items assessing participation in workshops, peer collaboration, and online training. Items were rated on a 5-point Likert scale (1 = *Never,* 5 = *Always*). The Professional Development Application in Classrooms (PDAC) Questionnaire included 14 five-point Likert-scale items evaluating the practical application of professional development in such areas as lesson

planning, classroom management, and student engagement. Adaptations involved tailoring the TALIS items to the Iranian EFL context (e.g., adding items on technology-mediated collaboration). These adaptations were validated through a pilot study with 30 EFL teachers. Three TPD experts also reviewed the piloted test to ensure content validity, followed by exploratory factor analysis (EFA) confirming a three-factor structure for the PDA questionnaire (collaboration, training engagement, reflective practice), and a two-factor structure for the PDAC questionnaire (classroom application, student engagement) with factor loadings above 0.60. Reliability was high (Cronbach's alpha: PDA = 0.87, PDAC = 0.89).

Qualitative data were gathered through semi-structured interviews with 20 participants (five per group), using open-ended questions to explore interventional effectiveness, challenges, and benefits. All 200 participants completed weekly reflective journals to document their experiences. Prompts were aligned with the research questions and theoretical frameworks.

3.4. Procedure

The study was conducted over six months in 2024. Moodle was used as the online platform for intervention delivery and data collection. The mentoring group received personalized guidance from experienced EFL mentors through biweekly Zoom videoconferencing sessions (60 minutes each) and weekly asynchronous feedback on lesson plans and teaching strategies via Moodle forums, tailored to individual needs. Mentors followed a standardized protocol, developed based on Harwell-Kee (1999), ensuring consistent feedback quality, with fidelity monitored through session recordings and supervisor reviews. In contrast, the scaffolding group participated in structured Moodle-based modules, delivered weekly, including guided activities (e.g., lesson design tasks), peer discussion forums, and collaborative projects, designed to build teaching competencies within a supportive peer network. Modules were identical across participants, with facilitators ensuring consistent delivery. Building on both approaches, the combined mentoring and scaffolding group engaged in a dual intervention, integrating biweekly mentoring sessions with weekly scaffolding modules to maximize synergy. Finally, the control group received no intervention but completed pre- and post-test questionnaires via Moodle. The PDA and PDAC questionnaires were administered online during the pretest and posttest phases, with automated reminders ensuring consistency. Post-intervention semi-structured interviews, conducted via Zoom, were audio-recorded and transcribed verbatim.

Reflective journals were submitted weekly through Moodle, with prompts encouraging reflection on professional growth, challenges, and insights.

All data collection adhered to ethical guidelines, with informed consent obtained, anonymity ensured through pseudonyms and data encryption, and voluntary participation with the option to withdraw at any time (British Educational Research Association, 2018). The study also received approval from the Institutional Review Board of Islamic Azad University, Karaj Branch. Moreover, the collected data were stored on password-protected servers, accessible only to the research team, and will be retained for five years per institutional guidelines. Measures minimized discomfort during interviews and journal reflections, and participants were assured that responses would not affect their professional standing (British Educational Research Association, 2018).

3.5 Data Analysis

Quantitative data were analyzed using multiple statistical approaches to evaluate intervention outcomes. Descriptive statistics (means and standard deviations) summarized PDA and PDAC responses, providing an overview of professional development engagement and application. Multivariate Analysis of Variance (MANOVA) compared group performance across dependent variables (self-development, collaboration, teaching competencies, content knowledge, creativity), with group type (mentoring, scaffolding, combined, control) as the independent variable. Scheffé's post-hoc tests identified specific group differences. Statistical assumptions were verified: linearity was confirmed via scatterplot inspection, normality was assessed with skewness and kurtosis within the acceptable ranges (±2), and equality of variances was confirmed via Levene's Test.

In addition to quantitative analysis, qualitative data were analyzed using thematic analysis (Braun & Clarke, 2006). Interview transcripts and journals were coded independently by two researchers, with themes defined through iterative discussion to ensure alignment with research questions. Discrepancies were resolved through consensus meetings, reviewing coded excerpts to refine themes, achieving high inter-coder reliability (Cohen's $\kappa = 0.82$). Data triangulation integrated quantitative and qualitative findings to enhance credibility and provide a comprehensive understanding of intervention impacts (Creswell & Plano Clark, 2018).

4. Results

4.1. Results for the First Research Question

To address the first research question (i.e., How do technology-mediated mentoring and peer scaffolding impact the professional development of Iranian EFL teachers in terms of self-development, collaboration, teaching competencies, content knowledge, and creativity?), both quantitative and qualitative data were analyzed. The quantitative analysis demonstrated that technology-mediated mentoring and peer scaffolding significantly enhanced the professional development of Iranian EFL teachers across five dimensions: self-development, collaboration, teaching competencies, content knowledge, and creativity. The post-test means and univariate analysis of variance (ANOVA) results for each dimension are summarized in Table 2.

Table 2

Impact of Interventions on Professional Development Dimensions

Dimension	Mentoring (*M*, *SD*)	Scaffolding (*M*, *SD*)	Combined (*M*, *SD*)	Control (*M*, *SD*)	F (df)	p	η^2
SD	4.10, 0.52	3.95, 0.60	4.28, 0.50	3.30, 0.65	18.45 (3, 196)	< .001	0.32
COL	3.85, 0.57	3.90, 0.58	4.20, 0.48	3.25, 0.62	22.67 (3, 196)	< .001	0.38
TC	3.98, 0.54	3.88, 0.59	4.15, 0.49	3.35, 0.64	16.89 (3, 196)	< .001	0.30
CK	4.05, 0.55	3.85, 0.61	4.25, 0.47	3.40, 0.66	19.12 (3, 196)	< .001	0.33
CR	4.00, 0.56	3.90, 0.60	4.32, 0.45	3.20, 0.63	25.34 (3, 196)	< .001	0.45

*Note***:** SD = Self-Development; COL = Collaboration; TC = Teaching Competencies; CK = Content Knowledge; CR = Creativity.

As shown in Table 2, the MANOVA results revealed a significant overall effect of the interventions, Wilks' $\Lambda = .62$, $F(42, 552) = 3.85$, $p < .001$, $\eta^2 = .38$, indicating that the interventions collectively influenced professional development outcomes. Univariate ANOVA tests further confirmed significant effects for each dimension: self-development ($F(3, 196) = 18.45$, $p < .001$, $\eta^2 = 0.32$), collaboration ($F(3, 196) = 22.67$, $p < .001$, $\eta^2 = 0.38$), teaching competencies ($F(3, 196) = 16.89$, $p < .001$, $\eta^2 = 0.30$), content knowledge ($F(3, 196) = 19.12$, $p < .001$, $\eta^2 = 0.33$), and creativity ($F(3, 196) = 25.34$, $p < .001$, $\eta^2 = 0.45$). The combined mentoring and scaffolding group obtained the highest mean scores, especially in creativity ($M = 4.32$, $SD = 0.45$), reflective practice ($M = 4.28$, $SD = 0.50$), and peer collaboration ($M = 4.20$, $SD = 0.48$). The mentoring group showed notable gains in self-appraisal ($M = 4.10$, $SD = 0.52$) and content knowledge related to critical thinking ($M = 4.05$, $SD = 0.55$), while the scaffolding group excelled in self-directed growth ($M = 3.95$, $SD = 0.60$) and communication ($M = 3.90$, $SD = 0.58$). The control group exhibited minimal improvement ($M = 3.20$–3.50 across dimensions). The inferential statistics confirm significant differences in post-test scores

between the intervention groups and the control group, with the largest effect sizes observed in the combined mentoring and scaffolding condition.

The quantitative data indicated that the interventions, particularly the combined condition, were associated with higher self-reported scores across all measured dimensions. These results were supported by qualitative findings, which identified four themes: personalized support enhanced motivation, collaboration fostered growth, technology enabled flexibility, and reflective practice drove pedagogical change. For example, a teacher from the combined group stated, "The mentor's feedback and peer discussions sparked new ways to teach creatively."

4.2. Results for the Second Research Question

To address the second research question (i.e., What are the differences in professional development outcomes among Iranian EFL teachers receiving technology-mediated mentoring, scaffolding, combined mentoring and scaffolding, and no intervention?) differences in professional development outcomes among the four groups were examined. Table 3 summarizes the results of the MANOVA and paired samples t-tests.

Table 3
Post-Test Mean Scores and Group Differences

Group	SD (M, SD)	COL (M, SD)	TC (M, SD)	CK (M, SD)	CR (M, SD)	*t*	*p*	*d*
Mentoring	4.10, 0.52	3.85, 0.57	3.98, 0.54	4.05, 0.55	4.00, 0.56	6.32	< .001	0.89
Scaffolding	3.95, 0.60	3.90, 0.58	3.88, 0.59	3.85, 0.61	3.90, 0.60	5.47	< .001	0.77
Combined	4.28, 0.50	4.20, 0.48	4.15, 0.49	4.25, 0.47	4.32, 0.45	8.74	< .001	1.24
Control	3.30, 0.65	3.25, 0.62	3.35, 0.64	3.40, 0.66	3.20, 0.63	1.12	.27	0.16
F (df)	18.45 (3, 196)	22.67 (3, 196)	16.89 (3, 196)	19.12 (3, 196)	25.34 (3, 196)			
Significant Differences	C < M, S, CM	C < M, S, CM; M < CM	C < M, S, CM	C < M, S, CM; S < M, CM	C < M, S, CM; S < CM			

*Note***:** SD = Self-Development; COL = Collaboration; TC = Teaching Competencies; CK = Content Knowledge; CR = Creativity. Paired t-tests compared pre- and post-test scores within groups. Significant differences ($p < .05$, $p < .01$) are indicated.

As presented in Table 3, the overall MANOVA results (Wilks' Lambda = 0.62, $F(42, 552) = 3.85$, $p < .001$, $\eta^2 = 0.38$) confirmed a significant effect of group type on outcomes. Scheffé's post-hoc tests indicated that the combined mentoring and scaffolding group significantly outperformed the control group across all dimensions ($p < .001$) and the scaffolding group in creativity and reflective practice ($p < .05$). The mentoring group outperformed the scaffolding group in self-appraisal and content knowledge ($p < .05$) but was surpassed by the combined group in collaboration ($p < .01$). The control group showed no significant pretest-to-posttest improvement ($p > .05$).

Paired t-tests comparing pretest and posttest scores within groups showed significant improvements for the combined group in creativity ($t(49) = 8.74$, $p < .001$, $d = 1.24$), the mentoring group in self-appraisal ($t(49) = 6.32$, $p < .001$, $d = 0.89$), and the scaffolding group in collaboration ($t(49) = 5.47$, $p < .001$, $d = 0.77$), but not for the control group ($t(49) = 1.12$, $p = .27$, $d = 0.16$). Effect sizes were the largest for the combined group, particularly in creativity ($\eta^2 = 0.45$) and collaboration ($\eta^2 = 0.38$). Significant differences indicate the combined group's superiority, particularly in creativity and collaboration, with large effect sizes ($d \geq 0.77$).

4.3. Results for the Third Research Question

Qualitative findings revealed that Iranian EFL teachers viewed technology-mediated mentoring and peer scaffolding as highly effective, with the combined approach most strongly valued. Thematic analysis of interviews and reflective journals identified four key themes:

(1) *Personalized Support Enhances Motivation*: Teachers in the mentoring and combined groups highlighted that individualized mentor feedback boosted confidence and engagement, with one stating, "My mentor helped me see my strengths and areas to improve."

(2) *Collaboration Fosters Growth*: Participants in the scaffolding and combined groups valued peer interactions, noting, "Discussing with peers online gave me new ideas for teaching."

(3) *Technology Enables Flexibility*: Teachers appreciated the accessibility of online platforms, though some reported connectivity challenges, as one remarked, "The platform was easy to use, but slow internet was a problem."

(4) *Reflective Practice Drives Change*: Reflective journals revealed increased self-awareness, particularly in the combined group, with a teacher noting, "Writing reflections helped me rethink my lesson plans." These themes emerged from 12 codes, such as "mentor feedback," "peer collaboration," and

"reflective insights," with high inter-coder reliability (Cohen's $\kappa = 0.82$). Quantitative data supported these perceptions, with the combined group's high scores in reflective practice ($M = 4.28$) and creativity ($M = 4.32$), aligning with qualitative reports. Table 4 shows the frequency and percentage of participants in each group mentioning each theme in the interviews or reflective journals.

Table 4

Frequency of Qualitative Themes Across Groups

Theme	Mentoring (n=50)	Scaffolding (n=50)	Combined (n=50)	Control (n=50)
Personalized Support Enhances Motivation	42 (84%)	15 (30%)	48 (96%)	5 (10%)
Collaboration Fosters Growth	30 (60%)	40 (80%)	46 (92%)	8 (16%)
Technology Enables Flexibility	38 (76%)	42 (84%)	47 (94%)	10 (20%)
Reflective Practice Drives Change	40 (80%)	35 (70%)	49 (98%)	6 (12%)

As displayed in Table 4, the combined group showed the highest frequencies, especially in reflective practice (98%) and personalized support (96%), indicating strong effectiveness. Table 5 details the codes and themes from the qualitative analysis.

Table 5

Codes and Themes from Qualitative Analysis

Theme	Code	Description	Example Quote
Personalized Support Enhances Motivation	Mentor Feedback	Positive impact of individualized mentor guidance on confidence and motivation	"My mentor's feedback helped me feel more confident in my teaching."
	Tailored Guidance	Customized support addressing specific teacher needs	"The mentor gave me specific strategies for my classroom challenges."
	Emotional Support	Encouragement and empathy from mentors boosting engagement	"My mentor's encouragement kept me motivated to try new methods."
Collaboration Fosters Growth	Peer Collaboration	Value of peer discussions and knowledge sharing in professional growth	"Discussing with peers online gave me new ideas for teaching."
	Community Building	Sense of community developed through peer interactions	"I felt part of a supportive group when working with peers."

	Knowledge Exchange	Sharing resources and strategies among peers	"Peers shared lesson plans that I adapted for my classes."
Technology Enables Flexibility	Platform Accessibility	Ease of accessing professional development through digital platforms	"The online platform let me learn at my own pace."
	Asynchronous Learning	Flexibility of engaging with materials at convenient times	"I could review modules whenever I had time, which was helpful."
	Connectivity Challenges	Technical issues impacting platform use	"Slow internet sometimes made it hard to join sessions."
Reflective Practice Drives Change	Reflective Insights	Increased self-awareness through reflective journaling	"Writing reflections helped me see where I could improve."
	Pedagogical Adjustments	Changes in teaching practices based on reflections	"Reflecting on my lessons led me to try new engagement strategies."
	Self-Evaluation	Critical self-assessment of teaching effectiveness	"Journaling made me question and refine my teaching methods."

As outlined in Table 5, the qualitative analysis generated four overarching themes (i.e., Personalized Support Enhances Motivation, Collaboration Fosters Growth, Technology Enables Flexibility, and Reflective Practice Drives Change), each supported by three codes, reflecting the diverse aspects of teachers' perceptions and experiences. Collectively, these themes demonstrate the multifaceted ways in which mentoring, collaboration, technology, and reflection shaped teachers' experiences and professional growth.

5. Discussion

This mixed-methods study investigated the impact of technology-mediated mentoring and peer scaffolding on the professional development of Iranian EFL teachers. The findings confirm that technology-mediated mentoring and peer scaffolding significantly enhance Iranian EFL teachers' professional development, with the combined approach producing the greatest improvements. These results align with Vygotsky's (1978) SCT, which posits that learning occurs most effectively through social interactions within the ZPD. The synergy of personalized mentoring and structured peer scaffolding created a dynamic, supportive environment that fostered creativity, reflective

practice, and peer collaboration, as evidenced by the combined group's superior performance. This supports Lave and Wenger's (1991) Community of Practice framework, which emphasizes the role of collaborative learning communities in professional growth. The combined approach facilitated a robust community of practice, enabling teachers to share knowledge, exchange strategies, and support each other's development. This is consistent with findings from Farrell and Jacobs (2023), who highlighted the transformative potential of technology-enhanced collaborative TPD in EFL contexts. The significant effect sizes for creativity and collaboration underscore the practical importance of integrating mentoring and scaffolding, particularly in resource-constrained settings like Iran, where traditional TPD models often lack such collaborative elements (Ganji et al., 2020).

Mentoring alone proved particularly effective for fostering higher-order skills, such as self-appraisal and critical thinking within content knowledge, corroborating Brookfield's (2017) assertion that guided reflection through mentoring promotes deep critical engagement with teaching practices. This is in line with the study's qualitative findings, where teachers in the mentoring group emphasized the motivational impact of personalized feedback. These results echo Tseng and Yeh (2022), who found that technology-mediated mentoring enhances reflective practice and pedagogical innovation in EFL settings. However, scaffolding alone, while effective for self-directed growth and communication, was less impactful for complex cognitive skills, as evidenced by its lower performance compared to the combined group for creativity. This suggests that structured peer support, while valuable for fostering autonomy and collaboration, may not sufficiently address the nuanced needs of developing higher-order pedagogical skills, as noted by Richards and Farrell (2005). The scaffolding group's qualitative feedback, which emphasized peer collaboration but lacked depth in complex skill development, supports this interpretation, highlighting the need for expert guidance to complement peer-based learning (Kleickmann et al., 2016).

Beyond these effects, the non-linear improvement patterns observed across groups indicated that contextual factors, such as intervention quality, teacher motivation, and technological infrastructure, significantly influence professional growth outcomes. The combined group's superior performance suggests that the quality of intervention delivery, integrating personalized mentoring with structured peer activities, maximized learning within the ZPD (Vygotsky, 1978). However, the variability in the outcomes, particularly the control group's minimal improvement, underscores the role of teacher

motivation, as highlighted by Runco (2014), who argued that intrinsic motivation is critical for creative and reflective development. Qualitative data revealed that teachers' engagement with reflective journals and peer discussions was influenced by their initial motivation levels, with highly motivated teachers in the combined group reporting greater pedagogical change. This finding aligns with Atai and Mazlum (2024), who noted that contextual factors, including teacher readiness and institutional support, shape TPD effectiveness in Iran's centralized education system. The study's results thus extend the literature by demonstrating how technology-mediated interventions can leverage teacher motivation to enhance professional development outcomes in resource-limited contexts (Hennessy et al., 2022).

Qualitative findings further supported the quantitative results, highlighting the motivational and collaborative benefits of technology-mediated interventions. Teachers' positive perceptions of online platforms, as captured in themes like "Technology Enables Flexibility" and "Collaboration Fosters Growth," underscore the potential of digital tools to overcome logistical barriers such as time and location, which is consistent with Dill and Røkenes (2021). However, challenges like connectivity issues, noted by some teachers ("Slow internet was a problem"), align with Hennessy et al.'s (2022) caution that technology access remains a critical barrier in low-resource settings. These findings bridge gaps in Iran's TPD landscape, where traditional programs often lack relevance and technological integration (Birjandi & Derakhshan Hesari, 2010). The high frequency of themes in the combined group for reflective practice and personalized support suggests that blended, context-sensitive approaches can address these gaps. This supports Bragg et al.'s (2021) findings on the efficacy of digital mentoring in enhancing pedagogical knowledge and collaboration.

This mixed-methods approach addresses a key research gap by combining quantitative and qualitative insights (Creswell & Plano Clark, 2018). By triangulating data, the findings provide a holistic understanding of how technology-mediated mentoring and scaffolding enhance EFL teacher development, particularly in Iran's resource-constrained context. The combined approach's success suggests that TPD programs should integrate personalized guidance with collaborative peer support to maximize impact, aligning with the TPACK framework's emphasis on integrating technological, pedagogical, and content knowledge (Mishra & Koehler, 2006). However, the study also highlights limitations, such as the potential influence of technology access disparities and varying mentor quality, which warrant further investigation.

6. Conclusions and Implications

This study provides strong evidence that technology-mediated mentoring and peer scaffolding significantly enhance Iranian EFL teachers' professional development, with the combined approach delivering the strongest improvements across self-development, collaboration, teaching competencies, content knowledge, and creativity. The findings demonstrate that the synergy of personalized mentoring and structured peer scaffolding within the ZPD fosters a supportive learning environment promoting reflective practice and pedagogical innovation. The combined group's superior performance in creativity and collaboration underscores the value of integrating individualized guidance with collaborative peer support. Qualitative insights further confirm that technology-mediated interventions overcome logistical barriers like time and location, addressing critical gaps in Iran's TPD landscape. In addition, the high level of teacher satisfaction with online platforms, despite reported connectivity challenges, suggests that improving technological infrastructure is critical to scaling these interventions. Furthermore, the study's mixed-methods approach, integrating quantitative outcomes with qualitative insights, provides a robust model for evaluating TPD effectiveness, offering a blueprint for educators globally to design context-sensitive professional development programs. Prioritizing blended approaches may enable educational institutions to adopt innovative pedagogies, ultimately improving student outcomes in Iran and similar contexts. Moreover, these findings extend the literature by demonstrating the efficacy of blended, context-sensitive TPD models in resource-constrained EFL settings, aligning with the TPACK framework's emphasis on integrating technological, pedagogical, and content knowledge.

The study's implications are significant for educators and policymakers in Iran, suggesting that technology-driven TPD programs can empower teachers to meet diverse classroom demands, enhance student engagement, and foster professional growth. The practical implications are substantial, particularly for Iran's centralized education system, where traditional TPD programs often lack relevance and technological integration. Such programs can address systemic challenges, such as limited peer collaboration and outdated curricula, by fostering communities of practice that enhance teacher agency and creativity.

Despite its contributions, this study has several limitations that should be considered. First, the six-month duration, while sufficient to observe

significant changes, may not capture the long-term sustainability of the interventions' effects, as longitudinal impacts are critical for assessing TPD efficacy (Avalos, 2011). Second, the purposive sampling of 200 lower-secondary EFL teachers, while appropriate for the study's context, limits generalizability to other educational levels or subject areas. Additionally, the reliance on self-reported data from questionnaires and reflective journals may have introduced bias, since teachers' perceptions do not always mirror actual classroom practices (Desimone, 2009). Teachers' responses may have been influenced by social desirability bias, leading them to report greater improvement than actually occurred, or by giving feedback they believed researchers wanted to hear. Fourth, although experienced mentors were recruited, the quality of mentors and the design of scaffolding activities varied, potentially affecting the consistency of intervention delivery. This variability could have introduced bias, potentially inflating outcomes for teachers assigned to particularly skilled mentors or dampening them for others. Finally, technological disparities, such as connectivity issues reported by some participants, may have influenced engagement and outcomes, particularly in semi-urban settings, aligning with challenges noted by Hennessy et al. (2022). These limitations suggest caution in interpreting the findings and underscore the need for further research to address these constraints.

Future research should prioritize longitudinal studies to explore the sustained impact of technology-mediated mentoring and scaffolding on EFL teacher development, especially across diverse educational contexts (Farrell & Jacobs, 2023). Investigating the scalability of these interventions across different regions in Iran, including rural areas with limited technological access, could provide insights into addressing infrastructure barriers (Hennessy et al., 2022). Additionally, exploring the impact of mentor training and standardized scaffolding protocols could enhance intervention consistency and effectiveness (Bragg et al., 2021). Comparative studies examining technology-mediated TPD in other EFL contexts globally would further validate the findings and contribute to a broader understanding of best practices (Tseng & Yeh, 2022). Incorporating objective measures, such as classroom observations or student performance data, could complement self-reported data to provide a more comprehensive assessment of TPD outcomes (Desimone, 2009). Finally, research exploring the integration of emerging technologies, such as artificial intelligence or virtual reality, into TPD could offer innovative solutions for enhancing teacher engagement and learning in resource-constrained settings.

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