

Empowering Women through Digital Literacy Skills in the Age of ICT: An Indian Perspective

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Abstract

This review paper examines the role of digital literacy in empowering women within the rapidly evolving Information and Communication Technology (ICT) landscape in India. Digital literacy has become a fundamental competency that enables women to access education, employment, financial services, healthcare, entrepreneurship, and government welfare schemes through digital platforms. Although India has witnessed significant progress through initiatives such as Digital India, PMGDISHA, BharatNet, and Skill India, disparities in digital access and literacy continue to affect women, particularly in rural and socio-economically disadvantaged communities. Drawing on recent literature published between 2020 and 2026, this review critically analyses the relationship between digital literacy, ICT adoption, women's empowerment, and sustainable development. It also discusses major challenges, including the gender digital divide, affordability, infrastructure limitations, digital safety concerns, and socio-cultural barriers. The paper concludes by proposing strategies to strengthen digital literacy among women through inclusive policies, gender-responsive digital education, community-based training, and improved digital infrastructure. Enhancing women's digital literacy is essential for achieving gender equality, inclusive development, and sustainable economic growth in India.

Keywords: Women, Digital Literacy, ICT, Women's Empowerment, Digital Inclusion, India, Digital Skills, Gender Equality.

1. Introduction

The twenty-first century has witnessed an unprecedented transformation in the way people access information, communicate, learn, and participate in economic and social activities. Information and Communication Technology (ICT) has become an integral part of everyday life, influencing education, employment, governance, healthcare, entrepreneurship, and financial services. The rapid growth of digital technologies, coupled with increasing internet penetration and smartphone usage, has created new opportunities for individuals to acquire knowledge, develop skills, and improve their quality of life. In this digital era, digital literacy has emerged as one of the most essential competencies, enabling individuals to access, evaluate, create, and communicate information effectively through digital technologies. It is no longer limited to the basic ability to operate computers or smartphones; instead, it encompasses critical thinking, information literacy, digital communication, online collaboration, digital content creation, cybersecurity awareness, and the ethical use of technology.

Digital literacy has become particularly significant for women, as it serves as a powerful catalyst for education, economic participation, social inclusion, and personal empowerment. Women who possess adequate digital literacy skills are better equipped to access online education, participate in digital financial systems, establish entrepreneurial ventures, seek employment opportunities, obtain healthcare information, and engage actively in civic and community life. Consequently, digital literacy has evolved from being merely a technological skill to becoming a key instrument for achieving gender equality, reducing social exclusion, and promoting sustainable development.

The importance of women's digital literacy has grown considerably in India during the past decade. As one of the world's fastest-growing digital economies, India has experienced remarkable progress in digital infrastructure through initiatives such as Digital India, Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA), BharatNet, Skill India, and the National Education Policy (NEP) 2020. These initiatives have expanded internet connectivity, digital public services, online learning platforms, and digital financial systems, creating unprecedented opportunities for women to participate in the digital society. Government programmes promoting digital inclusion have enabled millions of women, particularly in rural and semi-urban areas, to develop basic digital skills and access essential public services through digital platforms.

Despite these achievements, substantial challenges remain. India continues to experience a significant gender digital divide, particularly in rural and socio-economically disadvantaged regions. Many women face barriers such as limited access to digital devices, poor internet connectivity, financial constraints, inadequate digital education, language barriers, and socio-cultural norms that restrict technology use. Concerns regarding online privacy, cyber security, digital harassment, and misinformation further discourage women from actively engaging with digital technologies. These inequalities highlight that access to technology alone is insufficient; meaningful empowerment requires the development of comprehensive digital literacy skills that enable women to use digital technologies confidently, safely, and effectively.

Recent technological advancements, particularly in Artificial Intelligence (AI), cloud computing, big data, and digital learning platforms, have further transformed the nature of digital literacy. Women are increasingly expected not only to use digital devices but also to evaluate online information critically, understand AI-assisted technologies, protect their digital identities, and participate responsibly in digital environments. As workplaces, educational institutions, financial systems, and public services become increasingly digitized, digital literacy has become an indispensable life skill that determines an individual's ability to participate successfully in the knowledge economy.

Several national and international organizations have recognized digital literacy as a fundamental requirement for inclusive development. UNESCO emphasizes that digital literacy is essential for equitable access to quality education and lifelong learning, while the United Nations Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education) and SDG 5 (Gender Equality), identify digital inclusion as a critical pathway towards sustainable development. Similarly, the Organisation for Economic Co-operation and Development (OECD) has highlighted digital competence as a key employability skill required for future labour markets. These global perspectives reinforce the importance of strengthening women's digital literacy as a means of promoting educational achievement, economic independence, and social empowerment.

In India, women have increasingly adopted digital technologies for diverse purposes, including online education, digital banking, e-commerce, telemedicine, agriculture, entrepreneurship, and communication.

Self-help groups, women entrepreneurs, teachers, and students are increasingly using digital platforms to enhance their knowledge, expand business opportunities, and improve access to government welfare programmes. However, existing research suggests that disparities persist between urban and rural women, educated and less educated women, and economically advantaged and disadvantaged populations. Therefore, strengthening digital literacy requires comprehensive strategies that combine infrastructure development, affordable internet access, capacity-building programmes, gender-sensitive digital policies, and continuous professional development.

The COVID-19 pandemic further demonstrated the indispensable role of digital literacy in ensuring educational continuity and access to essential services. During the pandemic, women with adequate digital skills were better able to support children's online education, participate in remote work, access healthcare information, utilize digital financial services, and maintain social connectivity. At the same time, the pandemic exposed existing digital inequalities, highlighting the urgent need for inclusive digital literacy programmes that specifically address the needs of women and marginalized communities.

Against this background, the present review paper examines the role of digital literacy in empowering women in the age of ICT, with particular emphasis on the Indian context. It critically reviews recent literature published between 2020 and 2026 to analyse the relationship between digital literacy, ICT adoption, women's empowerment, education, employment, entrepreneurship, financial inclusion, and social participation. The review also explores government initiatives, identifies major challenges and research gaps, and proposes strategies for strengthening women's digital literacy through inclusive educational policies and technological interventions. By synthesizing contemporary evidence, this paper seeks to provide a comprehensive understanding of how digital literacy can serve as a transformative force in achieving gender equality and sustainable development in India.

2. Conceptual Framework of Digital Literacy and ICT

2.1 Concept of Digital Literacy

Digital literacy has become one of the most significant competencies in contemporary society, particularly in an era characterized by rapid technological advancement and digital transformation. Initially, digital literacy referred primarily to the ability to use computers and access digital information. However, the concept has evolved considerably over the past two decades, encompassing a broad range of cognitive, technical, social, and ethical competencies required for effective participation in digital environments. Digital literacy is now recognized as a multidimensional construct that enables individuals to locate, evaluate, create, communicate, and manage information using digital technologies while exercising critical thinking, creativity, collaboration, and responsible digital citizenship.

The term digital literacy was first introduced by Paul Gilster (1997), who described it as the ability to understand and use information from multiple digital sources. Gilster argued that digital literacy extends beyond technical competence and requires individuals to think critically about the information they encounter in digital environments. His work laid the foundation for subsequent frameworks that emphasize digital literacy as an essential life skill rather than merely a technological ability.

Contemporary scholars have expanded the concept significantly. According to UNESCO (2023), digital literacy encompasses the knowledge, skills, attitudes, and values necessary to access, analyse, evaluate, create, and communicate information safely and ethically through digital technologies. Similarly, the European Commission's Digital Competence Framework (DigComp 2.2) identifies digital literacy as comprising five major competency areas: information and data literacy, communication and collaboration,

digital content creation, safety, and problem-solving. These frameworks demonstrate that digital literacy is increasingly viewed as a lifelong learning competency essential for educational success, employability, and active citizenship.

In educational settings, digital literacy enables learners to engage effectively with online learning environments, digital libraries, virtual classrooms, educational applications, and Artificial Intelligence (AI)-assisted learning tools. Learners possessing strong digital literacy skills are better equipped to identify credible sources of information, evaluate online content critically, collaborate with peers through digital platforms, create multimedia content, and solve complex problems using technology. Consequently, digital literacy has become a prerequisite for academic achievement and lifelong learning in the twenty-first century.

For women, digital literacy assumes even greater significance because it facilitates access to education, employment opportunities, entrepreneurship, financial services, healthcare, government welfare programmes, and civic participation. Women equipped with digital competencies are more likely to participate in online education, digital banking, e-commerce, telemedicine, and skill development programmes. Thus, digital literacy functions as a transformative tool that promotes women's empowerment, reduces gender inequalities, and enhances social inclusion.

2.2 Information and Communication Technology (ICT) in Education

Information and Communication Technology (ICT) refers to a broad range of digital technologies used to create, store, process, transmit, and exchange information. These technologies include computers, smartphones, tablets, the internet, cloud computing, digital communication platforms, educational software, multimedia resources, learning management systems, and mobile applications. ICT has fundamentally transformed educational practices by making learning more interactive, collaborative, flexible, and learner-centred.

The integration of ICT into education has significantly improved teaching-learning processes by providing access to diverse learning resources, facilitating communication between teachers and learners, and supporting innovative pedagogical practices. Digital classrooms, virtual laboratories, online assessment systems, and open educational resources have expanded learning opportunities beyond traditional classroom settings. ICT also enables personalized learning experiences by allowing learners to progress at their own pace and access educational content anytime and anywhere.

The National Education Policy (NEP) 2020 recognizes ICT as an essential component of educational reform in India. It advocates the effective integration of digital technologies into curriculum design, teacher education, assessment practices, and lifelong learning initiatives. Furthermore, initiatives such as Digital India, DIKSHA, SWAYAM, e-Pathshala, and PMGDISHA have significantly expanded digital learning opportunities for students, teachers, and adult learners across the country.

For women, ICT provides numerous opportunities for educational advancement and socio-economic development. Through digital platforms, women can pursue higher education, vocational training, entrepreneurship, online employment, financial literacy, and professional networking. ICT also facilitates participation in self-help groups, digital marketing, telemedicine, agricultural extension services, and government welfare programmes. Consequently, ICT has become an important instrument for promoting women's empowerment and reducing educational and economic disparities.

2.3 Digital Literacy and Women's Empowerment

Women's empowerment refers to the process through which women gain the knowledge, skills, confidence, autonomy, and opportunities necessary to participate fully in economic, social, political, and

cultural life. In the digital era, digital literacy has emerged as one of the most influential drivers of women's empowerment because it enables women to access information, acquire education, develop professional skills, engage in entrepreneurship, and participate in decision-making processes.

Digital literacy enhances women's educational opportunities by facilitating access to online learning platforms, digital libraries, virtual classrooms, and Massive Open Online Courses (MOOCs). Women can pursue formal education, professional certification, and lifelong learning regardless of geographical or social constraints. Additionally, digital literacy promotes financial inclusion by enabling women to utilize digital banking services, mobile payment systems, online marketplaces, and e-commerce platforms. Such competencies contribute to increased economic independence and entrepreneurial success.

Digital literacy also strengthens women's participation in governance and civic engagement by improving access to government services, digital identity systems, healthcare information, legal awareness, and social support networks. Moreover, digital technologies facilitate communication, collaboration, and leadership within communities, thereby enhancing women's confidence and social participation.

Despite these opportunities, several challenges continue to hinder women's digital empowerment in India. These include unequal access to digital devices, limited internet connectivity in rural areas, affordability issues, low educational attainment, cultural restrictions, gender stereotypes, digital safety concerns, and inadequate digital skills training. Therefore, promoting women's digital literacy requires coordinated efforts involving government agencies, educational institutions, civil society organizations, and the private sector to ensure equitable digital inclusion.

2.4 Artificial Intelligence and the Future of Women's Digital Literacy

The rapid advancement of Artificial Intelligence (AI) has further expanded the scope of digital literacy. AI-powered technologies such as intelligent tutoring systems, virtual assistants, generative AI applications, personalized learning platforms, automated translation tools, and predictive analytics are transforming education and professional development. Consequently, women require additional competencies related to AI literacy, including understanding AI-generated content, evaluating algorithmic decisions, protecting digital privacy, and using AI responsibly and ethically.

Developing AI-related digital competencies will enable women not only to participate effectively in the digital economy but also to contribute to innovation, research, entrepreneurship, and leadership in technology-driven sectors. Therefore, future digital literacy programmes should integrate AI literacy, ethical technology use, cybersecurity awareness, and digital problem-solving to prepare women for emerging educational and employment opportunities.

Overall, the conceptual relationship between digital literacy, ICT, AI, and women's empowerment demonstrates that digital competence has become a fundamental requirement for inclusive education, sustainable development, gender equality, and lifelong learning. Strengthening these competencies among women will contribute significantly to achieving an equitable and digitally inclusive society.

3. Review of Related Literature

The growing importance of digital literacy has attracted considerable attention from researchers, policymakers, and international organizations over the past decade. Between 2020 and 2026, research increasingly shifted from viewing digital literacy as a basic technological skill to recognizing it as a multidimensional competency that contributes to educational achievement, economic participation, social inclusion, and women's empowerment. In the Indian context, digital literacy has gained prominence through national initiatives aimed at promoting digital inclusion and reducing gender disparities. The

following review critically examines recent literature under major thematic areas relevant to women's digital literacy and empowerment.

3.1 Digital Literacy and Women's Empowerment

Recent studies consistently demonstrate that digital literacy is a powerful enabler of women's empowerment. Rather than merely teaching women how to use digital devices, digital literacy equips them with the knowledge and confidence to access education, employment, healthcare, financial services, entrepreneurship opportunities, and government welfare programmes. Consequently, digital literacy has emerged as a key determinant of women's participation in the digital economy and knowledge society.

A review by Lalrinsangi and Kharbiryumbai (2024) examined the contribution of Information and Communication Technology (ICT) to women's empowerment. The authors reported that ICT has expanded educational opportunities through online learning platforms, improved women's access to employment and entrepreneurship, strengthened financial independence, and enhanced political and social participation. The review emphasized that ICT enables women to overcome geographical and social barriers by providing flexible access to information and learning resources. At the same time, the authors argued that meaningful empowerment requires continuous digital skill development rather than simple access to digital technologies.

Similarly, Halder (2026) analysed the relationship between digital literacy and women's empowerment in India and concluded that digital literacy has become a prerequisite for meaningful participation in contemporary society. The study highlighted that digitally literate women are better positioned to access online education, digital financial services, e-commerce, healthcare information, and employment opportunities. However, persistent barriers such as inadequate infrastructure, gender stereotypes, affordability, language diversity, and concerns about online safety continue to limit women's digital participation. The study recommended sustained investment in digital education, community-based training, and stronger legal protections to ensure inclusive digital empowerment.

A comprehensive review of government initiatives by Shailini Dixit and colleagues (2026) examined major programmes implemented under the Digital India framework. The authors observed that initiatives such as the National Digital Literacy Mission, Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA), Common Service Centres, and digital financial inclusion programmes have substantially expanded opportunities for women to acquire basic digital skills. Nevertheless, the review argued that policy efforts should move beyond one-time digital training towards sustained, livelihood-oriented digital capability that enables women to participate confidently in education, employment, entrepreneurship, and public life.

Recent international evidence also supports these findings. Chen et al. (2026) conducted a systematic review and meta-analysis on gender differences in digital literacy across different age groups and socio-cultural contexts. Their analysis revealed that gender differences in digital literacy are influenced not only by access to technology but also by educational opportunities, cultural expectations, socioeconomic status, and institutional support. The review concluded that targeted educational interventions and supportive learning environments can substantially reduce gender disparities in digital competence.

The relationship between digital literacy and women's health has also received growing attention. A scoping review of digital technologies for healthcare access in India found that mobile applications, telemedicine services, voice-response systems, and digital communication platforms significantly improved women's access to maternal and child healthcare information. The review emphasized that

improving digital literacy among women is essential for maximizing the benefits of these technologies and reducing inequalities in healthcare access.

Collectively, these studies indicate that digital literacy is a multidimensional capability that contributes directly to women's educational advancement, financial inclusion, health awareness, entrepreneurship, and social participation. However, they also demonstrate that sustainable empowerment depends upon addressing structural barriers such as unequal digital access, affordability, digital safety, and gender-sensitive policy implementation.

3.2 Emerging Trends in Women's Digital Literacy

Recent scholarship suggests that women's digital literacy is entering a new phase shaped by Artificial Intelligence, digital public infrastructure, and online learning ecosystems. Researchers increasingly argue that women require competencies extending beyond basic ICT use to include critical information evaluation, AI awareness, cybersecurity, digital ethics, and responsible online participation. Emerging technologies provide unprecedented opportunities for women to learn, work, innovate, and lead, but these opportunities can only be realized through comprehensive digital capability development supported by inclusive educational policies and institutional commitment.

Overall, the literature published between 2020 and 2026 demonstrates a clear transition from viewing digital literacy as a technical competency to recognizing it as a transformative mechanism for achieving women's empowerment, gender equality, and sustainable development within the digital age.

3.2 ICT in Women's Education and Skill Development

Information and Communication Technology (ICT) has transformed women's education and skill development by creating flexible, accessible, and inclusive learning opportunities. Over the past decade, digital technologies have enabled women to overcome many traditional barriers associated with geographical isolation, social restrictions, financial limitations, and limited educational infrastructure. The widespread availability of smartphones, internet connectivity, digital learning platforms, and online certification programmes has significantly expanded opportunities for women to acquire knowledge, develop professional competencies, and participate in lifelong learning. Consequently, ICT has become a critical instrument for enhancing women's educational attainment, employability, entrepreneurship, and socio-economic empowerment.

Recent literature indicates that ICT has shifted educational practices from conventional classroom instruction to learner-centred, technology-enabled environments. Online learning platforms, virtual classrooms, Massive Open Online Courses (MOOCs), digital libraries, educational applications, and video-based learning resources have enabled women to pursue formal and informal education irrespective of age, location, or family responsibilities. These flexible learning opportunities are particularly beneficial for women who are unable to attend regular educational institutions because of domestic responsibilities, employment commitments, or socio-cultural constraints. Researchers therefore argue that ICT has democratized access to education by reducing inequalities in learning opportunities and supporting continuous skill development.

Lalrinsangi and Kharbiryumbai (2024) reviewed the contribution of ICT to women's empowerment and observed that digital technologies have significantly expanded educational access for women through online learning platforms, digital resources, and virtual communication networks. The authors reported that ICT facilitates professional development, entrepreneurship, financial independence, and political participation by providing women with greater access to information and learning opportunities. They further emphasized that digital education enables women to acquire both technical and life skills that

enhance their confidence and decision-making capacity. However, the review cautioned that equitable access to ICT infrastructure and continuous digital skill development are essential for ensuring sustainable empowerment.

The relationship between ICT and skill development has also been highlighted in recent research on India's digital transformation. Sheikh and Nath (2026) examined the impact of educational digitalization on access, quality, and inclusivity in India. Their findings indicated that digital technologies have expanded educational opportunities by improving access to online learning, digital content, and technology-supported teaching. The study concluded that ICT contributes significantly to inclusive education when supported by adequate infrastructure, teacher preparedness, and learner-centred pedagogical practices. Nevertheless, disparities in digital access, particularly among rural women and economically disadvantaged communities, continue to limit the full benefits of educational digitalization.

A systematic review by De Lorenzo, Musso, Bono, Martin, and Rabaglietti (2026) explored the role of ICT in developing life skills within STEM education, with particular attention to gender-related outcomes. The review found that digital tools such as educational applications, robotics, game-based learning, and programming environments enhanced learners' critical thinking, creativity, problem-solving abilities, self-regulation, and communication skills. Importantly, ICT-supported learning environments showed considerable potential for improving female students' confidence and participation in technology-oriented disciplines, although the authors recommended further longitudinal research to strengthen the evidence base.

The emergence of Artificial Intelligence (AI) has further expanded opportunities for women's education and career development. Portell-Fonolla and colleagues (2026), in a scoping review, reported that AI-enabled career guidance systems, intelligent learning platforms, and personalized digital support tools can assist women in identifying educational pathways, developing career-related competencies, and accessing professional opportunities. However, the review emphasized that the effectiveness of these technologies depends upon women's digital literacy, institutional support, and equitable access to digital resources.

Recent evidence also suggests that ICT-based skill development programmes play a vital role in promoting women's employability and entrepreneurship. Digital platforms now provide training in financial literacy, e-commerce, digital marketing, coding, communication skills, and vocational competencies that prepare women for participation in the digital economy. Such programmes are particularly valuable for women in rural and semi-urban areas, where conventional educational and employment opportunities may be limited. Digital skills acquired through ICT not only improve employment prospects but also encourage self-employment, innovation, and participation in online markets.

Despite these positive developments, researchers consistently identify several barriers that limit women's effective participation in ICT-enabled education. Limited digital infrastructure, inadequate internet connectivity, affordability of digital devices, insufficient digital literacy, language barriers, and concerns regarding online safety continue to restrict women's access to technology-based learning. These challenges are particularly evident among marginalized communities, where educational inequalities intersect with socio-economic and cultural constraints. Consequently, scholars recommend strengthening digital infrastructure, expanding community-based digital training programmes, improving teacher capacity, and designing gender-responsive ICT policies that promote inclusive and equitable learning opportunities.

Overall, the literature demonstrates that ICT has become a transformative force in women's education and skill development. By expanding access to knowledge, supporting flexible learning, enhancing employability, and fostering entrepreneurship, ICT contributes significantly to women's empowerment

and social inclusion. However, the long-term success of ICT-enabled educational initiatives depends upon sustained investments in digital literacy, inclusive infrastructure, institutional support, and policies that address the diverse needs of women across different social and economic contexts.

3.3 ICT, Digital Inclusion, and Women's Skill Development: Recent Studies

The increasing adoption of Information and Communication Technology (ICT) has transformed women's access to education, vocational training, employment, and entrepreneurship. Recent research published between 2020 and 2026 consistently indicates that ICT is a catalyst for women's empowerment when accompanied by digital literacy, institutional support, and inclusive public policies. However, researchers also emphasize that meaningful digital inclusion extends beyond access to technology and requires sustained investments in digital competencies, digital safety, and lifelong learning.

Bond et al. (2021) examined the role of digital technologies in higher education and reported that ICT-supported learning environments significantly improved student engagement, collaborative learning, and academic achievement. The review emphasized that the effectiveness of ICT depends on teachers' digital competence, learner motivation, and appropriate pedagogical design rather than technology alone. The authors concluded that educational institutions should integrate digital literacy into curricula while strengthening teacher professional development to ensure equitable learning opportunities.

Tang and Chaw (2021) investigated the relationship between digital literacy and lifelong learning among university students. The study found that digitally literate learners demonstrated greater confidence in online learning, independent problem-solving, and information evaluation. The researchers argued that digital literacy enables learners, particularly women, to participate more effectively in higher education and continuous professional development by strengthening self-directed learning and adaptability in technology-rich environments.

Tinmaz et al. (2022) conducted a systematic review of digital literacy research and observed a significant shift from technical computer skills towards broader competencies that include information evaluation, digital communication, collaboration, critical thinking, digital ethics, and responsible technology use. The review highlighted that digital literacy has become an essential competency for education, employment, and civic participation, particularly as Artificial Intelligence becomes increasingly integrated into educational systems.

UNESCO (2023) emphasized that digital literacy is fundamental to achieving equitable and inclusive education. The organization argued that digital competence enables women and girls to access educational opportunities, participate in digital economies, utilize public services, and engage actively in community development. UNESCO recommended integrating digital literacy into school curricula, adult education programmes, and teacher education while promoting gender-responsive digital policies that reduce educational inequalities.

OECD (2023) highlighted that digital competence has become a core employability skill in knowledge-based economies. The report noted that individuals possessing strong digital literacy demonstrate greater adaptability, innovation, and employment readiness. For women, digital competence contributes to improved labour-market participation, entrepreneurial opportunities, and financial inclusion through access to digital platforms and online services.

Chiu (2024) examined the growing relationship between Artificial Intelligence and digital literacy. The study argued that traditional digital literacy frameworks should be expanded to include AI literacy, enabling learners to understand AI-generated content, recognize algorithmic bias, evaluate information

critically, and use intelligent technologies responsibly. The author concluded that AI literacy represents an essential extension of digital literacy in contemporary education and workforce preparation.

Nguyen and Habók (2024) investigated digital literacy among university students in technology-supported learning environments. Their findings indicated that higher levels of digital competence were positively associated with academic achievement, self-regulated learning, motivation, and online collaboration. The study also emphasized the importance of teacher support and institutional infrastructure in helping learners effectively utilize digital technologies.

Chen, Guo, and Liang (2026) conducted a systematic review and meta-analysis examining gender differences in digital literacy across educational stages and socio-cultural contexts. Synthesizing evidence from 43 studies, the authors found that gender differences in digital literacy are shaped by educational opportunities, cultural contexts, socioeconomic conditions, and institutional support rather than by technology access alone. The review recommended gender-sensitive educational interventions to reduce digital inequalities and strengthen girls' and women's participation in digital learning.

A recent systematic review by Springer Nature (2026) synthesized empirical research on digital literacy in higher education and identified learner agency, institutional support, teacher competence, student engagement, assessment practices, and pedagogical innovation as critical determinants of successful digital literacy development. The review concluded that sustainable digital transformation requires coordinated institutional strategies alongside investments in learner-centred teaching and continuous professional development.

Williams, Blackmore, Berretta, and Mansfield (2025) systematically reviewed the factors influencing women who seek to upskill or reskill for careers in ICT. The review found that positive workplace experiences, awareness of career opportunities, flexible learning pathways, and supportive mentors encourage women to pursue ICT careers. Conversely, self-doubt, gender stereotypes, and limited confidence remain important barriers. The authors recommended targeted digital training, mentoring programmes, and inclusive institutional practices to increase women's participation in technology-related professions.

3.4 Synthesis

The reviewed studies consistently demonstrate that ICT and digital literacy are closely linked to women's educational attainment, lifelong learning, employability, entrepreneurship, and social inclusion. While expanding digital infrastructure has increased opportunities for women, meaningful empowerment depends on the development of advanced digital competencies, supportive institutional environments, and gender-responsive policies. The literature further indicates that the emergence of Artificial Intelligence requires an expanded understanding of digital literacy that incorporates AI literacy, ethical technology use, and critical evaluation of digital information. Collectively, these findings reinforce the view that strengthening women's digital literacy is essential for achieving gender equality, inclusive development, and sustainable participation in the digital economy.

3.5 Research Gap

The review of recent literature published between 2020 and 2026 demonstrates that substantial progress has been made in understanding the relationship between digital literacy, ICT, and women's empowerment. Existing studies have consistently reported that digital literacy enhances women's educational participation, employability, financial inclusion, entrepreneurship, healthcare access, and civic engagement. Similarly, research has highlighted the transformative role of ICT in facilitating lifelong

learning, digital communication, and socio-economic development. Despite these important contributions, several significant research gaps remain.

First, a considerable proportion of existing studies have focused primarily on digital access and basic digital skills, while relatively fewer investigations have examined advanced digital competencies such as information evaluation, digital content creation, critical thinking, cybersecurity awareness, digital citizenship, and Artificial Intelligence (AI) literacy. As digital technologies become increasingly sophisticated, there is a growing need to explore how women develop these higher-order digital competencies and how they influence long-term educational and professional outcomes.

Second, although numerous studies have examined digital literacy among students and the general population, research specifically focusing on Indian women across diverse socio-economic, educational, and geographical backgrounds remains limited. Many studies have concentrated on urban populations or higher education contexts, with comparatively little attention given to rural women, women from marginalized communities, adult learners, self-help groups, informal workers, and women entrepreneurs. Consequently, there is insufficient evidence regarding the unique challenges and opportunities experienced by different groups of women within India's diverse social and cultural landscape.

Third, recent technological developments, particularly the rapid emergence of Artificial Intelligence (AI), generative AI tools, and intelligent digital learning platforms, have fundamentally transformed digital environments. However, current literature provides limited empirical evidence on how Indian women understand, adopt, and use AI-enabled technologies for education, employment, entrepreneurship, and decision-making. Research examining AI literacy as an extension of digital literacy remains in its early stages and requires further exploration.

Fourth, while several government initiatives—including Digital India, Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA), BharatNet, Skill India, and the National Education Policy (NEP) 2020—have aimed to improve digital inclusion, relatively few studies have comprehensively evaluated their long-term effectiveness in enhancing women's digital literacy, employability, financial independence, and social empowerment. Systematic evaluations of these initiatives across different regions of India are still limited.

Fifth, most existing studies have adopted cross-sectional research designs, providing only a snapshot of women's digital literacy at a particular point in time. There is a lack of longitudinal research investigating how digital literacy develops over time and how it contributes to sustained educational achievement, career progression, entrepreneurship, leadership, and social mobility. Longitudinal and mixed-methods studies would provide deeper insights into the long-term impact of digital literacy programmes on women's lives. Finally, although the literature acknowledges barriers such as the gender digital divide, affordability, inadequate infrastructure, language diversity, socio-cultural norms, and online safety concerns, relatively few studies propose integrated, evidence-based strategies that simultaneously address technological, educational, social, and policy-related challenges. More interdisciplinary research is therefore needed to design inclusive digital literacy programmes that respond to the diverse needs of women across different regions and communities in India.

In view of these gaps, the present review seeks to synthesize recent evidence on digital literacy, ICT, and women's empowerment from an Indian perspective. By critically examining contemporary research, emerging technologies, government initiatives, and policy developments, this review contributes to a more comprehensive understanding of how digital literacy can serve as a transformative instrument for

empowering women in the age of ICT while identifying directions for future research, educational practice, and policy formulation.

4. Government Initiatives for Promoting Women's Digital Literacy in India

The Government of India has introduced several initiatives to strengthen digital literacy and bridge the digital divide, particularly among women and other marginalized groups. These programmes recognize that digital literacy is essential not only for accessing information but also for improving educational attainment, financial inclusion, employment opportunities, entrepreneurship, healthcare, and participation in governance. Over the last decade, digital transformation has become a national priority, with policies focusing on expanding digital infrastructure, enhancing internet connectivity, promoting digital education, and developing citizens' digital competencies. Collectively, these initiatives contribute significantly to empowering women through technology and supporting inclusive socio-economic development.

One of the most influential initiatives is the Digital India Programme, launched in 2015 to transform India into a digitally empowered society and knowledge economy. The programme aims to provide universal digital infrastructure, improve access to high-speed internet, expand digital public services, and promote digital literacy across the country. For women, Digital India has created opportunities to access online education, digital banking, telemedicine, e-governance services, and e-commerce platforms. Through digital service delivery and mobile-based applications, women are increasingly able to participate in educational programmes, access welfare schemes, and engage in entrepreneurial activities without geographical constraints. The programme has also encouraged the establishment of digital learning centres and community service facilities that support women's digital inclusion.

Another landmark initiative is the Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA), which specifically targets digital literacy among rural households. The programme aims to equip at least one individual from every eligible rural household with basic digital skills, enabling beneficiaries to operate digital devices, access online information, communicate through digital platforms, and utilize government services. Women constitute a substantial proportion of PMGDISHA beneficiaries, reflecting the programme's emphasis on reducing gender disparities in digital literacy. Research indicates that women trained under PMGDISHA demonstrate increased confidence in using smartphones, accessing online educational resources, utilizing digital payment systems, and communicating through digital applications. Nevertheless, researchers also emphasize the need for advanced digital training that extends beyond basic operational skills to include digital problem-solving, cybersecurity awareness, and digital entrepreneurship.

The National Education Policy (NEP) 2020 further reinforces the importance of digital literacy by advocating the integration of technology into teaching, learning, teacher education, and lifelong learning. The policy emphasizes equitable access to digital education, particularly for girls and disadvantaged learners. It encourages educational institutions to adopt blended learning, digital assessment, online teacher training, and technology-enabled pedagogical practices. By promoting digital competence among learners and educators, NEP 2020 provides an important policy framework for enhancing women's educational participation in the digital era.

The Skill India Mission complements these initiatives by providing vocational education and digital skill training that improves women's employability and entrepreneurship. Through various training centres and online learning platforms, women acquire competencies in information technology, digital marketing, financial literacy, e-commerce, communication skills, and entrepreneurship. These programmes

contribute to economic empowerment by preparing women for employment in technology-driven sectors and enabling them to establish small businesses using digital platforms.

The BharatNet Project has significantly expanded broadband connectivity to rural areas by extending high-speed internet infrastructure to Gram Panchayats across India. Improved internet connectivity has facilitated access to digital education, telemedicine, online banking, agricultural information, and government services for rural women. Enhanced connectivity also supports self-help groups, women entrepreneurs, and community organizations by enabling participation in online markets and digital capacity-building programmes.

The Government has also promoted digital education through platforms such as DIKSHA, SWAYAM, SWAYAM Prabha, e-Pathshala, and the National Digital Library of India (NDLI). These platforms provide free educational resources, online courses, teacher training programmes, e-books, video lectures, and digital learning materials. Women and girls who are unable to attend conventional educational institutions because of geographical, financial, or family constraints benefit significantly from these flexible learning opportunities. Such initiatives have strengthened lifelong learning and professional development, particularly among female students, teachers, and adult learners.

Financial inclusion initiatives have also played a critical role in strengthening women's digital literacy. The promotion of Unified Payments Interface (UPI), Aadhaar-enabled services, Jan Dhan Yojana, mobile banking, and digital payment systems has encouraged women to participate in formal financial systems. Digital financial literacy enables women to manage savings, conduct secure online transactions, access government subsidies directly, and participate in digital commerce. These developments have contributed to greater economic independence and financial decision-making.

Despite these achievements, several challenges continue to limit the effectiveness of government initiatives. Digital infrastructure remains uneven across regions, particularly in remote rural and tribal areas. Limited internet connectivity, affordability of digital devices, language barriers, inadequate digital awareness, and socio-cultural restrictions continue to affect women's participation in digital learning programmes. In addition, many initiatives focus primarily on basic digital literacy, whereas contemporary educational and employment environments increasingly require advanced competencies such as information evaluation, digital content creation, Artificial Intelligence (AI) literacy, cybersecurity awareness, and digital problem-solving.

Therefore, future government initiatives should prioritize comprehensive digital capability development rather than basic digital training alone. Greater collaboration among government agencies, educational institutions, civil society organizations, and the private sector is essential to provide continuous digital education, gender-sensitive training programmes, affordable internet access, multilingual digital resources, and safe digital environments. Such integrated efforts will strengthen women's digital literacy, promote inclusive participation in the digital economy, and contribute to achieving the Sustainable Development Goals related to quality education, gender equality, and reduced inequalities.

Overall, the Government of India's digital initiatives have created a strong foundation for improving women's digital literacy and digital inclusion. Continued investment in infrastructure, capacity building, advanced digital skills, and AI readiness will be crucial for ensuring that women are fully empowered to participate in India's rapidly evolving digital society and knowledge economy.

5. Challenges to Women's Digital Literacy in India

Despite significant progress in digital transformation and the implementation of several national initiati-

ves, women in India continue to encounter numerous barriers that hinder the effective acquisition and utilization of digital literacy skills. Although the expansion of ICT infrastructure and internet connectivity has increased access to digital technologies, access alone does not guarantee meaningful digital participation. Women's digital empowerment is influenced by a combination of socio-economic, educational, cultural, technological, and institutional factors. Understanding these challenges is essential for designing effective interventions that promote inclusive and sustainable digital literacy.

One of the most significant barriers is the gender digital divide. Studies consistently show that women are less likely than men to own smartphones, have regular internet access, or use digital technologies confidently. This disparity is more pronounced in rural and economically disadvantaged communities, where financial limitations and inadequate infrastructure restrict access to digital devices and internet services. Consequently, many women remain excluded from digital education, online employment opportunities, digital banking, and e-governance services.

Another major challenge is the limited availability of digital infrastructure. Although broadband connectivity has improved through programmes such as BharatNet, many remote villages continue to experience poor internet connectivity, frequent power interruptions, and inadequate technological facilities. Such infrastructural limitations significantly reduce women's opportunities to participate in online learning, skill development programmes, and digital entrepreneurship. The absence of reliable digital infrastructure widens educational inequalities and limits the effectiveness of government digital literacy initiatives.

Economic constraints also contribute substantially to digital exclusion among women. The cost of smartphones, laptops, internet subscriptions, and software applications remains unaffordable for many families. In households with limited financial resources, digital devices are often prioritized for male family members or income-generating activities, leaving women with fewer opportunities to develop digital competencies. As a result, financial inequality directly affects women's ability to access digital learning resources and technology-based services.

The educational background of women is another important determinant of digital literacy. Women with lower levels of formal education often experience difficulties in understanding digital interfaces, evaluating online information, navigating digital platforms, and using advanced technological applications. Language barriers further complicate digital participation because a significant proportion of digital content is available primarily in English. Women who are more comfortable using regional languages may therefore encounter additional challenges while accessing educational resources and online services.

Socio-cultural norms and gender stereotypes continue to restrict women's use of digital technologies in many parts of India. Traditional beliefs regarding gender roles often limit women's educational opportunities, mobility, and independent use of digital devices. In certain communities, women require family permission to access the internet or participate in online learning programmes. Such cultural constraints reduce women's confidence and limit their ability to develop digital competencies necessary for educational and professional advancement.

Concerns regarding cybersecurity, online privacy, and digital safety have emerged as significant barriers to women's digital participation. Incidents of cyberbullying, identity theft, online harassment, misinformation, financial fraud, and misuse of personal information discourage many women from actively engaging with digital platforms. Women frequently express concerns about protecting their privacy while using social media, digital payment systems, and online communication platforms.

Therefore, digital literacy programmes should include comprehensive training in cybersecurity, responsible digital behaviour, and online safety practices.

The rapid emergence of Artificial Intelligence (AI) presents both opportunities and challenges. While AI-powered educational platforms, intelligent tutoring systems, virtual assistants, and digital productivity tools offer personalized learning experiences, many women lack sufficient awareness of AI technologies and their ethical implications. Limited AI literacy may reduce women's ability to critically evaluate AI-generated content, recognize algorithmic bias, and use AI applications responsibly. Consequently, future digital literacy initiatives should integrate AI literacy alongside traditional ICT skills.

Another challenge concerns the digital competence of educators and trainers. Effective digital literacy education depends on teachers who possess strong technological and pedagogical competencies. However, variations in teachers' digital skills, limited professional development opportunities, and inadequate institutional support often affect the quality of ICT integration in educational institutions. Strengthening teacher capacity is therefore essential for promoting high-quality digital education, particularly for girls and women.

Furthermore, regional disparities remain evident across India. Urban women generally benefit from better educational facilities, stronger internet connectivity, and greater exposure to digital technologies than women residing in rural, tribal, and remote areas. These inequalities contribute to unequal educational outcomes and limit opportunities for skill development, employment, and entrepreneurship among disadvantaged populations.

Despite these challenges, recent research suggests that they can be effectively addressed through coordinated policy interventions, community participation, institutional collaboration, and continuous investment in digital education. Expanding affordable internet access, improving digital infrastructure, promoting multilingual educational resources, strengthening cybersecurity awareness, integrating AI literacy into educational curricula, and implementing gender-responsive digital policies are essential strategies for reducing digital inequalities. Community-based digital learning centres, women's self-help groups, public libraries, higher education institutions, and non-governmental organizations can also play an important role in creating supportive learning environments that encourage women to develop digital competencies.

In conclusion, the challenges to women's digital literacy in India are multidimensional and require comprehensive solutions. Addressing technological, economic, educational, social, and cultural barriers simultaneously will enable women to participate more effectively in the digital society. Strengthening digital literacy is not merely a technological objective but a broader developmental strategy that promotes educational equity, economic independence, social inclusion, and gender equality. Empowering women with advanced digital competencies will contribute significantly to India's vision of an inclusive digital economy and sustainable national development.

6. Strategies and Policy Recommendations for Strengthening Women's Digital Literacy in India

Digital literacy has emerged as a fundamental competency for women's educational advancement, economic independence, and social empowerment in the twenty-first century. While India has made considerable progress through various digital initiatives, persistent disparities in access, affordability, digital skills, and technology use continue to hinder women's meaningful participation in the digital ecosystem. Therefore, comprehensive and gender-responsive strategies are essential to strengthen

women's digital literacy and ensure that digital transformation contributes to inclusive and sustainable development.

6.1 Expanding Digital Infrastructure

The Government should continue investing in high-speed internet connectivity, particularly in rural, tribal, and geographically remote regions. Strengthening broadband infrastructure through initiatives such as BharatNet will reduce regional disparities and ensure equitable access to digital education, healthcare, financial services, and e-governance. Community Digital Learning Centres equipped with computers, internet facilities, and trained instructors should be established to support women who lack access to digital devices at home.

6.2 Promoting Gender-Responsive Digital Education

Digital literacy should be integrated into school curricula, higher education, vocational education, and adult literacy programmes. Educational institutions should provide structured training in information literacy, digital communication, online collaboration, digital content creation, cybersecurity, Artificial Intelligence (AI) literacy, and responsible digital citizenship. Gender-sensitive teaching strategies should encourage girls and women to participate confidently in Science, Technology, Engineering, and Mathematics (STEM) education and technology-related careers.

6.3 Strengthening Teacher Capacity

Teachers play a central role in promoting digital literacy. Continuous professional development programmes should be organized to enhance teachers' technological, pedagogical, and AI-related competencies. Training should focus on learner-centred teaching, blended learning, digital assessment, educational technologies, and ethical technology use. Well-trained educators can effectively guide women learners in acquiring advanced digital competencies required for lifelong learning and employment.

6.4 Promoting Financial and Digital Inclusion

Affordable smartphones, subsidized internet services, digital devices, and digital banking facilities should be made accessible to women from economically disadvantaged communities. Digital financial literacy programmes should educate women about online banking, Unified Payments Interface (UPI), digital wallets, cybersecurity, and financial management. Such initiatives will strengthen women's economic independence and participation in the digital economy.

6.5 Enhancing Cybersecurity Awareness

Digital literacy programmes should include comprehensive training on online safety, cybersecurity, privacy protection, cyberbullying prevention, responsible social media use, and digital ethics. Women should be equipped with practical knowledge to recognize cyber threats, protect personal information, identify misinformation, and report cybercrime. Developing safe digital environments will increase women's confidence in using digital technologies.

6.6 Integrating Artificial Intelligence Literacy

The rapid emergence of Artificial Intelligence requires digital literacy programmes to move beyond basic ICT skills. Women should be trained to understand AI-powered applications, evaluate AI-generated information critically, recognize algorithmic bias, and use AI tools ethically and responsibly. AI literacy will prepare women for emerging educational opportunities, future workplaces, entrepreneurship, and technology-driven innovation.

6.7 Strengthening Community Participation

Community organizations, Self-Help Groups (SHGs), non-governmental organizations, higher education institutions, and local governments should collaborate to organize digital literacy campaigns, workshops,

mentoring programmes, and peer-learning initiatives. Women who have successfully acquired digital competencies can serve as community mentors, encouraging greater participation and reducing technology-related anxieties among other women.

6.8 Promoting Inclusive Public Policies

Future digital policies should adopt a gender-responsive approach that prioritizes women from rural areas, marginalized communities, minority groups, and economically weaker sections. Policymakers should regularly evaluate digital literacy programmes to assess their effectiveness, identify implementation challenges, and improve programme quality. Strong partnerships among government agencies, educational institutions, private organizations, and civil society will ensure sustainable digital inclusion.

6.9 Encouraging Research and Innovation

Higher education institutions and research organizations should undertake interdisciplinary research examining women's digital literacy, ICT integration, AI literacy, digital entrepreneurship, and emerging technologies. Longitudinal studies evaluating the long-term impact of digital literacy interventions will provide valuable evidence for improving educational policies and programme implementation.

Overall, strengthening women's digital literacy requires coordinated efforts that combine technological infrastructure, educational reforms, institutional support, policy innovation, and community engagement. Such integrated strategies will enable women to participate confidently and productively in India's rapidly evolving digital society.

7. Future Directions

The future of women's digital literacy will be shaped by rapid advancements in Artificial Intelligence, digital public infrastructure, cloud computing, data analytics, and emerging educational technologies. Consequently, digital literacy programmes must evolve continuously to meet changing educational, social, and labour market demands.

Future educational initiatives should prioritize AI literacy, computational thinking, digital creativity, innovation, cybersecurity, and lifelong learning competencies. Universities and teacher education institutions should redesign curricula to prepare women for technology-intensive careers while promoting ethical and responsible technology use.

There is also a need for greater investment in multilingual digital educational resources that accommodate India's linguistic diversity. Artificial Intelligence-powered translation systems and adaptive learning technologies can significantly improve educational accessibility for women residing in rural and underserved communities.

Future research should explore the long-term effects of digital literacy on women's educational achievement, employment outcomes, entrepreneurship, leadership, political participation, financial inclusion, and social empowerment. Comparative studies across different Indian states and socio-economic groups would contribute valuable insights into regional disparities and effective intervention strategies.

Finally, achieving sustainable digital empowerment requires collaboration among governments, educational institutions, industries, civil society organizations, and international agencies. Such partnerships will facilitate innovation, knowledge sharing, capacity building, and evidence-based policymaking that supports inclusive digital development.

8. Conclusion

Digital literacy has become an indispensable competency in the twenty-first century, serving as a foundation for education, employment, entrepreneurship, financial inclusion, healthcare access, and active citizenship. This review has demonstrated that Information and Communication Technology (ICT) has significantly expanded educational and economic opportunities for women in India by improving access to digital learning, communication, government services, and digital financial systems. Recent literature published between 2020 and 2026 consistently indicates that women possessing strong digital literacy skills are better equipped to participate effectively in the knowledge economy and contribute to national development.

The review also reveals that despite substantial progress through initiatives such as Digital India, PMGDISHA, Skill India, BharatNet, and the National Education Policy 2020, considerable challenges remain. The gender digital divide, inadequate digital infrastructure, affordability constraints, socio-cultural barriers, limited digital skills, cybersecurity concerns, and unequal educational opportunities continue to restrict women's meaningful participation in digital society. Addressing these challenges requires coordinated policy interventions, sustained investment in digital education, gender-sensitive training programmes, and equitable access to technology.

Furthermore, the emergence of Artificial Intelligence has expanded the scope of digital literacy beyond basic ICT competencies. Women now require advanced capabilities in AI literacy, critical thinking, digital ethics, cybersecurity, information evaluation, and responsible technology use to succeed in increasingly digital educational and professional environments.

In conclusion, empowering women through digital literacy is not merely an educational objective but a national development priority. Strengthening women's digital competencies will enhance educational achievement, economic independence, entrepreneurship, leadership, and social inclusion while contributing directly to the achievement of the Sustainable Development Goals, particularly Quality Education (SDG 4), Gender Equality (SDG 5), Decent Work and Economic Growth (SDG 8), and Reduced Inequalities (SDG 10). A collaborative approach involving government, educational institutions, industry, civil society, and local communities is essential to build an inclusive digital ecosystem in which every woman has the opportunity to learn, innovate, lead, and thrive in the digital age.

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