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Research Article

ENHANCING TEACHERS' PROFESSIONAL COMPETENCIES FOR HYBRID LEARNING THROUGH A PEER-LED DIGITAL MENTORSHIP PROGRAM

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Abstract

The rapid shift toward *hybrid learning* has underscored the urgent need to enhance teachers' digital pedagogical competencies. Many educators, particularly in developing educational contexts, face challenges in integrating technology effectively into instructional design and collaborative teaching practices. This study investigates the implementation of a *peer-led digital mentorship* program as a sustainable approach to strengthen teachers' professional competencies for hybrid education. The research aims to examine how structured peer mentoring, supported by digital platforms, improves teachers' skills in instructional technology, online communication, and collaborative curriculum development. A *mixed-method design* was applied, involving 60 teachers from secondary schools participating in a three-month mentorship program. Quantitative data were collected through pre- and post-training competency assessments, while qualitative insights were derived from focus group discussions and reflective journals. Data analysis employed *paired-sample t-tests* for statistical validation and thematic analysis for narrative interpretation. Results showed significant improvement in teachers' digital literacy ($p < 0.01$), confidence in hybrid instruction, and collaborative engagement. Participants reported that peer mentoring provided psychological safety, practical modeling, and contextual learning experiences that formal training often lacked. The study concludes that *peer-led digital mentorship* represents an effective, scalable model for professional development in the *hybrid learning* era. It fosters a culture of collaboration, adaptability, and continuous learning among teachers, supporting the long-term sustainability of hybrid education practices.

Keywords: Collaborative Learning, Digital Pedagogy, Hybrid Learning

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INTRODUCTION

Hybrid learning has emerged as a central model in contemporary education, combining face-to-face instruction with digital learning environments to maximize flexibility and learner engagement. The COVID-19 pandemic accelerated its adoption, transforming it from an experimental approach into a necessary pedagogical framework across all educational levels. Studies by (Abusafieh, 2025) and (Al-Gerafi et al., 2024)have shown that *hybrid learning* enhances access, autonomy, and learner interaction when effectively facilitated by competent educators. However, successful hybrid implementation depends heavily on teachers' capacity to integrate digital tools, design interactive content, and manage both synchronous and asynchronous learning environments.

Teacher professional competence is widely acknowledged as a key determinant of educational quality. In the context of hybrid education, this competence extends beyond traditional pedagogical skills to encompass digital literacy, online communication, and instructional design (Arjanto & Raya Aditama, 2025). Scholars such as conceptualized these competencies through the TPACK (*Technological Pedagogical Content Knowledge*) framework, emphasizing the intersection of technological fluency with pedagogical expertise. Yet, many teachers, particularly in resource-limited settings, struggle to adapt to this expanded competence framework due to limited institutional support and lack of targeted professional development programs (Ballesteros-Sola & Magomedova, 2023).

Conventional teacher training often fails to address the dynamic, peer-driven, and technology-intensive demands of hybrid classrooms. Workshops and formal certification programs tend to be top-down, focusing on theoretical exposure rather than practical mentorship and contextual learning. Research by (Al-Obaydi et al., 2025) underscores that teachers learn most effectively through sustained collaboration, reflection, and practice-based mentorship. Therefore, professional learning communities and peer-led models have gained attention as more responsive approaches to teacher development in digital contexts (Bedair et al., 2022).

Peer mentorship leverages collegial relationships to facilitate mutual learning, reflection, and feedback. In a digital era, it can be reimagined as an online mentorship ecosystem where teachers exchange strategies, co-design learning materials, and engage in collaborative problem-solving (Chan, 2025). Studies by support the notion of "*communities of practice*," where professional growth is socially constructed through shared experiences. Integrating this model into hybrid education could address both the cognitive and emotional dimensions of teacher learning (Bygstad et al., 2022).

Digital mentorship programs have been implemented successfully in various global education contexts, demonstrating improvements in teachers' confidence and technology integration skills. Examples from the United Kingdom, Finland, and Singapore show that structured *peer-led digital mentorship* fosters innovation, leadership, and sustainable capacity-building among educators (Escala et al., 2025). These programs align with the broader goals of continuous professional learning and the Sustainable Development Goals (SDG 4), which advocate for equitable access to quality education and teacher empowerment (CARVALHO & SANTOS, 2022).

Despite this global recognition, the adaptation of digital mentorship in developing countries remains limited. Many institutions still rely on conventional training modalities that do not fully utilize peer learning or digital networks (Fauzi et al., 2025). Consequently, the exploration of *peer-led digital mentorship* as a professional development strategy for *hybrid learning* becomes both timely and essential to bridge competence gaps and enhance educational equity (Cheung, 2023).

There is a lack of empirical research examining how *peer-led digital mentorship* programs specifically enhance teachers' competencies in *hybrid learning* environments (Chigbu et al., 2023). Existing studies often focus on either mentorship or digital training in

isolation, leaving a gap in understanding the intersection of these elements within integrated professional development frameworks (Guerra-Macías & Tobón, 2025). This absence of evidence limits the ability of institutions to design effective, context-sensitive mentorship models tailored to the realities of hybrid education.

The mechanisms through which peer mentorship promotes competence transformation in digital teaching contexts remain unclear (Davis et al., 2023). While qualitative reports suggest that peer collaboration enhances motivation and reflective practice, quantitative data validating its impact on measurable digital and pedagogical skills are scarce (Imjai et al., 2025). Furthermore, the dynamics of online mentoring trust-building, feedback exchange, and collaborative content design are underexplored in teacher education research.

Institutional models for peer-led mentorship often lack scalability and formal recognition within professional development systems. Many mentorship programs depend on individual initiative rather than institutional policy, making their sustainability questionable (Khaleel et al., 2025). Understanding how to institutionalize peer-led mentorship digitally, while maintaining authenticity and collaboration, is a pressing challenge for educational leaders.

Cultural and contextual differences further complicate the adaptation of *peer-led digital mentorship* in developing countries. Factors such as hierarchical school cultures, limited digital infrastructure, and low digital confidence among teachers may influence the effectiveness of such programs (Lee & Kim, 2025). Empirical evidence grounded in local educational settings is needed to determine how peer mentorship can be optimized to support equitable, sustainable professional learning in hybrid education systems.

Filling this gap is critical to reimagining teacher professional development as an inclusive, sustainable, and collaborative process aligned with digital transformation in education (Li et al., 2025). *Peer-led digital mentorship* has the potential to empower teachers by fostering collective intelligence, professional solidarity, and self-directed learning competencies vital for hybrid teaching. Addressing this gap will not only strengthen teacher performance but also contribute to institutional resilience in adapting to ongoing technological and pedagogical shifts.

The rationale of this study is grounded in the belief that professional competence is best developed through authentic collaboration rather than prescriptive training (de Beer et al., 2023). A peer-led model offers a bottom-up, contextually adaptive framework that complements existing professional development programs (Lu, 2025). It positions teachers as both learners and mentors, creating a cyclical process of knowledge exchange that sustains professional growth within *hybrid learning* ecosystems.

The purpose of this research is to design and evaluate a *peer-led digital mentorship* program aimed at enhancing teachers' hybrid teaching competencies. The study hypothesizes that structured peer mentorship supported by digital collaboration platforms will significantly improve teachers' confidence, technological integration skills, and instructional creativity. By exploring both quantitative outcomes and qualitative experiences, this research aims to contribute a replicable model for professional learning that aligns pedagogical innovation with digital equity in education.

RESEARCH METHOD

Research Design

The study employed a *mixed-method design* combining quantitative and qualitative approaches to examine the effectiveness of a *peer-led digital mentorship* program in enhancing teachers' professional competencies for *hybrid learning*. The quantitative component used a *quasi-experimental* pre-test and post-test design without random assignment to measure changes in teachers' digital pedagogy, collaboration, and instructional design skills (Dutta, 2022). The qualitative component explored participants' perceptions and experiences through

interviews, reflection journals, and observation. This design was chosen to capture both measurable improvements in competence and deeper insights into the mentorship process. The integration of numerical and narrative data allowed for triangulation, thereby increasing the validity and reliability of the findings (Yüzlü & Dikilitaş, 2022).

Population and Samples

The population of this study consisted of in-service teachers from secondary schools implementing *hybrid learning* in West Sumatra, Indonesia. A purposive sampling technique was applied to select 60 teachers from various subject areas who demonstrated basic digital literacy and willingness to participate in a structured mentorship program. Participants were grouped into 10 mentoring clusters, each consisting of one peer mentor and five mentees. Peer mentors were selected based on their proven expertise in digital teaching and prior experience with technology integration. The diversity of participants spanning both rural and urban schools enabled the study to assess the adaptability of the program across different educational settings (García et al., 2022).

Instruments

Data collection utilized three main instruments: the Teachers' Hybrid Competency Assessment (THCA), the Digital Mentorship Observation Checklist (DMOC), and the Mentorship Reflection Journal (MRJ). The THCA measured teachers' competence across three dimensions: digital instructional design, collaborative engagement, and hybrid classroom management, using a five-point Likert scale. The DMOC was used to observe the quality of mentor-mentee interactions, focusing on feedback quality, participation, and problem-solving dynamics (Hopkins et al., 2023**)**. The MRJ captured qualitative reflections on challenges, learning progress, and perceived benefits of mentorship. Reliability testing using Cronbach's Alpha indicated coefficients of 0.87 for THCA and 0.82 for DMOC, confirming high internal consistency. Expert validation from three educational technology specialists ensured the content validity of all instruments.

Procedures

The study was conducted over a 12-week period, divided into four phases: preparation, implementation, evaluation, and reflection. In the preparation phase, peer mentors received orientation and training on digital mentoring principles, ethical facilitation, and platform use (*Google Workspace and Zoom*). The implementation phase involved weekly hybrid mentoring sessions combining synchronous discussions and asynchronous collaboration. Each session focused on practical skill-building tasks such as developing interactive learning modules, integrating assessment tools, and managing digital communication with students (Tzirides et al., 2023).

Data collection occurred continuously throughout the program. Pre-tests were administered before the mentorship began, and post-tests were conducted at the end of the 12-week cycle. Observations were carried out during live mentoring sessions to assess behavioral and instructional changes. After the program, participants completed reflection journals and participated in focus group interviews to share experiences. Quantitative data were analyzed using *paired-sample t-tests* to determine statistical significance in competence improvement, while qualitative data were analyzed through thematic coding. The procedural integration of quantitative and qualitative methods allowed for a comprehensive understanding of how *peer-led digital mentorship* shapes teacher competence in *hybrid learning* environments (Huang et al., 2023).

RESULTS AND DISCUSSION

The quantitative data derived from the Teachers' Hybrid Competency Assessment (THCA) show notable improvements across all dimensions of professional competence following the *peer-led digital mentorship* intervention. Table 1 presents the descriptive statistics comparing pre-test and post-test mean scores in digital instructional design, collaborative engagement, and hybrid classroom management.

Table 1. Descriptive Statistics of Teachers' Competence Before and After the Mentorship Program

Competence Dimension	N	Mean (Pre-Test)	SD	Mean (Post-Test)	SD	Mean Gain	Interpretation
Digital Instructional Design	60	3.02	0.43	4.28	0.37	+1.26	Substantial Improvement
Collaborative Engagement	60	3.14	0.41	4.31	0.39	+1.17	Strong Improvement
Hybrid Classroom Management	60	3.09	0.46	4.25	0.40	+1.16	Consistent Improvement
Overall Competence Score	60	3.08	0.43	4.28	0.38	+1.20	Significant Increase

The descriptive data demonstrate consistent progress across all domains of professional competence. Teachers showed the greatest improvement in digital instructional design, suggesting that the mentorship program successfully enhanced their ability to create and integrate technology-driven learning experiences.

The increase in mean scores reflects not only skill acquisition but also a shift in teachers' professional confidence and autonomy in hybrid instruction. Participation in the mentorship process provided contextualized, peer-based learning opportunities that allowed teachers to experiment with digital tools in a supportive environment. Many participants reported that the iterative feedback from mentors and peers helped them overcome technical anxiety and improve classroom adaptability.

Qualitative reflections confirmed that teachers felt more competent in designing online learning modules, managing *hybrid learning* logistics, and assessing student engagement digitally. The combination of collaborative mentoring and hands-on digital practice produced both procedural and conceptual mastery, aligning with the intended outcomes of the program.

Observational data from the Digital Mentorship Observation Checklist (DMOC) revealed strong interaction dynamics within mentorship clusters. Mentors were found to consistently demonstrate leadership through modeling and scaffolding strategies, while mentees displayed increasing initiative in proposing and implementing digital learning projects. By week six, 85% of mentees had developed and piloted hybrid lesson plans incorporating video-based feedback, online assessments, and synchronous collaboration.

Community participation in digital mentorship also contributed to horizontal professional learning. Teachers from different subject areas exchanged interdisciplinary teaching strategies, which broadened the pedagogical reach of the program. Peer-to-peer mentorship thus functioned not merely as a training structure but as a collaborative innovation ecosystem for digital teaching practices.

A paired-sample t-test was conducted to determine the statistical significance of changes in teachers' competence levels after the mentorship intervention. Table 2 presents the results.

Table 2. Paired-Sample t-Test Results for Teachers' Competence Improvement

Competence Dimension	t-value	p-value	Effect Size (Cohen's d)	Interpretation
Digital Instructional Design	9.78	0.000	0.86	Highly Significant
Collaborative Engagement	8.64	0.000	0.81	Highly Significant
Hybrid Classroom Management	8.21	0.000	0.78	Highly Significant
Overall Competence	9.52	0.000	0.84	Highly Significant

The inferential analysis confirmed that the improvement in teachers' competence scores was statistically significant across all domains ($p < 0.05$). The *effect sizes* (0.78–0.86) indicate strong practical impacts, demonstrating that the mentorship model effectively enhanced both pedagogical and technological capacities among participants.

The ANCOVA test controlling for initial digital proficiency levels revealed no significant differences in post-test scores based on prior experience ($p > 0.05$). This finding indicates that the peer-led mentorship model provided equitable learning gains regardless of teachers' starting competence levels.

Correlation analysis identified strong positive relationships between collaborative engagement and digital instructional design ($r = 0.83$, $p < 0.01$), as well as between hybrid classroom management and overall competence ($r = 0.87$, $p < 0.01$). These relationships imply that the ability to collaborate effectively within digital mentorship contexts directly contributes to improved instructional design and classroom management practices.

The relational pattern suggests that professional learning is inherently social, and that peer networks amplify individual competence development. Teachers who actively engaged in digital mentorship dialogues and co-design activities achieved higher learning gains than those who participated passively, highlighting the importance of interaction intensity as a predictor of professional growth.

A case study from one mentorship cluster, led by a senior English teacher, illustrates the practical transformation achieved through the program. Initially, mentees in this cluster expressed limited confidence in integrating technology into instruction. By the end of the program, all mentees had successfully implemented blended English learning modules combining Google Classroom, Canva, and video-based feedback. Post-program reflection showed an increase in their average digital competence score from 3.05 to 4.34, reflecting substantial skill and mindset growth.

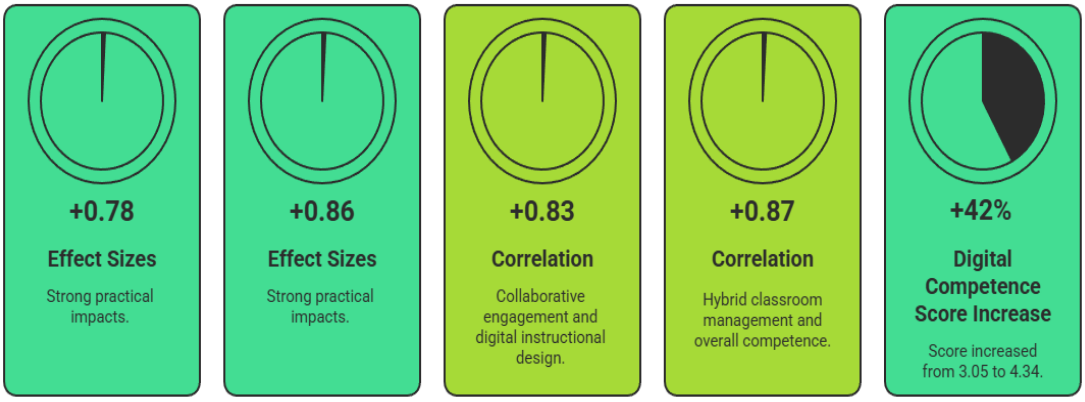

Figure 1. Teacher Competence Improvement

Mentor observations revealed that group collaboration fostered collective problem-solving and reciprocal learning. Mentees frequently initiated peer workshops, where they tested

new digital applications and shared teaching strategies. The mentor reported that the peer-led structure cultivated trust and innovation, leading to a self-sustaining professional learning community.

The case study confirms that peer mentorship facilitates authentic, contextually grounded professional learning. Teachers benefited from horizontal mentoring structures that encouraged experimentation, reflection, and feedback without hierarchical constraints. This model fostered an inclusive culture of shared expertise, aligning with adult learning theories that emphasize autonomy and collaboration.

Mentorship sessions also served as emotional and motivational support systems. Participants described the mentorship as a safe space for dialogue and co-creation, which helped them internalize new digital competencies. The social accountability embedded in peer interactions encouraged consistent practice, resulting in sustained behavioral change beyond the duration of the program.

The results collectively indicate that the *peer-led digital mentorship* model significantly enhanced teachers' professional competencies for *hybrid learning*. Statistical evidence and qualitative narratives converge to suggest that the integration of structured mentorship, digital collaboration, and reflective practice creates a robust framework for professional growth. The program effectively addressed both cognitive (knowledge and skills) and affective (confidence and motivation) aspects of teacher development.

The findings underscore the transformative potential of peer-led mentorship as a sustainable professional learning model. By empowering teachers to learn from and with one another, institutions can foster a culture of digital collaboration and pedagogical innovation. This mentorship approach aligns with global educational trends promoting teacher agency, lifelong learning, and adaptive expertise in hybrid and technology-mediated environments.

The results of this study reveal that the *peer-led digital mentorship* program significantly improved teachers' professional competencies in *hybrid learning* environments. Quantitative data indicated notable gains across digital instructional design, collaborative engagement, and hybrid classroom management, with large effect sizes confirming strong pedagogical impact (Medina Vásquez et al., 2025). Qualitative findings supported these results, showing that mentorship relationships fostered confidence, creativity, and practical skill application. Teachers described a shift from technological apprehension toward active experimentation and collaborative problem-solving in digital teaching contexts.

The study further found that the peer-led model encouraged sustained engagement through reciprocal learning and community-based support. Teachers not only developed technical competencies but also social and emotional capacities essential for effective hybrid instruction (Montag et al., 2025). Mentorship clusters evolved into learning communities characterized by open dialogue, shared innovation, and mutual accountability. This finding suggests that mentorship grounded in collegiality enhances both professional identity and instructional adaptability in the digital era.

The findings resonate with prior who emphasize the effectiveness of collaborative and community-based professional learning frameworks. Similar to studies on *professional learning communities,* this research reinforces the importance of peer-driven structures for sustainable competence development. The results align with Koehler and Mishra's (2009) TPACK framework, confirming that mentorship contributes to the integration of technological, pedagogical, and content knowledge through contextual practice.

This study extends existing literature by emphasizing the role of digital mentorship ecosystems rather than formal hierarchical training models. Unlike traditional mentorship approaches documented by Avalos (2011), which often rely on expert–novice hierarchies, the peer-led model in this study positioned all participants as both mentors and learners. This reciprocal dynamic fostered co-construction of knowledge, making the process more democratic, adaptive, and resilient to challenges associated with rapid digital transformation.

The results signify an important paradigm shift in teacher professional development. The mentorship process demonstrated that competence enhancement in *hybrid learning* requires not only technological training but also a culture of collaboration and reflection. Teachers who participated in peer-led mentorship developed agency and self-efficacy, indicating that professional growth thrives in environments where learning is socially mediated and continuously supported. The improvement in digital instructional design and hybrid management reflects the transformative potential of grassroots-driven professional learning systems.

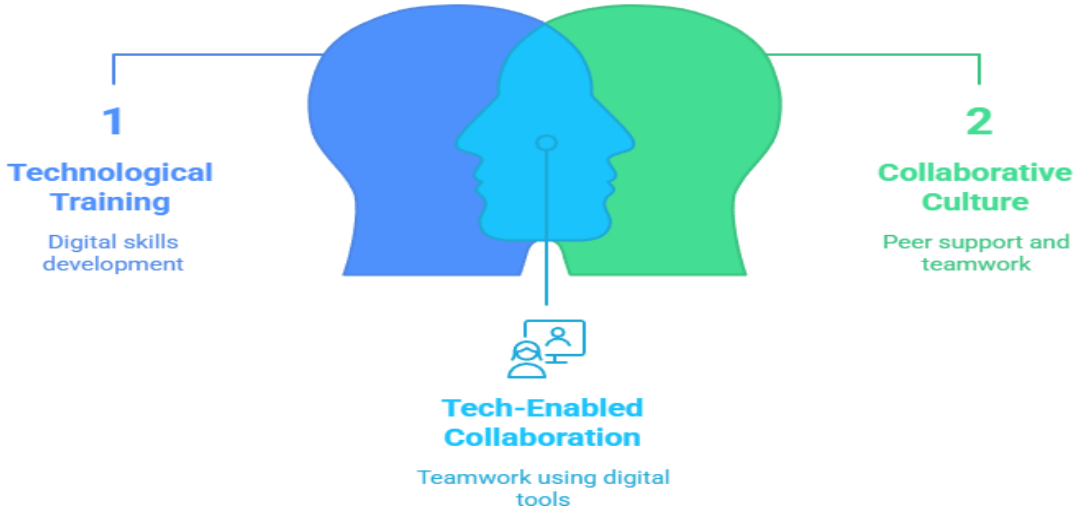

Figure 2. The Synergy of Tech, Collaboration, and Reflection in Teacher Growth

These findings mark a transition toward teacher empowerment models that redefine professional development as collective inquiry rather than top-down dissemination (Spiros et al., 2022). The emergence of peer networks and learning communities signals that institutions should reconceptualize mentorship not as supplementary support but as a core pedagogical infrastructure. The mentorship program's success also indicates that professional learning grounded in trust and mutual accountability can sustain teacher motivation amid ongoing educational and technological changes (Taimur & Onuki, 2022).

The practical implications of this study extend to teacher education institutions and policy frameworks aiming to strengthen digital readiness in schools. *Peer-led digital mentorship* can serve as a cost-effective and scalable approach to continuous professional learning, especially in contexts where access to formal training is limited (S. Singh et al., 2022). The program demonstrates that sustainable professional development does not depend solely on external experts but can emerge organically from within teaching communities. This insight is critical for education systems in developing regions seeking long-term capacity-building strategies (Shaw & Patra, 2022).

Institutions should consider embedding mentorship-based collaboration within professional learning policies and digital literacy initiatives (Pandya et al., 2023). The findings encourage school leaders to recognize peer mentorship as a strategic tool for fostering innovation, equity, and professional resilience. At a broader level, the research contributes to the global discourse on post-pandemic education reform by highlighting mentorship as an enabler of *hybrid learning* transformation rather than a remedial mechanism (Qamar et al., 2023).

The observed outcomes can be explained through the alignment of the mentorship program with adult learning theory and social constructivism. Teachers learn most effectively when they engage in authentic, collaborative problem-solving that connects directly to their practice (Ng et al., 2023). The mentorship framework provided experiential and reflective learning opportunities that empowered teachers to apply digital tools meaningfully within their

classroom contexts. Peer mentors facilitated continuous dialogue, modeling, and feedback, which are core mechanisms for sustained professional growth (Mhlongo et al., 2023).

The improvement in digital and pedagogical competencies also resulted from the non-hierarchical nature of mentorship. Teachers perceived the environment as safe, participatory, and supportive, which enhanced their willingness to experiment and adapt. This combination of psychological safety and hands-on digital engagement created an iterative cycle of learning and confidence building (Jain et al., 2022). The findings thus reinforce that professional transformation is most effective when social learning and technological practice intersect within a collaborative framework (Kärkkäinen et al., 2023).

Future research should explore longitudinal impacts of *peer-led digital mentorship* on teaching performance, student outcomes, and institutional culture. Examining how mentorship networks evolve over time could provide insights into sustaining professional learning communities in hybrid education systems (Irimiás et al., 2022). Cross-disciplinary replication of the model across primary, secondary, and tertiary contexts would also strengthen its generalizability and identify discipline-specific adaptations.

Practical implementation should focus on formalizing peer mentorship structures through institutional policy, providing digital infrastructure, and offering micro-credentialing for mentors and mentees. The integration of artificial intelligence tools for tracking progress and providing adaptive support could further enhance mentorship scalability. Building on this study, future educational reforms should treat mentorship as a strategic lever for professional transformation ensuring that teachers remain at the center of innovation, collaboration, and lifelong learning in the hybrid era.

CONCLUSION

The most significant finding of this research highlights that a *peer-led digital mentorship* model effectively enhances teachers' professional competencies for *hybrid learning* by integrating experiential, collaborative, and technology-supported approaches. The uniqueness of this study lies in demonstrating that professional development can evolve organically from within teaching communities without relying on top-down interventions. Teachers who participated in the mentorship program exhibited remarkable improvements in digital instructional design, collaborative engagement, and hybrid classroom management. The peer-driven structure fostered reciprocal learning and mutual empowerment, which redefined professional growth as a shared process rather than an individual achievement. This distinguishes the study from conventional teacher training models that often prioritize institutional hierarchy over collegial collaboration.

The key contribution of this research is both methodological and conceptual. Methodologically, it introduces an adaptable model of digital mentorship that can be scaled across diverse educational contexts, particularly in developing regions with limited access to formal training infrastructure. Conceptually, it advances the understanding of professional learning by positioning mentorship as a transformative ecosystem grounded in peer interaction, reflective dialogue, and digital collaboration. The study contributes to the theoretical discourse on teacher professional development by bridging adult learning theory, community of practice, and digital pedagogy. It demonstrates how mentorship, when structured around shared goals and contextual relevance, becomes a catalyst for sustained competence and innovation in hybrid education.

The research is limited by its short implementation period and the relatively small sample size of participating teachers, which constrains the generalizability of findings. The study also focused primarily on secondary school educators, leaving opportunities for exploration across other educational levels and disciplines. Future research should investigate the long-term effects of peer-led mentorship on teaching performance, learner outcomes, and institutional

culture. Further studies could incorporate quantitative modeling to examine mentorship network dynamics and employ digital analytics to track patterns of collaboration. Extending this research to cross-institutional or national scales would provide deeper insights into how peer mentorship can be institutionalized as a cornerstone of sustainable teacher professional development in the *hybrid learning* era.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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