

e-Learning Approach for Primary School Teacher Training in Developing Countries: A Systematic Review

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Abstract

Purpose: To better understand the state of e-learning strategies for primary school teacher preparation in developing nations, this study does an organized literature review.

Methodology: The study reviewed and analyzed relevant academic literature published between 2013 and 2023 to identify and examine papers pertinent to e-learning approaches for primary school teacher training in developing countries.

Findings: The results show that the field of study is still in its infancy, with few publications and writers working on new projects. The evaluation also emphasizes how little theoretical rigor and methodological variation there is in the studied material. Although several theme trends are noted, frameworks and recommendations to support the successful integration of e-learning techniques in primary school teacher preparation programs in developing nations are conspicuously lacking. In summary, the study emphasizes the necessity of more research to progress understanding and application in this crucial field.

Conclusion: The study concludes that the literature on e-learning for primary school teacher training in underdeveloped nations is still emerging, with few publications and authors currently conducting research in this area.

Recommendations: The study recommends that stakeholders prioritize further research into e-learning approaches, promote interdisciplinary collaborations to develop culturally appropriate e-learning materials and platforms, and integrate e-learning components into existing teacher training curricula supported by adequate resources and infrastructure. The study also recommends establishing knowledge-sharing networks among developing nations and continuously monitoring and evaluating e-learning programs to ensure their long-term effectiveness. Overall, these recommendations aim to enhance the quality of primary school teacher training and education in developing countries through the successful implementation of e-learning initiatives.

1. INTRODUCTION

In order to maintain educational continuity, the use of eLearning in the classroom, especially in developing nations, has become essential. The pandemic forced a quick switch to online learning, underscoring the value of eLearning in learner preparation and instruction (Castelli & Sarvary, 2021; Sum & Oancea, 2022). This shift was especially noticeable in developing nations, where there were already issues with the resources and infrastructure supporting traditional education. According to Bennell (2023) and Popova et al. (2022), over 380 million children worldwide (56% on average and 85% in sub-Saharan Africa) will finish primary school without being able to read or write. Low educational attainment is caused by factors such as poor instruction design and inadequate internet access in schools (Kennedy, 2016; Whitworth & Chiu, 2015). Online training using e-learning programs for ongoing professional development can be pivotal in equipping teachers to be effective educators in rural areas where technology is deemed scarce (The Education Commission, 2019).

Online Teacher training using e-learning solutions interventions is associated with positive effects on primary school learning outcomes (Wang et al., 2023). According to Kennedy (2016), primary school teachers in remote areas often lack access to in-service ongoing teacher development programs situated in mostly urban settings and at a cost. Providing the use of eLearning technology across education systems in remote places offers diverse benefits for mediating this ongoing teacher development program for quality education. Emerging eLearning solutions provide effective delivery for teacher development, especially in remote areas in developing nations (Karasneh et al., 2021). If government agencies adopt and support these solutions, they will be able to provide peer teacher support, online coaching, and reflection by utilizing online training modules in various multimedia forms, including self-paced training, videos that teachers can watch again, assessment tools on PCs, and portable devices that most teachers in remote areas own. Technology integration in teacher training, especially in remote places of developing nations, brings extra needs to upgrade educators. These eLearning applications have the potential to provide several training gains through adaptive artificial intelligence solutions embedded in the eLearning platforms (Hennessy et al., 2022).

An existing review (Khalil et al., 2023) for supporting learners with disabilities in remote places strongly emphasizes the dire need for ongoing rural teacher training technology-driven training programs. However, such interventions limit their focus on providing hardware/software solutions, which over time age out and are deemed ineffective compared with those coupled with other measures to promote pedagogic change or teacher development (Kennedy, 2016; Muchira et al., 2023). This lack of sustained support for educators in rural settings to develop confidence in using e-learning systems for both training and teaching before the classroom and after is a bottleneck to effective classroom management (Koomar, 2022) and the widespread rollout of modern innovative solutions for rural schools in developing countries (Hennessy et al., 2022). It is therefore important to note that teacher training mediated through eLearning solutions can improve positive teacher-learner experience, quality, and student learning outcomes.

The COVID-19 pandemic that led to global school closures has escalated the need for government and institutions to offer online training for educators and learners in remote places. To mitigate this pandemic, teachers in developing nations were asked to continue teaching without the appropriate training (Koomar, 2022). The majority of the content that was delivered by untrained teachers in rural places was not designed for online teaching. This brought anxiety and depression to both learners and teachers who were not previously used to sitting long online (Shirish et al., 2023). According to Hennessy et al. (2022), there has been a rising number of publications regarding education technology solutions in developing countries. This increasing number of publications drives the motivation behind this review. In this systematic literature review, the study evaluates available data in the teaching domain. The content to be analyzed will include those that address teacher development to support teaching and student learning, online and physical peer community support activities, peer mentorship strategies, assessment and evaluation, course timetabling, and extra curriculum activities that support learner wellness

The study conducted a broad appraisal of literature from authoritative journals published between 2013-2023 that addresses the emerging issues in teacher training using technology as an avenue for delivering quality training to educators in rural areas in emerging economies. This is the first comprehensive analysis of technology-mediated e-learning approaches for training primary school teachers in developing nations the acronym in this review is (PSTT).

- Evaluating emerging themes, gaps, strengths, and weaknesses in the field of research,
- Selecting and recommending suitable learning solutions, content design framework, context-specific user-centered design principles for scalable and adaptable E-learning platform design,
- Provide solid evidence to guide future studies and plans about fresh initiatives in e-learning teacher preparation.

1.1. Key Determinant of an Effective PSTT

Regarding the characteristics of successful modern models of PSTT, there is broad agreement in the field. According to (Darling-Hammond, 2016) impact is more often focused on instructional strategies than student outcomes, where causality is less clear. There is little evidence for some PSTT characteristics, and it is difficult to distinguish the impact of

particular factors (Fernández-Batanero et al., 2022; Kennedy, 2016). Following are the key determinants to effective PSTT;

Understanding Program content and its applicability to educators' needs.

Adaptive pathways must be integrated into an efficient e-learning pedagogy for training primary school teachers in developing nations (Bridget Maphoto & Suliman, 2024; Morze et al., 2021). It provides culturally appropriate materials, encourages collaborative learning communities, and guarantees accessibility on low-cost devices. According to (Pourahmad & Ko, 2023) the design of eLearning must contextualize learning to teachers' classrooms and needs, relevant content and programs in teacher training capitalize on the knowledge and skills already possessed by educators. Teachers engaged in remote e-learning are motivated to learn new when the content and programs are relevant to their needs, interests, schedules, and constraints (Giovanis, 2015). Relevance is ensured by customized content that includes examples that are appropriate for the target culture

Teacher participation through institutional and external support.

Both internal and external support are essential for remote teacher training in developing countries, as it aligns with national policies, curriculum standards, and assessment frameworks. Similarly, it needs to be in line with organizational goals and secure support from school officials to guarantee full school engagement. Trust is fostered by an atmosphere that is encouraging for professional growth, reflection, and feedback. Perpetuating programs with regular sessions and setting aside time for group research guarantee long-term effectiveness.

Delivery method and supporting systems.

Primary school teachers training in remote areas of developing countries should be provided with delivery and support mechanisms that prioritize practical application. Using a combination of online and offline content delivery methods is essential for e-learning teacher training in distant locations (Koomar, 2022). The design of the eLearning content for remote teachers should emphasize learner-centered methods in line with the recommended pedagogical approaches.

Role of eLearning in PSTT.

Learning technologies have the potential to play an increasingly important role in enhancing and supplementing overburdened educational systems as access to information and communication technology grows in developing nations (Nye, 2015). E-learning enables educators to collaborate and share knowledge among themselves, as well as to create individualized learning experiences that are catered to their specific needs (Giovanis, 2015). It also makes use of digital platforms and resources to improve the sustainability and scalability of teacher training programs (Kibuku et al., 2020). In general, e-learning enables instructors in far-off places to advance their knowledge, refine their methods, and ultimately help students receive higher-quality education.

A variety of articles covering different subjects in teacher development techniques from 2013 to 2023 are included in the Table 1.

Table 1: Historical overview of publications, Thematic Areas on teacher for development strategies.

Year/Authors	Thematic Areas	Publication Themes	JOURNAL
(Randall, 2023)	Pre Teacher-Training.	'We want to, but we can't': pre-service teachers' experiences of learning to teach primary physical education.	Taylor and Francis
(Sabeh et al., 2021)		Model of Information Systems Success in an E-Learning Context (2010-2020)	IEEE
(Valverde-Berrocso et al., 2020)	Research Trends	Trends in educational research about e-Learning: A systematic literature review (2009-2018)	MDPI-Sustainability (Switzerland)

(Girvan et al., 2016), (Admiraal et al., 2021); (OECD, 2009); (Gloria & Oluwadara, 2015)	Teacher Professional Development	Extending experiential learning in teacher professional development. Schools as professional learning communities: what can schools do to support professional development of their teachers? The professional development of teachers Pre-service teachers' ease of use and intention to use selected e-learning technologies in designing instruction	Science Direct Taylor and Francis
(Barteit et al., 2020) (Akram et al., 2022)	eLearning Evaluation	Evaluation of e-learning for medical education in low- and middle-income countries: A systematic review Teachers' Perceptions of Technology Integration in Teaching-Learning Practices: A Systematic Review	Science Direct Frontiers in Psychology
(Nye, 2015) (Demartini et al., 2024)	Emerging trends in AI	Intelligent tutoring systems by and for the developing world: A review of trends and approaches for educational technology in a global context. Artificial Intelligence Bringing Improvements to Adaptive Learning in Education: A Case Study	Springer MDPI -Sustainability (Switzerland)
(Hennessy et al., 2015) (Boumadan et al., 2020)	Challenges for PSTT adoption.	Challenges and opportunities for teacher professional development in interactive use of technology in African schools	Taylor and Francis
(Whitworth & Chiu, 2015)	Gaps in PSTT Adoption	Professional Development and Teacher Change: The Missing Leadership Link	Taylor and Francis
(Wang et al., 2023)	Navigating eLearning Technostress	Navigating Technostress in primary schools: a study on teacher experiences, school support, and health	Frontiers in Psychology
(Maune, 2023)		Adoption and use of eLearning platforms in developing countries: Evidence from Zimbabwe	Taylor and Francis
(Zarei & Mohammadi, 2022)		Challenges of higher education related to e-learning in developing countries during COVID-19 spread: a review of the perspectives of students, instructors, policymakers, and ICT experts	Springer

1.2. Research Questions

- What are the main obstacles to and possibilities presented by using e-learning techniques to train primary school teachers in developing nations?
- What are the best practices for creating and distributing e-learning materials for training primary school teachers in settings with limited resources?
- In developing nations, how do sociocultural elements affect the uptake and efficacy of e-learning programs for training primary school teachers?
- What is the future research agenda for eLearning based primary school teachers training in developing countries?

2. RESEARCH METHODOLOGY

An initial systematic mapping review that provided a thorough overview of the entire research field focused on the use of eLearning in training primary school teachers in developing countries. With the mapping review in mind, the decision was made to focus on the most prevalent theme that surfaced, which is the use of e-learning solution as a medium of educator training in primary schools. Using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) methodology (Moher et al., 2010), data extraction and in-depth thematic coding were done after two rounds of screening against inclusion criteria.

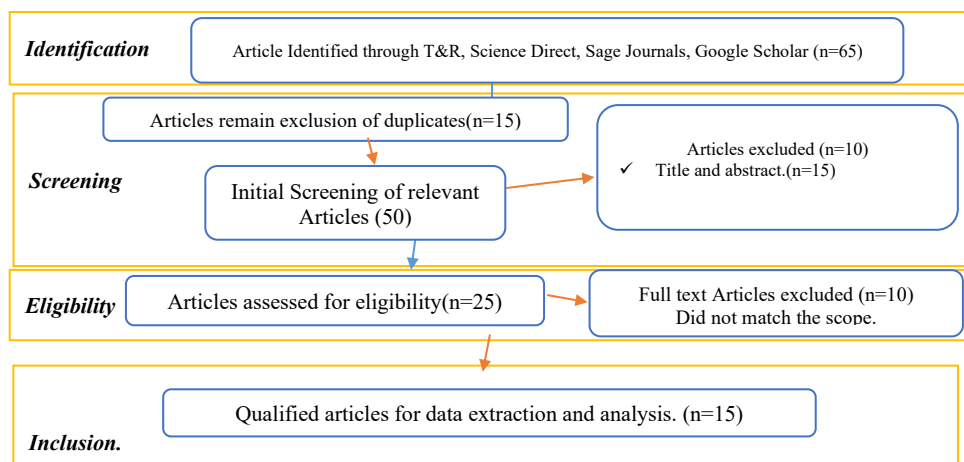


Figure 1: PRISMA flow diagram for the selection of articles

2.1. Thematic Search

Next, we evaluated the research evidence's quality and synthesized its findings. This gave the higher caliber research studies priority. Figure 2 depicts the eight-step overall review process, which includes defining the review scope and choosing the final papers for analysis. The three components of the methodology are quality scoring, thematic coding, and screening. Before moving on to the next review stage, I became acquainted with the pertinent scheme (inclusion/exclusion criteria, quality scoring framework, and data extraction variables).

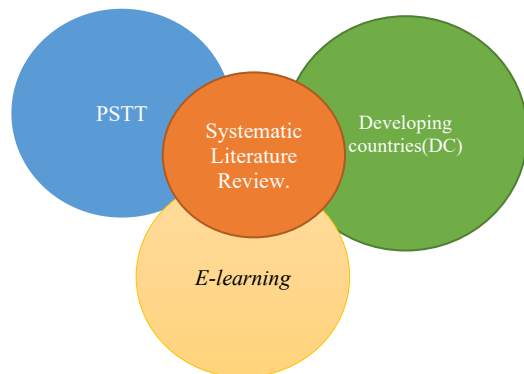


Figure 2: Literature Search strategy.

By looking over the titles, abstracts, and keywords from pertinent literature in the field, a preliminary priority list of related keywords was produced. ProQuest trial searches were used to improve this list. Following the finalization of the search terms, 65 papers were found by searching academic literature through Google Scholar, Taylor and Francis, emerald, IEEE, Science Direct, ten papers—nine of which focused on "technology for PSTT"—were judged appropriate for inclusion in the larger systematic mapping review after inclusion criteria were applied. In the end, the systematic literature review covered in this article contained these nine publications.

Table 2: Search Terms

No	Theme Name	Search Terms
1	PSTT	Primary teacher developments OR teacher training OR teacher education OR teacher learning OR teacher professional learning OR [teacher OR educator OR classroom practitioner OR trainer OR school OR instructor] AND [professional development OR in* educator OR pre*service training OR in*service education OR pre*service education OR coach* OR mentor*]
2	eLearning	eLearning technolog* OR online OR distance OR virtual OR phone OR ICT OR ICT* OR learning OR * OR Moodle OR learner management system OR LMS OR virtual learning environment OR VLE OR e*learning OR blended learning OR online learning OR mobile learning OR social network* OR adaptive OR learning OR MOOC OR social media OR professional learning network OR remote learning
3	Developing countries	Developing countries OR low middle-income country* OR sub*saharan africa OR latin americ

Note: The use of an asterisk (*) denotes a wild character used to locate all singular/plural forms of a term.

2.2. Eligibility Screening.

- Research Theme Area One(DC): Research was considered included if information were gathered from a minimum of one low- and/or middle-income nation. Thus, a total of 26 nations in Latin America and South Africa, East Asia and the Pacific, Europe, and Central Asia were included in the search.
- Research Theme Area Two(PSTT): Research on eLearning technology-related teacher learning in teacher education, professional development, peer learning initiatives, mentoring, and coaching, was included.
- Research Theme Area Three(Technology): The use of online technology for teacher development and learning. Technology used in educational administration such as online learner registration software was left out.

Stage 1 screening was done on titles, abstracts, and keywords to eliminate texts that weren't relevant. To further filter records, whole texts were read in Stage 2. Duplicate or non-independent records were thrown away. Journal articles were given precedence over other types of materials, including conference papers and book chapters.

2.3. Data Synthesis

Reviews of studies in international development encompass a variety of contexts, making it difficult to determine which studies are relevant and generalizable. The review focused on providing in-depth explanations of the contextual features. The final terms included study design, teacher age and gender, publication type, PSTT audience, setting (country, institution type), sampling strategy, sample size, clustering basis (e.g., teaching experience), and analytic techniques. Additionally, succinct study summaries were created.

2.4. Thematic Coding.

The study was subjected to thematic coding, which involved utilizing established qualitative methods and their specialized knowledge to create a preliminary thematic framework. Throughout several cycles of testing and improvement, this framework was subjected to more scrutiny to address emerging codes and possible changes. It addressed several topics, including the PSTT audience, educational attainment, context, technology use, modes and methods, peer support, results, and systemic and local factors. Cross-tabulations were used to look at important correlations. The study database's data was thoroughly analyzed and organized thanks to this methodical approach.

2.5. Quality Assessment of the Review.

A checklist that was developed iteratively with colleagues in our larger research community was used to assess the studies' quality. This checklist included several important requirements. First, it looked at whether the study report addressed cultural contextualization and adopted a critical stance toward the use of technology. Subsequently, it assessed contextual elements of the research methodology, such as details about participants and settings and sampling strategy.

Thirdly, it evaluated the research design, which included studies using mixed methods, qualitative, non-randomized, and descriptive quantitative approaches. It also examined methodological biases, such as the acknowledgment and mitigation of study limitations and the researchers' positioning. In addition, it assessed the methodological sensitivity to ethics and culture, guaranteeing that data collection and analysis were both morally and culturally sound. Lastly, it examined the consistency of assertions and conclusions as well as how well they lined up with previously collected data and study-derived data.

2.6. Methodological limitations.

The review was limited to English-language publications only, which frequently give preference to works from English-speaking nations. Furthermore, it's possible that some PSTT initiatives run by local partners, NGOs, and educational institutions weren't made public. Teacher perspectives were indirectly included through limited research on co-design models for PSTT, as only published works were reviewed. To improve understanding, future initiatives should ask practitioners in remote parts of developing countries directly for their input.

3. RESULTS

3.1 Research question characteristics.

In response to RQ 1,2, this section outlines the salient features of developing "tech for PSTT" studies.

RQ 1: What are the main obstacles to and possibilities presented by using e-learning techniques to train primary school teachers in developing nations?

RQ 2: What are the best practices for creating and distributing e-learning pedagogical materials for training primary school teachers in settings with limited resources?

With this pertinent question, the review sought to understand the state of development of the literature on obstacles adoption of eLearning for PSTT in developing countries. To answer this question, the review focused on several papers published per year within the study period (2013–2023), see table below.

Table 3: Publications and sources addressing RQ1 and RQ2.

Author	Title	Journal	Citation Index
(Frehywot et al., 2013)	E-learning in medical education in resource constrained low- and middle-income countries	springer	621
(Cox, 2013)	Formal to informal learning with IT: Research challenges and issues for e-learning	Wiley	256
(Balogun & Ahlan, 2014)	Issues of e-learning in developing countries: A Nigerian perspective	Taylor and Francis	10
(Giovanis, 2015)	Keep It Simple: Challenges, Solutions, and Best Practices for Global eLearning Initiatives	ProQuest	15
Than et al,(2015)	Challenges of Implementing e-Learning in Developing Countries	Springer	27
(Aldhafeeri & Khan, 2016)	Teachers' and Students' Views on E-Learning Readiness in Kuwait's Secondary Public Schools	SagePublication	107
(Muhammad et al., 2017)	Challenges in Development of eLearning Systems in Higher Education of the Developing Countries	London Journal of Research in Humanities and Social Sciences	13
(Akbarov, 2018)	Students' Attitudes Toward Blended Learning In Efl	ProQuest	150
(Hofmeister & Pilz, 2020)	Using e-learning to deliver in-service teacher training in the vocational education sector: Perception and acceptance in poland, Italy and Germany	Education Sciences(mdpi)	62
(Eriksen et al., 2021)	Adaptation interventions and their effect on vulnerability in developing countries: Help, hindrance or irrelevance?	Elsevier/Science Direct	463
(Maune, 2023)	Adoption and use of eLearning platforms by universities in developing countries: Evidence from Zimbabwe	Taylor and Francis	1

(Ali et al., 2024)	Can the compulsive use of e-learning lead to lower academic performance?	Elsevier	1
(Sarker et al., 2019)	Use of e-learning at higher educational institutions in Bangladesh: Opportunities and challenges	Emerald	73
(Saeed Al-Maroofof et al., 2020)	The continuous intention to use e-learning, from two different perspectives	MDPI	119
(Monroe et al., 2020)	Evaluating teen driving knowledge and behaviors following educational outreach	Springer	5

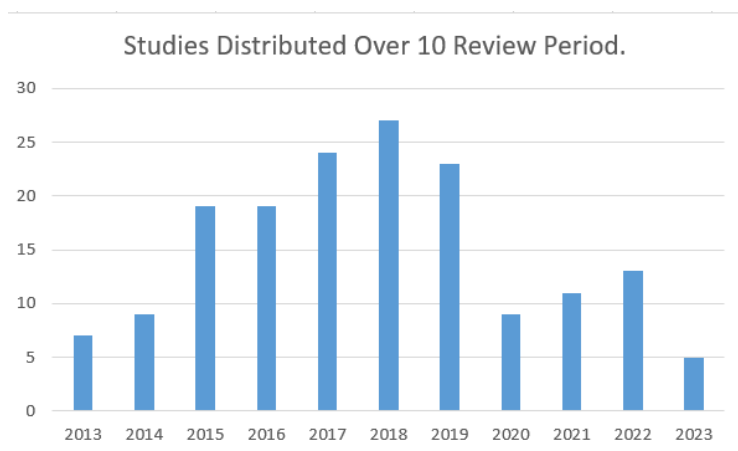


Figure 3: Articles distributed over review period.

3.2 Emerging trends observed.

eLearning conceptualization and PSTT: The authors' conceptualization of eLearning for PSTT has been approached from a variety of angles, which reflects the complexity of online teacher preparation. Regarding the conceptualization of the term eLearning authors have precisely specified their understanding and application of the term in education. For example, (Hofmeister & Pilz, 2020), emphasized the professional development needs of practicing educators across vocational sectors in various countries and concentrate on using e-learning platforms for in-service teacher training. This conceptualization emphasizes how crucial it is to use digital tools to give teachers who are already working in the field flexible and accessible training options.

On the other hand, research like that done by (Aldhafeeri & Khan, 2016) examines how teachers and students feel about e-learning settings and how prepared they are for it. These conceptualizations emphasize how important it is to deal with stakeholders' perceptions (Giovanis, 2015) and readiness in order to guarantee that eLearning initiatives in pre-service teacher training are adopted and implemented effectively. Above studies have been more intent on pinpointing important patterns and obstacles related to the adoption of e-learning in these areas. Examining problems, fixes, and best practices for international e-learning projects is one popular trend.

Methodologies Adopted: Research works such as (Giovanis, 2015) explores the nuances of e-learning implementation on a global basis, frequently employing qualitative research approaches like case studies and literature reviews to obtain understanding of the various obstacles that educators and policymakers encounter about the various difficulties faced by educators and decision-makers. Examining teachers' and students' attitudes and readiness for e-learning in particular educational contexts is another trend. (Aldhafeeri & Khan, 2016), for example, assess Kuwait's secondary public schools' preparedness for e-learning adoption by collecting qualitative or quantitative data on perspectives and preparedness through surveys, questionnaires, or interviews. Similar to this, (Hofmeister & Pilz, 2020) use focus groups, interviews, surveys, and other methods to gather qualitative data on the perceptions and acceptance of e-learning for in-service teacher training in vocational education across several nations.

Researchers have looked at readiness and perceptions as well as the efficacy of e-learning interventions in resolving issues related to education. (Eriksen et al., 2021) use a mixed-methods approach, combining qualitative and quantitative techniques like case studies, surveys, and statistical analysis, to assess how adaptation interventions affect vulnerability in developing nations. Researchers can obtain a thorough grasp of the intricate relationships between e-learning interventions and educational outcomes in a variety of contexts by using this interdisciplinary approach. Moreover, research frequently concentrates on pinpointing particular problems and difficulties associated with the adoption of e-learning in developing nations. For instance, (Balogun & Ahlan, 2014) investigate e-learning issues from a Nigerian perspective, probably using qualitative techniques like focus groups, interviews, or case studies to gain understanding of the particular difficulties encountered by teachers and students in the area. Through the use of diverse research methodologies, academics hope to provide nuanced insights into the complex aspects of e-learning in developing nations, which will help shape the creation of more efficient and contextually appropriate teaching strategies.

Theoretical and contextual issues: Theories serve as the foundation for the study of eLearning for (PSTT), influencing both its design and execution. Four major theories namely Pedagogical Frameworks, UTAUT, Learning Theories and Socio-Cultural Perspectives: guided the review. The theory of acceptance and use of technology, or UTAUT, helped shed light on the variables affecting the uptake and application of technology in teacher preparation settings. These theories help researchers to conceptualize how eLearning environments can support pre-service teachers' learning and skill development within a variety of cultural and educational contexts, drawing on learning theories and socio-cultural perspectives. 10 of the studies focused on eLearning for teachers in remote areas while the four were generalized the application of eLearning across education in remote areas.

When it comes to eLearning for PSTT, contextual factors are very important. The viability and efficacy of eLearning initiatives are impacted by regional and community (Boumadan et al., 2020) differences in technology infrastructure and access to digital resources. Additionally, the diversity of primary school teachers' backgrounds and languages makes it necessary to create inclusive and culturally sensitive eLearning resources and methodologies (Hennessy et al., 2022). Resources allocated for technology-enhanced teacher training and the incorporation of eLearning into PSTT curricula are influenced by national policies, institutional frameworks, and professional development cultures. To fulfill the various needs of pre-service teachers and get them ready for today's educational challenges, ensuring the quality and efficacy of eLearning for PSTT necessitates paying close attention to assessment procedures, curriculum alignment, and continuous evaluation procedures.

3.3 Contextual Issues and PSTT

- **Infrastructure and Access:** The viability and efficacy of eLearning initiatives for PSTT are impacted by differences in technological infrastructure and access to digital resources among various communities and regions (Akram et al., 2022; Galuszka et al., 2021; Nye, 2015; Zarei & Mohammadi, 2022).
- **Professional Development Culture:** The acceptance and execution of eLearning initiatives for PSTT, including views toward technology integration and support systems for educators, are influenced by the current professional development culture found in educational institutions and teacher training programs (Admiraal et al., 2021; Fernández-Batanero et al., 2022; Francom et al., 2021; Huda, 2019).
- **Cultural and Linguistic Diversity:** In order to meet the varied learning needs of pre-service teachers, inclusive and culturally sensitive eLearning materials and methods are required (Bridget Maphoto & Suliman, 2024; Giovanis, 2015; Sum & Oancea, 2022; Whitworth & Chiu, 2015).
- **Policy and Governance:** Funding and support for technology-enhanced teacher training, as well as the incorporation of eLearning into PSTT curricula, are determined by national policies, regulations, and institutional frameworks (Hennessy et al., 2015; Kong et al., 2013; Sims & Fletcher-Wood, 2021).

From the available sources subjected to present review, e-learning can be used training primary school teachers in resource-constrained contexts and enhance student results by adhering to following best practices, which can optimize the impact and efficacy of the program;

- **Pedagogical Resources in settings with limited resources:** There is a rising need to develop eLearning content suited to the situations and requirements of primary school teachers working in environments with limited resources. As part of this, designers need to make sure the information is interesting, pertinent, and in line with regional curriculum and instructional strategies (Maune, 2023).
- **Customized Content Creation:** Provide e-learning resources that are especially suited to the requirements and environments of primary school teachers in environments with limited resources (Saeed Al-Marroof et al., 2020). As part of this, content designers need to make sure that the information on eLearning is interesting, pertinent, and in line with regional curriculum and instructional strategies
- **Accessibility and Affordability:** Create e-learning tools and platforms that are both inexpensive and accessible, keeping in mind the restricted financial and technological resources available in these environments (Monroe et al., 2020). To guarantee more access, this might include utilizing low-bandwidth solutions and open educational resources (Sarker et al., 2019).

3.4 eLearning issues for PSTT.

- **Digital Literacy and Skills Gaps:** It's possible that primary school teachers in developing nations don't have the necessary digital literacy abilities or familiarity with e-learning resources (Barrot et al., 2021; Darling-Hammond, 2016; Muhammad et al., 2017). In order to ensure the efficient use of e-learning resources and close these skills gaps, educators and students alike must receive training and support.
- **Cost and Affordability:** Using e-learning solutions in environments with limited resources is severely hampered by the high expenses of purchasing and maintaining technology hardware, software licenses, and internet connectivity (Djeki et al., 2023; Giovanis, 2015; Maune, 2023). The availability of pertinent e-learning resources and materials may also be affected by affordability, especially if they are proprietary or require a membership fee.
- **Language & Localization:** In developing nations where a variety of linguistic origins are common, language limitations may make it more difficult for PSTT users to access and utilize e-learning resources (Canals & Al-Rawashdeh, 2019; Nye, 2015). To make e-learning materials more accessible and pertinent to a varied range of learners, localization efforts including the translation of content and interfaces into local languages are vital.
- **Contextual Relevance:** E-learning approaches and materials need to be sensitive to cultural differences and pertinent to the sociocultural norms and local educational context of developing nations (Bridget Maphoto & Suliman, 2024; Giovanis, 2015; Valverde-Berrocso et al., 2020). E-learning programs for PSTT may encounter resistance, disengagement, or limited efficacy if cultural and contextual aspects are not taken into account.

3.5 Social Cultural Elements

RQ 4: In developing nations, how do sociocultural elements affect the uptake and efficacy of e-learning programs for training primary school teachers?

From the selected papers sociocultural elements exert a profound influence on the adoption and effectiveness of e-learning programs designed for training primary school teachers in developing nations. Firstly, cultural perceptions and readiness towards technology-enabled education significantly shape the reception of e-learning initiatives among stakeholders. Studies such as those by (Aldhafeeri & Khan, 2016; Giovanis, 2015) illuminate the pivotal role of understanding and addressing stakeholders' perceptions and preparedness to ensure the successful implementation of e-learning programs. Moreover, language and linguistic diversity pose substantial barriers to e-learning accessibility and utilization, particularly in regions with diverse linguistic backgrounds. (Balogun & Ahlan, 2014; Maune, 2023) underscore the necessity of localization efforts, including content translation, to enhance the accessibility and relevance of e-learning materials across varied linguistic contexts.

Majority of the selected papers for the study demonstrate that the acceptance and effectiveness of e-learning programs for teacher preparation are significantly impacted by community expectations and support. The effectiveness of e-learning programs is influenced by the degree of community support and engagement, especially when it comes to

initiatives for in-service teacher training. According to research by (Hofmeister & Pilz, 2020), community involvement is crucial in creating a climate that is favorable for the use of e-learning technologies.

Furthermore, how e-learning programs are accepted and implemented at educational institutions is greatly influenced by the culture of professional development that is currently prevalent. According to studies by (Aldhafeeri & Khan, 2016; Hofmeister & Pilz, 2020), addressing attitudes toward technology integration and offering sufficient support mechanisms for instructors are vital for successful e-learning uptake. In settings with low resources, the high costs and scarce resources linked to the adoption of e-learning present significant hurdles. In order to reduce inequities in e-learning access, (Djeki et al., 2023; Galuszka et al., 2021) highlight challenges present and the necessity of focused initiatives.

4. DISCUSSION OF THE FINDINGS

4.1. Discussion

Research Outcome #1: Limited Authorship for Primary School teachers training; A notable vacuum exists in the e-learning literature, as evidenced by recent research, which most of which favors higher education over the unique requirements and circumstances of primary school teacher training (PSTT) (Barteit et al., 2020; Johnson et al., 2023). Considering how important primary teachers are in influencing kids' academic and socioemotional development, this neglect is worrisome (Brown & Williams, 2020). Future research on PSTT as a separate field with an emphasis on the particular difficulties and demands of elementary education is necessary to close this gap (Jones et al., 2021). By doing this, researchers may aid in the creation of customized e-learning programs that help primary school instructors improve both their methods of instruction and the results of their students.

Research outcome #2 Theoretical Gaps; Recent research findings and theoretical developments must be carefully considered in order to address theoretical limits in primary school teacher training (PSTT). According to recent research, instructional frameworks specifically designed for PSTT environments are essential (Smith & Johnson, 2022). According to (Monroe et al., 2020) these frameworks must take into consideration the many topic areas taught in elementary education as well as the special developmental requirements of young students.

The significance of theoretical frameworks emphasizing equity and inclusion in PSTT is demonstrated by studies conducted by (Chen et al., 2023). These frameworks should provide guidance to educators on how to address the diverse needs of students, including those from underrepresented communities and those with disabilities, in an inclusive way (Bridget Maphoto & Suliman, 2024) highlights the necessity for theoretical approaches that take into consideration a variety of cultural and socioeconomic elements. It is imperative that theoretical models exhibit cultural responsiveness and adaptability to diverse primary education environments. A study (Chen et al., 2023) emphasize the significance of theoretical frameworks in education that gives priority to fairness and inclusion. These frameworks need to offer direction on how to help educators meet the many needs of students including those from underrepresented communities and those with disabilities in an inclusive manner.

Research Outcome # 3: Pedagogical strategies to PSTT; Research on how e-learning platforms may support inclusive, participatory, and developmentally appropriate teaching methods for primary school teachers is lacking, despite the fact that these techniques are necessary for effective teacher preparation (Muchira et al., 2023). (Boumadan et al., 2020) looked at how well active learning techniques worked in PSTT programs in underdeveloped nations.

In order to improve teacher preparation and student results in resource-constrained contexts, the research examined strategies such cooperative learning, problem-based learning, and peer teaching (Giovanis, 2015; Muchira et al., 2023). Similarly, (Hennessy et al., 2015) delved into the use of technology-enhanced pedagogies in PSTT programs in low-resource settings. Their study assessed the effectiveness of digital tools, online resources, and blended learning approaches in improving teacher preparation and student learning outcomes (Darling-Hammond, 2016; Hennessy et al., 2022).

Research Outcome#4: Subject-Specific Training; (Valverde-Berrocso et al., 2020) found that subject-specific training is essential for training educators and necessitates theoretical frameworks that integrate effective teaching strategies with topic expertise. These models must address the challenges associated with training young pupils in a number of subjects at varying ability levels.

For example, several studies (Benda et al., 2020; Muzaffar et al., 2021) have investigated the function of technology and offered integration frameworks emphasizing the optimal integration of e-learning platforms and digital technologies into primary school settings. Their findings emphasize the potential of technology to improve teacher training and professional development by offering flexible and accessible learning opportunities.

Research outcome #5: More Themes under PSTT training to be addressed; Artificial intelligence (AI) and Machine learning integration in teacher preparation programs in underdeveloped nations has become a focal point of recent research in primary school teacher training (PSTT). Recent research has demonstrated that AI-driven tools and platforms can improve PSTT by offering instructors real-time feedback, automated evaluation mechanisms, and individualized learning experiences (Demartini et al., 2024; Hooda et al., 2022; Nye, 2015; Xu, 2022). These studies address the difficulties associated with technological infrastructure, digital literacy, and cultural adaptation while also highlighting the potential provided by AI to enhance the caliber and accessibility of teacher preparation in environments with limited resources.

Additionally, a prominent subject in PSTT research has been the training of teachers for kindergarten environments (Johnson et al., 2023), especially in developing nations where early childhood education is increasingly acknowledged as a vital aspect of educational development. A study conducted by (Oppenheim-Shachar & Berent, 2023) analyzed the unique training requirements of kindergarten instructors and have pinpointed efficient methods for delivering early childhood education of the highest caliber. These findings highlight the significance of providing educators with the pedagogical knowledge, abilities, and tools required to establish nurturing and stimulating learning settings for early children, therefore establishing a solid basis for their future academic achievement.

4.2. Limitations of the Study

There are significant limitations to the methods used in this systematic review that should be taken into account. Our search technique was mostly limited to journal papers published in the English language, which may have resulted in the exclusion of pertinent research published through other channels like conferences and gray literature. Furthermore, the limitation to English-language publications would have missed important discoveries from studies done in languages other than English, especially in developing nations where linguistic diversity is common. As such, it is possible that our evaluation does not fully capture the range of e-learning strategies used in developing nations to train primary school teachers.

Despite these drawbacks, the systematic review offers a thorough summary of the body of research on e-learning strategies for educating primary school teachers in poor nations. This review provides insightful information that can direct future research goals and the creation of efficient e-learning solutions for teacher training in different contexts by highlighting important themes, gaps, and issues in the literature. Researchers, decision-makers, and practitioners looking to improve the standard and accessibility of e-learning interventions for primary school teacher preparation are expected to find value in the insights offered here. It is clear that in order to close the gaps found and progress the area of e-learning in primary school teacher preparation in developing nations, further investigation and coordinated efforts are required.

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The study concludes that the literature on e-learning for primary school teacher training in underdeveloped nations is still emerging, with few publications and authors currently conducting research in this area. The analysis of pertinent

literature published between 2013 and 2023 reveals that this important field of research needs more attention, as indicated by the paucity of submissions in mainstream education publications. Building on these results, the study suggests several future research avenues to enhance the understanding and use of e-learning strategies for educating primary school teachers in developing nations. Further empirical research is needed to improve our comprehension of the application and effects of e-learning on teacher preparation outcomes. Academics should investigate the efficacy of various e-learning models and pedagogical techniques, considering contextual elements that may impact their adoption and efficacy. Additionally, more research is required to address understudied subjects, including the creation of inclusive and culturally appropriate e-learning materials and the incorporation of e-learning into teacher training courses.

Despite the insightful information provided by this study, it is important to recognize the gaps and limitations in the current body of research. To gain a comprehensive understanding of e-learning strategies for primary school teacher training in developing nations, more systematic evaluations are necessary. In the absence of strong evidence, policymakers and education stakeholders should carefully review relevant case studies and best practices to inform the design and implementation of e-learning programs. By addressing these research gaps and issues, stakeholders can more effectively promote the successful integration of e-learning into primary school teacher training programs in developing nations, thereby improving the quality of education for all.

5.2 Recommendations

The study recommends that stakeholders prioritize further research and development of e-learning approaches for primary school teacher training in developing countries. Comprehensive empirical studies should evaluate the effectiveness of various e-learning models and techniques, considering diverse sociocultural contexts. Interdisciplinary collaborations should explore innovative, culturally appropriate e-learning materials and platforms. Integrating e-learning into existing teacher training curricula, along with professional development for educators' digital literacy, is recommended. Establishing partnerships and knowledge-sharing networks among developing nations can facilitate the exchange of best practices and effective solutions. Adequate resources and funding should be allocated for robust e-learning infrastructures, including internet connectivity, hardware, and technical support in remote areas. Continuous monitoring and evaluation of e-learning programs, incorporating stakeholder feedback, can inform necessary adjustments and ensure long-term sustainability and effectiveness of initiatives.

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