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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, Peer Mentorship, Teacher Professional Development.

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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 (Fan et al., 2025). The COVID-19 pandemic accelerated its adoption, transforming it from an experimental approach into a necessary pedagogical framework across all educational levels. Studies by (Mark Feng Teng, 2025) and (Spooner-Lane et al., 2025) 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 (Momdjian et al., 2025). In the context of hybrid education, this competence extends beyond traditional pedagogical skills to encompass digital literacy, online communication, and instructional design. Scholars such as (Dandan et al., 2025) conceptualized these competencies through the TPACK (Technological Pedagogical Content Knowledge) framework, emphasizing the intersection of technological fluency with pedagogical expertise (Al-Kamzari & Alias, 2025). 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.

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

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. Studies by (Sheldrake et al., 2025) 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.

Digital mentorship programs have been implemented successfully in various global education contexts, demonstrating improvements in teachers' confidence and technology integration skills (Hlado et al., 2025). Examples from the United Kingdom, Finland, and Singapore show that structured peer-led digital mentorship fosters innovation, leadership, and sustainable capacity-building among educators (Xie & Lin, 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.

Despite this global recognition, the adaptation of digital mentorship in developing countries remains limited (Marinšek et al., 2025). Many institutions still rely on conventional training modalities that do not fully utilize peer learning or digital networks (Dapper et al., 2026). 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.

There is a lack of empirical research examining how peer-led digital mentorship programs specifically enhance teachers' competencies in hybrid learning environments (DelPrete, 2025). 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 (Nizar & R, 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 (Diab et al., 2025). 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 (Neelaveni 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 (Saniuk et al., 2025). Many mentorship programs depend on individual initiative rather than institutional policy, making their sustainability questionable (Vatankhah et al., 2026). 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 (Feng et al., 2026). Factors such as hierarchical school cultures, limited digital infrastructure, and low digital confidence among teachers may influence the effectiveness of such programs (Zhang & Liu, 2026). 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 (Huggahalli & Gupta, 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 (Wang et al., 2025). 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 (Wider et al., 2026). A peer-led model offers a bottom-up, contextually adaptive framework that complements existing professional development programs (Le et al., 2026). 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 employs a Mixed-Methods Research Design, integrating a quasi-experimental pre-test and post-test framework with qualitative inquiry to evaluate the impact of a peer-led digital mentorship program (Döğer & Göçen, 2025). The quantitative component is structured to measure statistically significant changes in teachers' digital pedagogy and instructional design skills, while the qualitative component captures the nuanced experiences of participants through interviews and reflections (Tan et al., 2025). By utilizing this dual-approach design,

the research achieves data triangulation, ensuring that measurable improvements in professional competence are validated and contextualized by the deeper narrative insights of the educators involved.

### *Research Target/Subject*

The research population consists of in-service secondary school teachers in West Sumatra, Indonesia, who are currently implementing hybrid learning models (Peter the Great St. Petersburg Polytechnic University et al., 2025). Through purposive sampling, 60 teachers were selected and organized into 10 mentoring clusters, each comprising one expert peer mentor and five mentees. The selection process prioritized participants from diverse rural and urban backgrounds to ensure the program's adaptability across different socio-technical settings. Peer mentors were specifically chosen based on their demonstrated mastery of digital teaching and prior experience in technology integration, ensuring a high standard of guidance within each cluster.

### *Research Procedure*

The study followed a systematic 12-week procedure divided into four distinct phases: preparation, implementation, evaluation, and reflection. The process began with mentor orientation on digital facilitation ethics, followed by the implementation phase which featured weekly hybrid sessions blending synchronous Zoom discussions with asynchronous collaboration via Google Workspace. Throughout these sessions, teachers engaged in practical tasks such as module development and digital assessment management. The procedure concluded with the administration of post-tests and focus group interviews to assess the overall progression of teacher competencies from the initial baseline.

### *Instruments, and Data Collection Techniques*

Data collection was facilitated through three primary instruments: the Teachers' Hybrid Competency Assessment (THCA), the Digital Mentorship Observation Checklist (DMOC), and the Mentorship Reflection Journal (MRJ). The THCA utilized a five-point Likert scale to quantify digital instructional design and classroom management skills, while the DMOC focused on the quality of mentor-mentee interactions and problem-solving dynamics. Qualitative data were continuously gathered through the MRJ to document learning challenges and progress. Reliability testing yielded high Cronbach's Alpha coefficients (0.87 for THCA and 0.82 for DMOC), and content validity was established through rigorous expert validation.

### *Data Analysis Technique*

The analysis phase applies a dual-analytical framework to synthesize quantitative and qualitative findings. Quantitative data were processed using Paired-Sample T-Tests to determine the statistical significance of improvements in teacher competence before and after the 12-week cycle. Simultaneously, qualitative data from journals and interviews underwent Thematic Coding to identify recurring patterns regarding the perceived benefits and barriers of the mentorship process. This integrated analytical approach allows for a robust conclusion, explaining not only if the mentorship was effective but also how the peer-led dynamics contributed to the development of hybrid teaching professionality.

## \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 | 8.64 | 0.000 | 0.81 | Highly |

| | | | | |
|---|---|---|---|---|
| Engagement | | | | 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.

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.

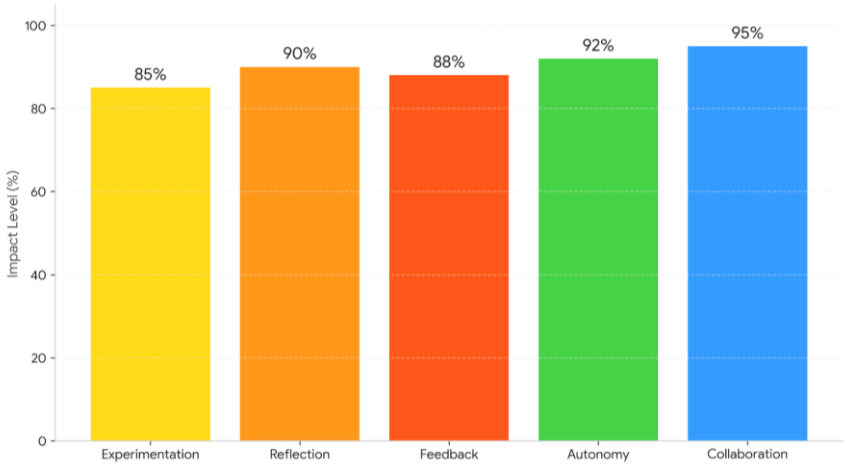


Figure 1 Impact of Peer Mentorship on Teacher Professional Learning

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. 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.

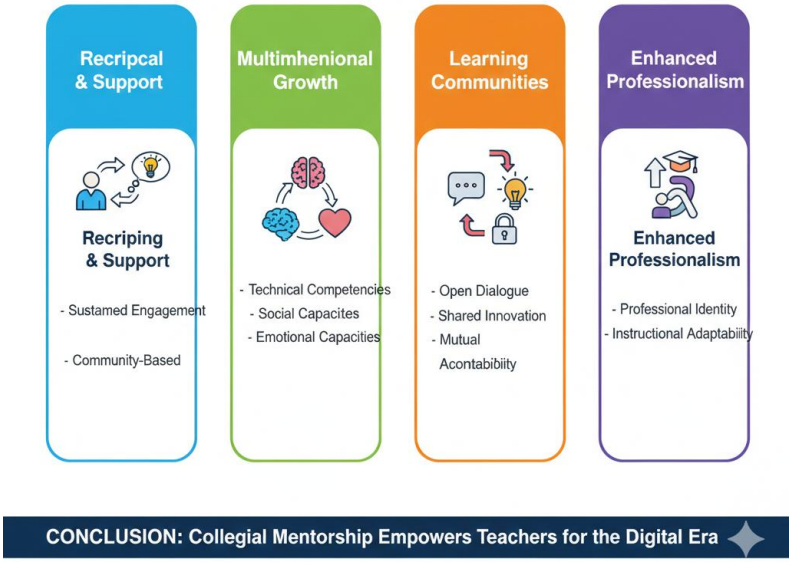


Figure 2 Peer Mentorship: Nurturing Nutrid Hybrid Instruction

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. 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 research by (Rguibi et al., 2025) and (Granström & Oppi, 2025) 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 (Siswantari et al., 2025) 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 (Harris et al., 2026), 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.

These findings mark a transition toward teacher empowerment models that redefine professional development as collective inquiry rather than top-down dissemination. 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.

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. 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.

Institutions should consider embedding mentorship-based collaboration within professional learning policies and digital literacy initiatives. 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.

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. 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.

The improvement in digital and pedagogical competencies also resulted from the non-hierarchical nature of mentorship (Shin & Kang, 2025). 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 (Information and Communication Technology for Education, King Mongkut's University of Technology North Bangkok, Thailand et al., 2026). The findings thus reinforce that professional transformation is most effective when social learning and technological practice intersect within a collaborative framework.

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. 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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