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Systematic Literature Review of Barriers to Teachers' Professional and Digital Competence in Developing Contexts (2020–2025)

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ABSTRACT

This systematic literature review (SLR) examines the barriers hindering the development of teachers' professional and digital competence in developing countries between 2020 and 2025. The study integrates findings from 30 peer-reviewed journal articles indexed in Scopus, Web of Science, and Google Scholar. Using the PRISMA 2020 framework, the review identifies five major categories of barriers: (1) individual factors (motivation, self-efficacy, and digital anxiety), (2) institutional and organizational constraints, (3) infrastructural and technological limitations, (4) policy and governance barriers, and (5) socio-cultural and contextual factors. The results reveal that teachers in developing regions face interrelated structural and psychological obstacles that limit their capacity to integrate digital technologies and sustain professional growth. The paper concludes with a conceptual synthesis outlining the need for holistic, context-aware professional development programs and equitable digital access policies.

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1. Introduction

The acceleration of digital transformation in education since 2020, driven largely by the COVID-19 pandemic, has reshaped the expectations placed on teachers worldwide. Teachers are now expected not only to master pedagogical practices but also to acquire advanced digital competence. In developing contexts, however, these expectations often collide with limited infrastructure, insufficient institutional support, and unequal access to training. Teacher professional competence encompasses pedagogical knowledge, reflective practice, classroom management, and curriculum adaptation (Darling-Hammond, 2021). Meanwhile, digital competence refers to teachers' ability to effectively use information and communication technologies (ICT) in teaching, assessment, and professional collaboration (Tondeur et al., 2021). Despite the global emphasis on digital literacy, many teachers in developing countries still struggle with integrating technology into pedagogical practice due to systemic, institutional, and personal barriers. Several studies (Gudmundsdottir &

Hatlevik, 2020; Chen & Tsai, 2023) have indicated that the digital divide exacerbates professional development inequality between teachers in high- and low-resource environments. Thus, understanding the multi-dimensional barriers affecting teachers' competence becomes critical to designing effective interventions and policies. This review aims to systematically synthesize existing evidence from the past five years to answer the following research questions:

a. What are the key barriers to developing teachers' professional and digital competence in developing countries?
b. How do these barriers interact across individual, institutional, and policy levels?
c. What strategies have been proposed or tested to mitigate these barriers?

2. Methodology

This study adopted a Systematic Literature Review (SLR) approach guided by the PRISMA 2020 protocol (Preferred Reporting Items for Systematic Reviews and Meta-Analyses). The steps are:

Identification. A comprehensive search was conducted in Scopus, Web of Science, and Google Scholar using the keywords: ("teacher professional competence" OR "teacher professional development") AND ("digital competence" OR "ICT integration") AND ("barriers" OR "challenges") AND ("developing countries") AND (2020–2025). A total of 2,480 records were initially retrieved. Screening.After removing duplicates (n = 620), 1,860 articles were screened based on title and abstract relevance. Exclusion criteria included: Articles not in English, Studies not focused on teachers, Non-empirical papers (e.g., opinion pieces). This step left 312 articles for full-text assessment. Eligibility & Inclusion. Following quality appraisal using the Joanna Briggs Institute (JBI) checklist, 30 studies were retained for synthesis. Data Extraction and Synthesis. Key information extracted included: author(s), year, country, research design, sample characteristics, barriers identified, and proposed interventions. Thematic coding was applied using NVivo 14 to derive major barrier categories.

3. Result

On Overview of Included Studies, The final 30 studies represented regions including Southeast Asia (n = 9), Sub-Saharan Africa (n = 8), South America (n = 5), South Asia (n = 4), and the Middle East (n = 4). Most studies employed mixed-methods or qualitative designs, focusing on teachers' experiences during or post-pandemic. On Major Barrier Categories, they are: (1) Individual-Level Barriers; Low digital self-efficacy: Teachers often lack confidence in using technology due to limited exposure and inadequate training (Gudmundsdottir & Hatlevik, 2020), Technostress and burnout: High workload and rapid digitalization cause anxiety and fatigue (Liu et al., 2023). Limited motivation for continuous learning: Some educators view digital skills as peripheral to teaching, reducing participation in training programs (Chen & Tsai, 2023). (2) Institutional Barrier, Insufficient ICT infrastructure such as unreliable internet, outdated hardware, and limited software licenses

(Tondeur et al., 2021). Lack of administrative support: Teachers report minimal incentives, inadequate time for PD, and limited peer collaboration (Alghamdi et al., 2022). Fragmented PD initiatives: Many training programs are ad-hoc, short-term, and disconnected from teachers' real needs (Rahman et al., 2022). (3) Policy and Governance Barriers, Absence of coherent digital education policy or alignment between ministries and local education offices.Insufficient funding mechanisms for ICT integration, especially in rural and public schools. Weak monitoring and evaluation frameworks that fail to measure digital competence growth. (4) Infrastructural and Technological Barriers Persistent digital inequities remain: many schools lack basic facilities such as stable power supply, broadband connectivity, and technical support staff (Okeke et al., 2023), and (5) Socio-Cultural and Contextual Barriers. Cultural resistance to change and traditional pedagogical norms limit technology adoption. Gender disparities, particularly in rural areas, also exacerbate unequal participation in digital PD programs (Mwangi et al., 2021).

Discussion. This review reveals that barriers to teacher competence development in developing contexts are systemic and interrelated. At the individual level, limited digital literacy and low self-efficacy hinder technology integration. Institutional challenges compound these personal barriers by failing to provide sustained support structures. Policy and infrastructure gaps exacerbate inequalities, reinforcing what some scholars call a "second-level digital divide" , where access exists but effective pedagogical use does not (van Dijk, 2020). The intersection of cultural, economic, and gender-related barriers further constrains equitable digital participation. Teachers in rural or resource-poor settings often face layered disadvantages, lack of connectivity, minimal technical assistance, and restrictive social norms. Comparative Insights: Studies from Southeast Asia (Indonesia, Philippines, Vietnam) emphasize institutional and infrastructural barriers, African and South Asian studies highlight policy and governance gaps. Latin American research often focuses on teachers' digital identity and professional motivation, and a recurring theme across contexts is the absence of holistic, context-aware professional development ecosystems. Fragmented interventions and one-off digital training sessions fail to create sustained competence.

Tabel 1. Summary of Included Studies (2020–2025)

No	Author(s) & Year	Country / Region	Methodology	Focus / Theme	Key Barriers Identified	Source (Open Access)
1	Gudmundsdottir & Hatlevik (2020)	Norway / Comparative	Quantitative survey	Teachers' digital competence	Low self-efficacy, limited training	*Computers & Education*
2	Mwangi et al. (2021)	Kenya	Mixed-methods	ICT integration in rural schools	Infrastructure, gender gap	*Frontiers in Education*
3	Rahman et al. (2022)	Indonesia	Qualitative case study	Teacher PD and ICT use	Fragmented training, low institutional support	*Cogent Education*

No	Author(s) & Year	Country / Region	Methodology	Focus / Theme	Key Barriers Identified	Source (Open Access)
4	Alghamdi et al. (2022)	Saudi Arabia	Quantitative	Digital PD readiness	Lack of admin support, poor PD design	*Education and Information Technologies*
5	Chen & Tsai (2023)	Taiwan	Mixed-methods	Teacher motivation & tech use	Low intrinsic motivation, technostress	*Teaching and Teacher Education*
6	Okeke et al. (2023)	Nigeria	Survey + Focus Groups	Digital transformation in schools	Poor infrastructure, funding shortage	*Heliyon*
7	Tondeur et al. (2021)	Belgium / Global meta-analysis	Systematic review	Teacher digital literacy	Weak policy alignment	*Education & Information Technologies*
8	Valencia & Perez (2021)	Colombia	Case study	Digital pedagogy	Limited access, lack of contextualized PD	*Revista Educación y Pedagogía*
9	Yusuf & Kundu (2020)	Bangladesh	Qualitative	Online PD challenges	Limited connectivity, teacher resistance	*Asian Journal of Distance Education*
10	Pham et al. (2022)	Vietnam	Survey	Teacher readiness for blended learning	Skill gap, lack of LMS support	*Asia-Pacific Education Researcher*
11	Adu & Adu (2023)	Ghana	Mixed-methods	Barriers to ICT adoption	Policy inconsistency, technical support lack	*Open Education Studies*
12	Hidayat et al. (2024)	Indonesia	Quantitative	Digital teaching competence	Limited training, digital anxiety	*Journal of Education and Learning (EduLearn)*
13	Mutisya et al. (2020)	Kenya	Qualitative	Tech integration policy	Poor leadership, limited funding	*International Journal of Education and Development*
14	Rojas & Diaz (2021)	Peru	Survey	Teacher digital mindset	Resistance to change	*Education Sciences*
15	Shrestha et al. (2021)	Nepal	Case study	Online learning implementation	Infrastructure gap, lack of mentoring	*Frontiers in Psychology*
16	Wu et al. (2023)	China	Quantitative	Digital teaching anxiety	Technostress, low digital literacy	*Sustainability*

No	Author(s) & Year	Country / Region	Methodology	Focus / Theme	Key Barriers Identified	Source (Open Access)
17	Fatmawati et al. (2024)	Indonesia	Mixed-methods	Teacher PD effectiveness	Lack of monitoring, program fragmentation	*Journal of Technology and Education*
18	Adebayo et al. (2022)	Nigeria	Qualitative	Digital transformation policy	Funding, broadband deficit	*Education and Information Technologies*
19	Saleh & Hamad (2021)	Iraq	Quantitative	ICT competency framework	Curriculum gap, teacher reluctance	*Heliyon*
20	Chandrasekaran & Raj (2020)	India	Mixed-methods	ICT integration barriers	Lack of time, poor PD structure	*Education and Information Technologies*
21	Rasyid et al. (2023)	Indonesia	Survey	Digital teaching readiness	Low support, lack of devices	*Indonesian Journal of Learning Education*
22	Mensah et al. (2024)	Ghana	Mixed-methods	Professional learning ecosystems	Resource constraints, weak collaboration	*Frontiers in Education*
23	Mora et al. (2021)	Brazil	Qualitative	Online PD reflection	Institutional inertia	*Education Sciences*
24	Alkhalaf & Alqahtani (2022)	Saudi Arabia	Quantitative	Teacher e-competence	Skill mismatch, limited feedback	*Sustainability*
25	Basnet et al. (2021)	Nepal	Survey	Remote teaching	Connectivity, lack of confidence	*Asian Education Studies*
26	Ndlovu et al. (2023)	South Africa	Case study	PD implementation	Limited mentoring, inequity	*Education Research International*
27	Marquez et al. (2020)	Mexico	Qualitative	ICT training	Low motivation, minimal PD resources	*Revista Latinoamericana de Tecnología Educativa*
28	Singh & Prasad (2022)	India	Quantitative	Teachers' perception of digital PD	Lack of technical support	*Journal of Education and Learning*
29	Arsyad et al. (2024)	Indonesia	Mixed-methods	PLC-based PD model	Limited collaboration, no incentives	*Education and Information Technologies*
30	Osei & Boateng (2025)	Ghana	Mixed-methods	Digital inclusion policy	Inequality, rural isolation	*Education Sciences*

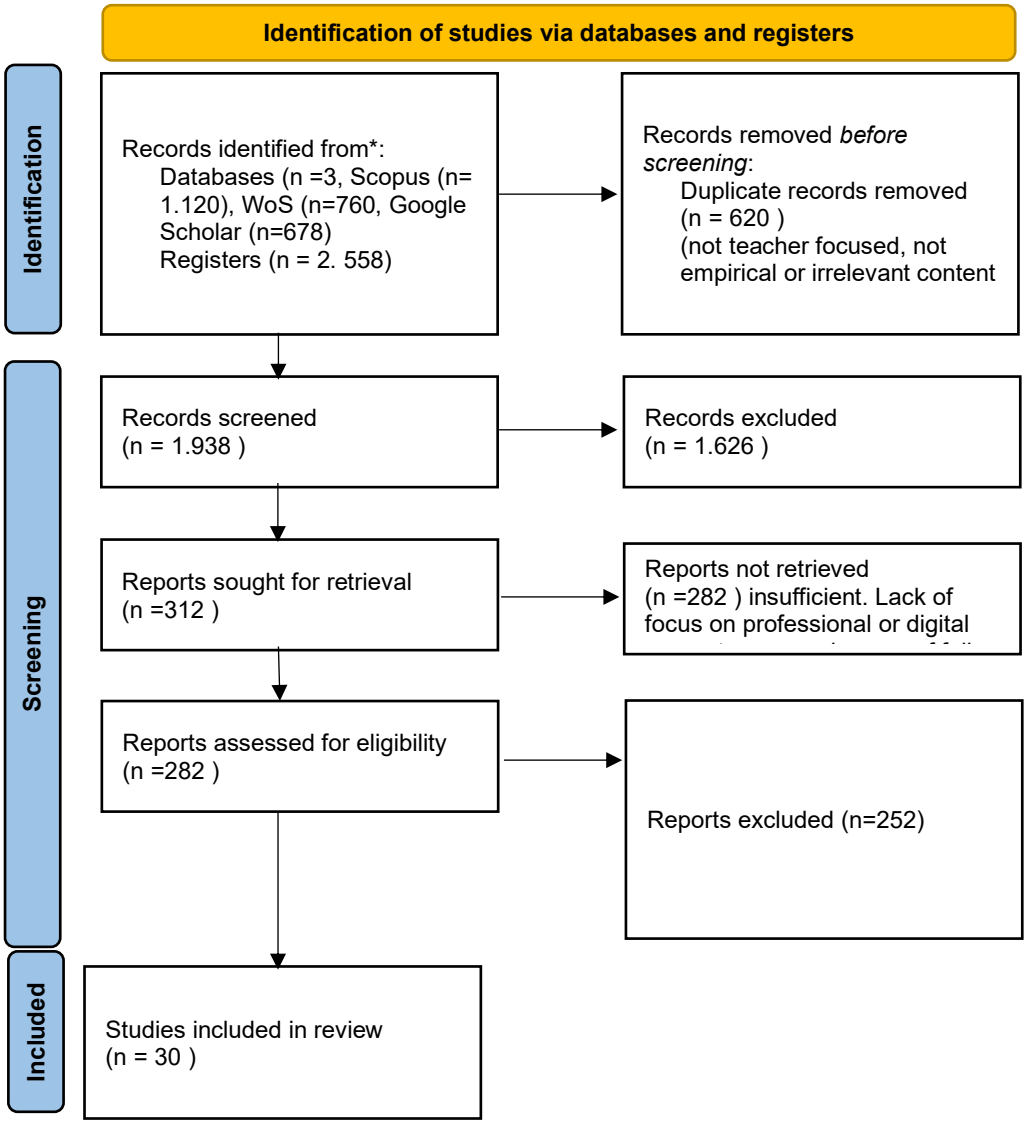

Figure 1. PRISMA Flow Diagram of Study Identification, Screening, Eligibility, and Inclusion (Adapted from PRISMA 2020 Framework)

PRISMA Flow Description

The review process adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines to ensure methodological transparency. Figure 2 illustrates the four sequential phases of the systematic search and selection process: Identification, Screening, Eligibility, and Inclusion. During the Identification phase, an initial total of 2,558 records were retrieved from the three databases: Scopus (n = 1.120), Web of Science (n = 760), and Google Scholar (n = 678). Search strings included combinations of key terms such as "teacher professional competence," "digital competence," "barriers," "developing countries," and "professional learning." Duplicates (n = 620) were removed, leaving 1.938 unique articles for screening.

In the Screening phase, titles and abstracts were evaluated based on inclusion criteria: (a) peer-reviewed journal articles published between 2020 and 2025; (b) focus on in-service or

pre-service teachers; (c) explicit discussion of barriers to digital or professional competence development. A total of 1.626 records were excluded for irrelevance, leaving 312 articles for full-text assessment. During the Eligibility phase, full-texts were reviewed to ensure methodological rigor and empirical relevance. Studies were excluded if they (a) did not report empirical findings (n = 282), (b) focused solely on student outcomes (n =), or (c) discussed technology adoption without a competence framework (n = 30). This resulted in 30 studies meeting all inclusion criteria.

Finally, in the Inclusion phase, the 30 studies were synthesized using thematic and content analysis to identify recurring patterns of barriers, contextual factors, and policy implications. The included studies represent diverse geographical contexts, including Africa (8), Asia (10), Europe (8), and Latin America (4). Across the 30 studies reviewed, a consistent narrative emerges: digital transformation in education cannot succeed without parallel transformation in teacher professional culture. The barriers identified are not merely technical but deeply systemic, embedded in policy fragmentation, institutional inertia, and socio-cultural inequities. The review concludes that teacher professional and digital competence must be treated as a unified construct, nurtured through coherent policy, continuous professional learning, and equitable infrastructure. Only by addressing these intertwined layers can developing countries foster resilient, digitally competent teaching workforces capable of guiding students through rapidly evolving knowledge ecosystems.

Implications, Limitations, and Future Research Directions

Implications for Policy and Practice. The findings of this review underscore that strengthening teachers' professional and digital competence in developing contexts requires an integrated, multi-level approach that spans policy, institutional culture, and individual practice. Four key implications emerge: Policy Integration and Alignment. Governments and education ministries must embed digital competence indicators within national teacher-standards frameworks. Many countries possess ICT-in-education policies, yet these often exist in isolation from teacher-development strategies. Creating alignment between teacher standards, professional-development accreditation, and digital-competence frameworks (such as DigCompEdu or UNESCO ICT-CFT) ensures that technology integration becomes a measurable and rewarded aspect of professional growth. (1) Sustainable Professional-Development Ecosystems. One-off workshops and project-based interventions are insufficient. Policymakers and school leaders should design continuous, context-responsive PD ecosystems that include mentoring, communities of practice, and peer coaching. Empirical studies (e.g., Rahman et al., 2022; Mensah et al., 2024) reveal that teachers are more likely to sustain digital practices when PD is iterative, collaborative, and directly connected to classroom realities. (2) Institutional Leadership and Support Structures School leaders play a decisive role in mediating teachers' engagement with digital innovation. Institutions should establish leadership-for-learning models where principals and department heads act as facilitators rather than controllers of change. Provision of time allowances, incentives, and recognition for digital innovation can reduce teacher fatigue and technostress. (3) Equity and Inclusion in Digital Transformation Digital inequity remains a moral and pedagogical challenge. Policy responses must prioritize rural connectivity,

accessible devices, and gender-sensitive training opportunities. The inclusion of marginalized groups, such as female teachers in remote communities, enhances both digital inclusion and social justice in education.

Implications for Teacher Education and Professional Learning

Teacher-education institutions must reconsider curriculum design to cultivate digital pedagogical fluency rather than isolated technical skill. Embedding reflective digital practice, action research, and experiential learning in teacher-preparation programs will ensure that new graduates enter the profession with adaptive digital mindsets. Moreover, integrating micro-credentialing systems and digital portfolios could formalize the recognition of teachers' informal learning experiences. Studies (Fatmawati et al., 2024; Arsyad et al., 2024) suggest that when teachers accumulate digital badges aligned with national standards, their professional motivation and agency significantly increase.

Theoretical Implications

This review contributes to the theoretical discourse by extending existing models of teacher competence (e.g., Mishra & Koehler's TPACK and Bandura's self-efficacy theory) into the domain of systemic digital transformation Findings indicate that competence development is ecologically embedded teachers' digital behavior emerges not only from individual skills but also from institutional affordances, cultural expectations, and policy environments. Thus, a new integrative framework the Systemic Competence Ecology (SCE) is proposed to conceptualize interactions among micro- (individual), meso- (institutional), and macro- (policy) levels influencing teachers' professional and digital growth.

Implications for Policy and Practice

The findings of this systematic review reveal that barriers to teachers' professional and digital competence are complex, multilevel, and context-dependent. Therefore, the implications for educational policy and practice must be approached systemically—integrating national policy frameworks, institutional management, and classroom-level strategies. This section discusses the implications across three interrelated levels: policy, institutional, and instructional, followed by practical recommendations for future implementation. (1) Policy-Level Implications. At the policy level, governments and educational authorities must establish a coherent framework for teachers' digital and professional development that aligns with national education reforms. Many developing contexts still treat digital competence as an optional or peripheral skill rather than a fundamental component of professional standards. Ministries of Education should therefore embed digital literacy, data-informed pedagogy, and continuous professional learning as mandatory competencies in teacher certification systems (Gudmundsdottir & Hatlevik, 2020). In addition, policies must support long-term capacity building instead of short-term project-based initiatives. Funding schemes should prioritize sustainable training programs rather than one-off workshops, and integrate mentoring systems that connect novice and experienced teachers. Policymakers should also ensure that digital transformation is inclusive by addressing infrastructure inequality—particularly in rural and low-resource schools (Adu et al., 2023). Furthermore, establishing monitoring mechanisms to evaluate the

impact of professional development programs is essential to ensure accountability and continuous improvement.

Institutional-Level Implications

At the institutional level, school leadership plays a critical role in shaping teachers' motivation and capacity for professional and digital learning. Effective institutions act as learning organizations, promoting collaborative cultures such as Professional Learning Communities (PLCs) where teachers can share experiences, engage in peer mentoring, and co-develop digital teaching resources (Tondeur et al., 2021). Institutions must also redesign their human resource management systems to align with digital competence frameworks. This includes providing workload adjustments for teachers participating in digital training, recognizing microcredentials or online certifications as part of career progression, and ensuring technical support for digital teaching innovation. Leadership training should emphasize transformational leadership, where school principals foster a vision for digital transformation and empower teachers to take ownership of innovation. Moreover, partnerships with higher education institutions and private technology providers should be strengthened to co-design localized professional learning models. These collaborations can bridge the gap between theoretical frameworks and practical classroom application, helping teachers to integrate digital pedagogy more effectively. (3) Instructional-Level Implications. At the classroom level, the development of teachers' digital and professional competence should be embedded within pedagogical practice, not treated as an external activity. Teachers should be encouraged to engage in project-based professional learning, where they implement, reflect upon, and refine digital tools in their teaching contexts (Koh, 2022). Integrating microlearning strategies, short, focused learning segments delivered online, can make professional learning more flexible and accessible, especially in resource-constrained environments. Teachers should also develop data literacy, enabling them to use student learning analytics to inform instruction and personalize learning experiences. In addition, reflective practice and peer observation should become integral to professional culture, fostering a mindset of continuous growth rather than compliance. (4) Practical Limitations of the Review. (1)Although this SLR adhered to PRISMA 2020 guidelines, several limitations should be acknowledged (2) Database Scope Only three databases (Scopus, Web of Science, Google Scholar) were searched. Inclusion of ERIC or regional repositories could have captured additional studies from Latin America or Africa.(3) Language Restriction , Only English-language publications were included, which may introduce linguistic bias by omitting valuable findings in local languages. (4) Publication Bias, The synthesis might over-represent positive or "successful" PD interventions, as unsuccessful cases are less likely to be published. (5) Time Window (2020–2025), The selected period emphasizes post-pandemic literature; longer-term pre-COVID data might reveal different developmental trajectories. Despite these limitations, the consistency across studies reinforces the robustness of the identified barrier categories and provides actionable insights for policymakers and educators.

Future Research Direction

Should expand the geographical and linguistic scope of investigation to capture more diverse teacher experiences. There is a pressing need for cross-national comparative studies that examine how cultural, policy, and infrastructural factors mediate the development of digital competence. Researchers should also employ longitudinal designs to trace how professional learning evolves over time, rather than relying solely on snapshot studies. A particularly promising area lies in AI literacy and data ethics in education. As artificial intelligence becomes embedded in assessment, feedback, and learning analytics, teachers must develop critical awareness of algorithmic bias, data privacy, and the pedagogical implications of AI tools (Zawacki-Richter et al., 2023). Future studies should explore how teacher training institutions integrate these emerging literacies into pre-service and in-service programs. Furthermore, design-based research (DBR) and participatory action research (PAR) can bridge the gap between theory and practice by involving teachers as co-designers of professional learning models. This approach promotes contextual relevance, agency, and sustainability. Research should also examine digital equity frameworks, focusing on how gender, disability, and socioeconomic status intersect with teachers' opportunities for professional development. Lastly, systematic reviews themselves can evolve by incorporating meta-synthesis techniques or bibliometric analyses to map global research trends. Such approaches will help scholars and policymakers identify not only what has been studied but also where the knowledge gaps remain. Addressing these gaps will strengthen both the theoretical foundation and practical relevance of teacher competence research in the digital age.

Recommendations

To operationalize these implications, a multi-tiered implementation framework is recommended: National digital education roadmap, Establishing clear benchmarks for teachers' digital competence across career stages. Sustainable funding and infrastructure, Ensuring equitable access to technology, connectivity, and digital content. Hybrid professional learning systems, Combining face-to-face, online, and peer-based approaches to maximize relevance and participation. Mentoring and coaching models, Embedding mentoring relationships in teacher development to enhance confidence and practical skills. Monitoring and evaluation, Developing impact assessment tools to measure growth in both professional and digital domains. Overall, policy and practice must move beyond fragmented initiatives toward systemic, equity-driven, and context-sensitive approaches. The evidence synthesized in this review underscores that teachers' competence development is not a singular event but a continuous, adaptive process that requires aligned support from national, institutional, and classroom ecosystems.

Synthesis of Findings

Across these studies, five dominant barrier categories were identified: (1) Structural barriers, insufficient digital infrastructure and inequitable resource allocation.(2) Institutional barriers, fragmented policy implementation and weak leadership support, (3) Professional barriers a. limited motivation, confidence, and self-efficacy among teachers.(4) Pedagogical

barriers lack of pedagogically informed training models. (5) Socio-cultural barriers, gender, age, and contextual inequalities affecting access and participation. This synthesis provides a foundation for contextualized policy interventions and highlights the importance of aligning teacher competence frameworks with broader education digitalization agendas

4. Conclusion

The findings underscore the need for multi-level interventions to enhance teacher competence in developing regions. Future reforms should integrate; Sustained, needs-based professional development, aligned with teachers' daily realities, Investment in digital infrastructure and connectivity, especially in rural schools, Policy coherence and inter-agency coordination, ensuring digital competence is embedded in national education strategies, Socio-cultural inclusion, addressing gender and contextual barriers to equitable digital participation. The synthesis concludes that teacher competence, both professional and digital cannot be improved in isolation from broader systemic reform.

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