



Digital Technology Integration in Teacher Education: A Review of the Current Trends and Challenges

Shivani Bhadola

DOI : <https://doi.org/10.5281/zenodo.21458254>

ARTICLE DETAILS

Research Paper

Received: 18-05-2026

Accepted: 21-06-2026

Published: 15-07-2026

Keywords:

Digital Technology, ICT Integration, Teacher Education, Digital Competence, Technology Integration, Educational Technology

ABSTRACT

Digital technology integration has now become a significant factor in terms of modern teacher training. The digital tools and Information and Communication Technologies (ICT) are important factors that facilitate effectiveness in teaching, interactive learning experiences, and professional development in teachers. This paper is aimed to examine recent trends and issues related to the integration of digital technology in the education of teachers. This paper follows the systematic literature review method to analyze the current studies on digital technology integration in teacher education. Academic databases were used to search relevant literature by defining specific keywords that are connected with ICT integration and digital technology in teacher education. Seventeen research papers published in 2016- 2025 were chosen to analyze. The findings show that the implementation of digital technology facilitates the learner-centered pedagogy, increases the digital competency of the teachers, and facilitates the innovative methods of teaching. Nevertheless, there are a number of issues that still impeded successful implementation that comprise the poor ICT network, lack of training facilities, and the digital gap with rural and urban institutions. The review recommends that effective use of technology in teacher education should include better digital infrastructure, teacher training, and professional development.

Disclaimer: The opinions, interpretations, conclusions, recommendations, analyses, and statements expressed in this research article are solely those of the author(s) and do not reflect the views, policies, or positions of the Publisher, Chief Editor, Editors, Editorial Board, Reviewers, or their affiliated institutions. The author(s) are solely responsible for ensuring the originality, authenticity, and integrity of the manuscript and for ensuring that it is free from plagiarism, AI-generated content, copyright infringement, data falsification, and any other form of academic misconduct.

Introduction

Digital technology has been an inseparable aspect of the education industry in the modern world. The fast evolution of Information and Communication Technologies (ICT) has had a great influence on the field of education and has generated new opportunities of adopting new teaching techniques. Digital technology in teacher education is crucial in equipping future teachers to utilize technological tools in their classrooms and how to respond to the emerging needs of learners in the digital age.

The teaching education course programs are also more likely to prepare pre-service and in-service teachers with digital and techno-pedagogical skills to be able to integrate technology into the teaching process, in a meaningful manner. Online learning platforms, multimedia tools, virtual classes, and collaborative technologies are digital tools that can be utilized to improve teaching and support the use of learner-centered teaching-learning methods. In addition, both national and international education policies focus on the significance of digital technology in the education of teachers as a way of enhancing the standard of teaching and learning. Regarding the Indian setting, policy programs like the National Education Policy (NEP) 2020 focus on incorporating digital technologies and ICT in teacher education to improve the quality, accessibility, and flexibility of education.

Despite of these benefits, a number of issues are still influencing the successful adoption of digital technology in teacher training. Such problems as poor infrastructure, lack of digital access and training access, and the digital divide between rural and urban institutions tend to impede effective application of technology in educational institutions.

To this context, it becomes pertinent to consider the current studies that have been conducted to learn how digital technology can be introduced into teacher education and what the challenges related to this process are. Thus, the aim of the paper is to discuss current trends and challenges that appear in relation to the implementation of digital technologies in teacher education.

Literature Review

In the study Perception of Preservice Teachers Towards ICT Integration in Teacher Education in India, Nasreen and Chaudhary (2018) examined pre-service teachers in India in terms of their attitudes toward ICT integration in teacher education. The research took a normative survey method and gathered the information based on a structured questionnaire on 100 B.Ed. students in Aligarh Muslim University. The results indicated that pre-service teachers had positive attitude towards the use of ICT in teaching. However, other

challenges were also found in this study such as lack of ICT infrastructure, lack of access to technological devices, and lack of training in teacher training programs.

In the study *Towards a Framework for ICTs Integration in Teacher Education in India*, Kundu (2019) investigated the situation, issues, and potential model of successful integration of ICT in teacher training in India. The study adopted a descriptive analytical approach in which a synthesizing literature review was conducted to review the secondary sources such as books, journal articles, policy documents, and research reports on ICT integration in teacher education. The results showed that there are some challenges such as lack of proper ICT infrastructure, lack of training and lack of pedagogical integration of technology in teacher education programs. The paper presented a framework that highlighted the importance of teaching and learning ICT at the curriculum level, pre-service and in-service training integration, local development of digital content, and implementation sustainability plans to enhance the effectiveness of technology integration in teacher education.

In the study *Information and Communications Technology for Teacher Training in India*, Sharma (2022) investigated how Information and Communication Technology (ICT) can be used to train and develop teachers in India. The research was founded on document analysis of policy reports, frameworks, and literature available on the topics of ICT integration in teacher education. The results revealed that ICT is important in the development of learner-centered teaching environments and in the development of the teachers. The research also placed great significance on national programs like DIKSHA, SWAYAM, and NISHTHA and the National Education Policy 2020 to support ICT based teacher education and develop digital literacy among teachers.

In the study *Teacher education for ICT integration in classroom*, Mena, Singh, and Clarke (2018) investigated the relevance of teacher education programs in promoting the effective use of ICT in classroom teaching. The research was informed by the conceptual and theoretical discussion of digital skills and technological Pedagogical knowledge that the teachers need. The results emphasized that technical knowledge of digital tools is not enough to be integrated successfully in ICT; to apply technology in the classroom effectively, teachers should possess good pedagogical strategies and digital skills. The research highlighted that teacher education interventions must be aimed at building the digital skills and innovative ways of teaching and professional competencies of teachers to improve the learning environments that are based on technology.

In the study *Role of ICT in 21st Century's Teacher Education*, Bhattacharjee and Deb (2016) discussed the importance of Information and Communication Technology (ICT) to teacher education in the 21st century.

The analytical approach used in the study was descriptive and it relied on the use of secondary data using books, journal articles, policy reports, and research studies that were already done on the use of ICT in teacher education. The results showed that ICT is very essential in developing the skills in teaching, improving classroom communication, and fostering new teaching techniques. Another important thing that was identified in the study is that ICT assists the pre-service and in-service teacher in their professional growth, effective communication, and development of a learning-teaching environment that is learner-centered.

In the study *Integrating ICT in Teacher Education*, Gulhane (2011) studied the usefulness of the ICT training modules as a part of teacher education programs. The researchers used an experimental study design with a single group of 25 teacher trainees in which an ICT training module was implemented over a 90-days period. The findings indicated that training in ICT enabled teacher trainees to become more skilled in technological use in teaching such as email, browsing the internet, using Power points and LCD projectors to teach. The authors indicated that ICT training in teacher education programs contributes to the development of digital competencies among teachers and successful technology-based teaching methods.

In the study *Role of Digital Technology in Teaching-Learning Process*, Srivastava and Dey (2018) highlighted the issue of the digital technology contribution to the process of teaching-learning in the educational facility. The research design taken in the study was a quantitative research design where a questionnaire survey was carried out on the teacher educators in Jharkhand. The results have shown that digital technology facilitates interactive learning situations and enhances teaching. Conversely, the research also revealed that there are many difficulties associated with the utilization of digital tools such as low internet coverage or access, absence of technical support, ineffective training, time management, and the general technological skills of educators.

In the study *A Critical Study of Different Policy Perspectives on ICT in Teacher Education*, Barman and Kumar (2024) analyzed various policy perspectives that have been associated with ICT integration in teacher education in India. The research took a documentary approach through examining national education policies and system concerning the use of ICT in education. The results also indicated that some policies including NCFTE (2009), National Mission on ICT (2009), ICT Policy in School Education (2012) and NEP 2020 focus on the relevance of incorporating ICT in teacher training and development. The research found that enhancing the digital competences of teachers and a correspondence of the use of ICT to national educational policies is the key to the rise of the quality of teaching and learning.

In the study *Bridging Self-Efficacy and Digital Competence: A Comprehensive Scoping Review of Teachers' Readiness for the Digital Age*, Hu et al. (2025) have done a scoping review to investigate the connection between the self-efficacy of teachers and their digital competence in digital learning. This study examined 120 articles in the Web of Science database covering 2000 to 2025 using a systematic review model. The results showed that there was a strong correlation between the self-efficacy of teachers and their digital competence, that is, the more teachers are confident in their ability to use digital technologies, the more they can properly incorporate them into their work. Another issue that was brought to the fore in the study is that teacher readiness to digital-age education is largely influenced by such factors as professional development, institutional support, collaborative practices, and access to digital resources.

In the study *Exploring 21st Century Digital Literacy Skills among the Prospective Teachers for Holistic Learning*, Varghese and Arya (2024) explored the position of digital literacy skills in the 21st century among the prospective teachers in teacher education programs. The research used a descriptive survey design and carried out a survey of 860 potential teachers in five districts of Kerala using a Likert-scale based Digital Literacy Scale and questionnaire. The results showed that despite the potential of ICT to enhance the teaching-learning activities and increase access to education, rural schools were characterized by a number of obstacles including insufficient qualified teachers, a poorly developed infrastructure, inadequate funding, weak technical services, poor internet connectivity, and lack of ICT equipment. Another issue in the study was the current curriculum of teacher education which offers minimal chances to acquire digital literacy skills which proves the necessity of further techno-pedagogical integration and training in the teacher education curriculum.

In the study *Issues and Challenges in Bringing ICT Enabled Education To Rural India*, Budhedeo (2016) explored the concerns and the problems relating to the application of ICT-enabled education in rural India. The literature review, government documents and policy documents, and past research studies on ICT based education in rural India were used as a conceptual and analytical approach of the study. The results showed that despite the potential of ICT to enhance the teaching-learning activities and increase access to education, rural schools were characterized by a number of obstacles including insufficient qualified teachers, a poorly developed infrastructure, inadequate funding, weak technical services, poor internet connectivity, and lack of ICT equipment. The research findings established that the appropriate application of ICT in education in rural settings entails better infrastructure, teacher education, policy assistance, and community engagement.

In the study *Analyzing Barriers to ICT Integration in Education: A Systematic Review*, Joshi and Khatiwada (2024) examined a systematic review to study the key challenges in the integration of ICT in education. The

method involves the thematic analysis of 21 research articles that were published in 2020-2024, which showed that the majority of challenges involved in technology integration are common in the research. The results indicated that a number of obstacles prevent successful integration of ICT, such as the poor level of infrastructure, expensive nature of high technology, digital illiteracy among teachers and students, insufficient training, and institutional backing. Another issue raised in the review concerned the presence of a digital divide between rural and urban regions, the presence of which inhibits fair access to digital education. The authors highlighted that there is need to have better infrastructure, professional development programs and good policy support in order to have a successful integration of ICT in learning institutions.

In the study *Teacher Preparedness and Professional Development Needs for Successful Technology Integration in Teacher Education*, Mpuangnan (2024), the author explored the teacher preparedness and professional development requirement in successful technology integration of teacher education programs. The research design used was mixed-method research design, where 485 participants (469 tutors and 16 principals) were sampled in sixteen Colleges of Education in Ghana, to gather both quantitative and qualitative data. The results revealed that despite the good attitude of teachers towards technology integration, multiple obstacles to the successful implementation of the integration had been identified as a lack of ICT infrastructure, lack of training opportunities, financial aspects and resistance to change. The paper underlined that continuous professional learning, institutional support and enhanced technological resources are crucial in enhancing technology in teacher education.

In the study *Integrating Information and Communication Technology in Teacher Education: Its Role and Impact*, Saha, Das, and Dey (25) investigated the importance and contribution of Information and Communication Technology (ICT) in the education of teachers. The research employed a thematic literature review method based on secondary sources of data such as academic journals, research articles, books, and online educational databases. The results emphasized that teacher education integration with ICT supports the improvement of teaching experiences, collaborative learning, teaching with the help of multimedia, and access to current educational materials. Nevertheless, the research has also mentioned that most teachers do not have the proper training and digital skills, and continuous professional growth and institutional encouragement should be contributed to ensure successful ICT incorporation into the teacher education programs.

In the study *Digital technologies integration in teacher education: the active teacher, training model* Rodrigues (2020) explored the use of digital technologies in the training of teachers with the help of an Active Teacher Training (AT) model. A qualitative research approach applied in the study involved the

action research in in-service teacher training and a case study in pre-service teacher training in Portugal. The results showed that project-based learning, collaborative work, and flipped classroom are the active training methods which assist teachers to acquire the digital skills and use technology efficiently in the teaching process. This study also pointed out that effective digital technology integration in education should be in the form of teacher training programs that emphasized on continuous professional development, collaborative learning community and that pedagogy, technology and content knowledge should be integrated to enhance effective integration of digital technology in education.

In the study *ICT Integration in Education: Incorporation for Teaching and Learning Improvement*, Ghavifekr et al. (2014) explored how ICT integration can be effective in enhancing teaching-learning process in school. The research design was quantitative survey research and was based on 61 primary school teachers in ten public schools located in Klang Valley, Malaysia using a structured questionnaire. The results demonstrated that ICT integration may positively influence the teaching practice, learning outcomes of students, and interactive classroom settings. Nevertheless, the investigation further showed a majority of the teachers utilized ICT more often in administrative work than in class instruction and therefore more effective training, institutional reinforcement as well as tactical planning is necessary in the effective ICT adoption in education.

In the study *Preparing teachers for digital education Continuing professional learning on digital skills and pedagogies*, OECD (2025) studied the relevance of preparing teachers to digital education using continuing professional learning (CPL). The article is a policy-based analytical report based on the international data sources, including PISA 2022 and Policy Survey on School Education in the Digital Age, which analyses the digital competencies and professional development practices used by teachers in various education systems. The results show that despite the growing popularity of the digital technologies in schools, many teachers do not have the technical and pedagogical expertise to incorporate them into teaching. The report highlighted that continuous professional learning, collaborative training models, and competency frameworks are key in the development of digital skills of teachers and the effective provision of digital education.

Conclusion of the Literature Review

Altogether, the studies reviewed point out that digital technology and ICT can be of great importance in teacher education, which is the improvement of teaching skills, the encouragement of interactive learning conditions, and the promotion of professional growth in the teacher market. Some of the studies highlight the need to enhance the digital capabilities, techno- pedagogical and digital literacy of teachers in order to

successfully incorporate technology into teaching practice. Simultaneously, the lack of appropriate infrastructure, the lack of digital tools, lack of training opportunities, and the digital divide between rural and urban educational institutions are also the issues that are expressed in the literature. Professional development programs as well as policy initiatives are thus regarded as a key step to enhance ICT integration in teacher education and equip teachers with the digital-age classroom.

Research Gap

Despite the fact that many studies have been conducted regarding the role of ICT and digital technologies in teacher education, a critical analysis of the available literature has shown that there are a number of gaps. Most of the research on the topic concentrates on particular elements, e.g. perception of teachers, digital literacy, or infrastructural issues, whereas the impact of these elements on the successful integration of technology is not yet studied comprehensively. Moreover, there is a lack of research which would give a detailed synthesis of the latest trends and future challenges to digital technology integration of teacher education. Thus, a review study that will undertake a systematic examination of the available research to determine the most important trends, opportunities, and challenges of integrating digital technologies in teacher education is needed.

Research Objectives

1. To analyse the role of integration of digital technology in teacher education.
2. To determine recent trends of using digital technologies in the teacher education programs.
3. To examine the major issues and obstacles related to the implementation of digital technology integration in teacher education.
4. To analyse the existing literature in order to understand the opportunities and implications of digital technology integration in to the teaching–learning process.

Methodology

It is a systematic literature review study that will look at the recent trends and issues surrounding the integration of digital technology in teacher education. The relevant research papers were located using web-based academic databases and online repositories, including Google Scholar, ERIC, Academia.edu, ResearchGate, and other journal databases. The keywords that were used in the literature search were, ICT

integration in teacher education, digital technology in teacher education, and challenges of integrating ICT in teacher education.

To conduct this review, the research paper between 2016-2025 were taken into consideration. The selection of studies was made depending on their topicality to digital technology integration, teacher preparedness, digital competencies, and challenges in teacher education. Having filtered the existing sources of literature, 17 research articles and reports were chosen to be thoroughly analyzed. The chosen articles were reviewed and generalized so as to distinguish the major trends, issues and prospects concerning the incorporation of digital technologies in teacher education.

Findings

The review of the chosen literature shows that there are a number of important themes connected to the integration of digital technology in the process of teacher education. To begin with, the numerous studies emphasize that digital technologies and ICT tools would improve the effectiveness of teaching and facilitate the learner-centered pedagogy. Online learning platforms, multimedia and digital platforms allow teachers to develop interactive and engaging learning experiences.

Second, the literature reviewed highlights the need to establish the digital competencies and technopedagogical skills of teachers. As a number of studies reveal, active integration of technology cannot be achieved without technical knowledge, as well as without the skills of integrating technology with knowledge of the subject content and pedagogy.

Third, the reviewed literature shows that professional development and ongoing training programs are significant facilitators of teacher preparedness to digital education. The programs to use include ICT training programs and community-based learning and policy frameworks which are critical in improving digital literacy and technological preparedness of teachers.

Finally, the literature has always mentioned some of the challenges that impede successful integration of digital technology in teacher education. These issues are the poor ICT infrastructure, lack of access to digital facilities, lack of access to training opportunities, and the continuing digital gap between the rural and urban sector of educational facilities.

The findings are useful in establishing the overall implications of the digital technology integration in teacher education. These themes continue to be interpreted further and analyzed in the following discussion

with reference to implications to pedagogical practices, institutional issues, and development prospects of teacher education.

Discussion

Teacher Education: Pedagogical Shifts

In the reviewed studies, it is observed that the integration of digital technology has become a significant part of the teacher education in the modern world. Some of the researches emphasize that ICT and digital tools enhance the effectiveness of teaching, interactive learning, and learner-centered pedagogies (Bhattacharjee and Deb, 2016; Sharma, 2022; Saha et al., 2025). Digital technologies allow educators to get access to various educational aids and embrace new instructional methods. In addition, the literature is keen on the need to build the digital skills, techno-pedagogical competencies and digital literacy of the teachers so that they can adequately incorporate technology in teaching. Technological Pedagogical Content Knowledge (TPACK) frameworks, collaborative learning, blended learning and project-based learning approaches are becoming popular as instructional technologies in teacher education programs.

Infrastructural and Institutional Barriers

Despite of these, the literature also shows that there are several challenges that do not allow effective integrations of digital technology. The issue of poor ICT infrastructure, unavailability of digital devices, restricted internet connectivity, and insufficient technical assistance remain a problem in many institutions (Srivastava and Dey, 2018; Budhedeo, 2016). Moreover, teacher education programs do not always include many possibilities to acquire digital literacy and techno-pedagogical skills in future teachers (Varghese & Arya, 2024). The disparity between the rural and urban educational institutions in the digital domain only serves to limit the accessibility of equal digital resources as well as technological learning opportunities.

Future Implications

The literature recommends that the enhancement of digital infrastructure, teacher training, and providing continuous professional development are crucial for successful integration of digital technology. With the current trends, education of teachers is projected to be more technology-oriented with the continued adoption of digital platforms, online learning environment and new technologies like artificial intelligence and adaptive learning systems to facilitate new teaching and learning practices.

Conclusion

The analysis of the available sources shows that the incorporation of digital technology into the educational process has become one of the significant critical areas in modern teacher education. The results indicate that application of ICT and digital tools may make teaching more effective, facilitating interactive and learner-centered classroom activities and contributing to the professional growth of teachers. Other studies also stress on the need to establish digital skills, techno-pedagogical and digital literacy skills among pre-service and in-service educators to meaningfully incorporate technology in teaching practices.

However, the literature highlighted some challenges which include lack of proper ICT infrastructures, lack of access to digital materials, lack of training opportunities, and digital divide between rural and urban educational institutions. These obstacles tend to curtail successful use of digital technologies in teacher education programs. Thus, to be an effective technology integrator, it is necessary to strengthen the digital infrastructure, enhance teacher training, and foster the sustained professional development. Overall, digital technology can profoundly change teacher education as long as these issues can be effectively managed due to efficient policy support, infrastructure development, and further professional growth of teachers.

References

1. Nasreen, & Chaudhary. (2018). *Perception of preservice teachers towards ICT integration in teacher education in India*. <https://doi.org/10.1145/3300942.3300948>
2. Kundu, A. (2019). *Towards a framework for ICTs integration in teacher education in India*. https://www.academia.edu/40442131/Towards_a_Framework_for_ICTs_Integration_in_Teacher_Education_in_India
3. Sharma, R. (2022). *Information and communications technology for teacher training in India*. <https://www.econstor.eu/handle/10419/249853>
4. Mena, J., Singh, B., & Clarke, A. (2018). *Teacher education for ICT integration in classroom*. <https://doi.org/10.1145/3284179.3284279>
5. Bhattacharjee, B., & Deb, K. (2022). *Role of ICT in 21st century's teacher education*. *Bioscience Biotechnology Research Communications*. <https://doi.org/10.21786/BBRC/17.1.7>
6. Gulhane, T. F. (2011). *Integrating ICT in teacher education*. *MIER Journal of Educational Studies, Trends & Practices*. <https://mierjs.in/index.php/mjestp/article/view/1618/1173>

7. Srivastava, S., & Dey, N. (2018). *Role of digital technology in teaching-learning process*. <https://doi.org/10.9790/0837-2301057479>
8. Barman, S., & Kumar, A. (2024). *A critical study of different policy perspectives on ICT in teacher education*. [https://www.bhu.ac.in/Images/files/17\(6\).pdf](https://www.bhu.ac.in/Images/files/17(6).pdf)
9. Hu, X., et al. (2025). *Bridging self-efficacy and digital competence: A comprehensive scoping review of teachers' readiness for the digital age*. *SAGE Open*. <https://doi.org/10.1177/21582440251363716>
10. Varghese, A., & Arya, A. (2024). *Exploring 21st century digital literacy skills among the prospective teachers for holistic learning*. *Indian Journal of Educational Technology*. <https://journals.ncert.gov.in/IJET/article/view/448>
11. Budhedeo, S. (2016). *Issues and challenges in bringing ICT enabled education to rural India*. *International Journal of Scientific Research and Education*. <https://doi.org/10.18535/IJSRE/V4I01.01>
12. Joshi, P., & Khatiwada, R. (2024). *Analyzing barriers to ICT integration in education: A systematic review*. <https://nepjol.info/index.php/TTP/article/view/73325>
13. Mpuangnan, M. (2024). *Teacher preparedness and professional development needs for successful technology integration in teacher education*. *Cogent Education*. <https://doi.org/10.1080/2331186X.2024.2408837>
14. Saha, S., Das, S., & Dey, A. (2025). *Integrating information and communication technology in teacher education: Its role and impact*. *International Journal for Multidisciplinary Research*. <https://www.ijfmr.com/papers/2025/1/36803.pdf>
15. Rodrigues, A. L. (2020). *Digital technologies integration in teacher education: The active teacher training model*. *Journal of e-Learning and Knowledge Society*. https://www.je-lks.org/ojs/index.php/Je-LKS_EN/article/view/1135273
16. Ghavifekr, S., et al. (2014). *ICT integration in education: Incorporation for teaching & learning improvement*. *Malaysian Online Journal of Educational Technology*. <https://files.eric.ed.gov/fulltext/EJ1086419.pdf>
17. Organisation for Economic Co-operation and Development. (2025). *Preparing teachers for digital education: Continuing professional learning on digital skills and pedagogies*. OECD Publishing. https://www.oecd.org/content/dam/oecd/en/publications/reports/2025/05/preparing-teachers-for-digital-education_13a76e57/af442d7a-en.pdf