

# The Role of Technology in Women's Empowerment in Professional Education: Opportunities, Challenges, and Pathways Forward

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## ABSTRACT

This paper explores how technology can empower women through professional education, particularly in fields like science, engineering, medicine, law, and business. It emphasizes the transformative potential of digital platforms, mobile technologies, and online learning environments in expanding access and flexibility for women, especially those from marginalized or rural communities.

Drawing on global literature and case studies, the paper highlights how technology reduces barriers to education and supports continuous professional development. It also stresses that empowerment goes beyond access—it includes agency, confidence, decision-making, and workforce participation.

However, the paper cautions that technology's benefits are not automatic or evenly distributed. Challenges such as the digital divide, gendered cultural norms, limited digital literacy, and unequal access to infrastructure persist. These issues risk deepening existing inequalities unless addressed through targeted interventions.

**KEYWORDS:** *Women Empowerment, Professional Education, Digital Technology, ICTs, Online Learning, Gender Equality, Digital Divide, Self-Efficacy.*

## 1. INTRODUCTION

The 21st century has witnessed a rapid transformation in the way knowledge is accessed, disseminated, and utilized—primarily driven by technological advancements. From online learning platforms to mobile apps and digital classrooms, technology has revolutionized education by breaking down traditional barriers of time, space, and cost. In parallel, the global discourse around gender equality and women's empowerment has gained unprecedented momentum, with education being recognized as a critical pathway toward achieving this goal.

Professional education—covering fields such as engineering, medicine, business, law, and information technology—is particularly significant in this context. It not only enhances individual competencies and employability but also contributes to the socio-economic development of communities and nations. However, despite the growing emphasis on gender equity, women remain underrepresented in many professional and technical domains, especially in

developing and patriarchal societies. Socio-cultural norms, economic constraints, limited mobility, caregiving responsibilities, and institutional biases continue to restrict women's access to and participation in professional education.

### ➤ Background & Importance

The empowerment of women is central to social development, economic growth, and equality. Professional education (fields like engineering, law, medicine, management, technology) plays a crucial role in enabling women to access high-skilled, well-paid careers. Yet many obstacles—cultural norms, infrastructural deficits, lack of access, bias—limit women's participation.

### ➤ Role of Technology

Over the past two decades, advances in information and communication technologies (ICTs), online/distance education, blended models, MOOCs, mobile learning, etc., have opened new opportunities. Technology can reduce barriers of geography, time, cost, and social constraints.

**How to cite this paper:** Dilshad Anjum Gulam Ambiya Khan "The Role of Technology in Women's Empowerment in Professional Education: Opportunities, Challenges, and Pathways Forward" Published in International

Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470,

Volume-9 | Issue-5, October 2025, pp.602-610,

[www.ijtsrd.com/papers/ijtsrd97532.pdf](http://www.ijtsrd.com/papers/ijtsrd97532.pdf)

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### ➤ **Role of Technology in Bridging Gender Gaps**

In this landscape, **technology emerges as a potentially transformative tool**—one that can mitigate structural inequalities and open up new opportunities for women to access quality professional education. Digital platforms, online courses (e.g., MOOCs), mobile learning apps, and virtual classrooms have enabled women to learn at their own pace, often from the comfort of their homes. These tools offer flexibility, convenience, and a diverse array of content that can accommodate various learning needs and lifestyles, particularly for women who are constrained by familial, cultural, or economic factors.

Moreover, technology can help develop **critical digital competencies** that are increasingly required in the 21st-century workforce. It enables women to connect with peers, mentors, and professionals across geographical boundaries, fostering a sense of community and shared learning. When applied inclusively, technology can also act as a levelling force, allowing women from remote or underserved areas to compete and thrive in global professional markets.

### **Problem Statement**

Despite its vast potential, the integration of technology in women's professional education is neither seamless nor universally empowering. A number of **critical challenges** remain unaddressed, including unequal access to digital infrastructure (known as the gender digital divide), lack of digital literacy, absence of gender-sensitive policies, and deep-rooted socio-cultural norms that limit women's freedom and educational aspirations. These issues not only hinder technological empowerment but also risk reinforcing existing inequalities if not properly addressed.

### **Purpose of the Study**

- This research seeks to explore **how technology can act as a catalyst for women's empowerment in the domain of professional education**, while critically analysing the limitations and obstacles that may arise. It aims to:
  - Identify the specific ways in which technology supports or enhances women's access to and success in professional education.
  - Examine the barriers—technical, social, cultural, and institutional—that prevent women from fully

leveraging technology in their educational journeys.

- Propose actionable strategies and policy recommendations to create more inclusive and empowering digital learning ecosystems for women.

### **Research Questions**

1. In what ways does technology contribute to women's empowerment in professional education?
2. What are the constraints or challenges in using technology to empower women in this field?
3. What policy, institutional and pedagogical strategies can enhance technology-mediated empowerment for women?

### **2. Literature Review**

#### ➤ **Global Studies on ICTs & Women Empowerment**

The scoping review by Mackey & Petrucka (2021) shows that ICTs are used for outreach, education, lifestyle, prevention, addressing health challenges, etc. Other studies examined how ICT education influences self-confidence, independence, decision making.

#### ➤ **Professional / Technical / Vocational Education Contexts**

Studies on vocational and technical education (VTE) show that when women acquire technical skills, they gain economic empowerment, improved societal status, ability to make decisions. Also, role of higher education (including professional schools) in raising awareness of rights, enhancing capacity, etc.

#### ➤ **Technology Infrastructure & Digital Divide**

Key constraint: access to technology (internet, devices), especially in rural or socio-economically disadvantaged settings. Also, gendered barriers in how women use technologies. E.g. lower digital literacy, cultural constraints, safety concerns.

#### ➤ **Self-Efficacy, Confidence & Role Models**

Confidence and self-belief play a central role in whether women choose to engage in technical and professional education. Interventions which combine technology with mentorship, peer learning, role models are more effective. (See "Beyond STEM, How Can Women Engage Big Data..." by Samuel et al.)

### 3. Mechanisms: How Technology Empowers Women in Professional Education

Mechanism	Description	Examples/Evidence
<b>Access</b>	Technology reduces physical and geographic barriers (online courses, distance learning)	Women in remote or rural areas able to enroll in professional or technical courses via online or blended modes.
<b>Flexibility</b>	Allowing learning at times that fit domestic or work responsibilities—part-time, asynchronous delivery	Mobile learning, MOOCs, recorded lectures, flexible schedules.
<b>Cost reduction</b>	Technology can reduce costs of travel, accommodation, printed materials, etc.	Open Educational Resources (OER), virtual labs.
<b>Quality &amp; content exposure</b>	Access to rich content, international faculty, platforms, peer interaction, labs/simulations	Virtual labs, collaborative online learning across borders.
<b>Skill building &amp; digital literacy</b>	Digital skills are themselves highly valued, and ICT familiarity boosts employability in professional fields.	Short certifications in data science, programming, design etc., even for those without earlier background.
<b>Agency &amp; self-efficacy</b>	Success in tech-mediated learning builds confidence, decision-making, autonomy	Peer support, mentorship, project work, contributions in tech, etc.
<b>Networking &amp; mentorship</b>	Online communities, forums, professional networks help women see possibilities, get guidance	Women in tech groups, support forums, OSS contributions.

#### 4. Challenges & Barriers

Despite the transformative potential of technology in advancing women's empowerment through professional education, several **persistent challenges and structural barriers** hinder its full realization. These challenges are multifaceted—spanning infrastructural, socio-cultural, economic, institutional, and pedagogical dimensions. Without deliberate intervention, technology risks reinforcing existing inequalities rather than mitigating them.

Below is a comprehensive analysis of the key challenges:

**1. Digital Divide and Infrastructure Deficit:** One of the most fundamental barriers to technology-driven education is the **digital divide**, particularly pronounced in rural and marginalized communities. This includes:

- **Limited access to reliable internet:** Many women, especially in low-income and rural areas, lack access to high-speed or even basic internet connectivity, making it difficult to participate in online or hybrid learning models.
- **Lack of access to devices:** Smartphones, laptops, and tablets remain unaffordable or unavailable for many women, especially in households where male members are prioritized for digital resources.
- **Unreliable electricity supply:** Frequent power cuts or lack of electricity altogether further hinder consistent access to digital learning tools.

#### 2. Socio-Cultural Norms and Gender Stereotypes:

Deep-rooted cultural beliefs and patriarchal norms often limit women's educational aspirations and their engagement with technology:

- **Perception of professional education as a male domain:** Fields such as engineering, IT, or management are often seen as "masculine," discouraging women from pursuing them.
- **Restrictions on mobility and autonomy:** In conservative settings, women may not be allowed to travel for education or access public internet cafes, thereby limiting their opportunities.
- **Domestic responsibilities:** Women are often expected to prioritize household and caregiving duties over education, leaving little time or energy for professional development.
- **Concerns around online safety and social scrutiny:** Families may restrict women's digital access out of fear of cyber harassment, moral policing, or reputational harm.

#### 3. Digital Illiteracy and Skill Gaps

Even when infrastructure is available, **limited digital literacy** among women can be a significant barrier:

- **Lack of basic ICT skills:** Many women, especially those from older generations or disadvantaged backgrounds, are unfamiliar with computers, software, or online platforms.
- **Language and content barriers:** Most digital educational content is in dominant global languages (e.g., English), making it less accessible for non-English speaking women.

- **Limited exposure to online learning formats:** Women may feel overwhelmed by unfamiliar digital interfaces, reducing their confidence and motivation to continue learning.

#### 4. Economic Barriers and Financial Constraints

Economic dependency and financial limitations also restrict women's access to technology-enabled education:

- **Cost of devices and internet:** High costs of smartphones, laptops, and data plans are prohibitive for many women, especially those without independent incomes.
- **Hidden costs of learning:** Even free courses often require paid certification, software, or supplementary materials, which can discourage participation.
- **Gendered economic roles:** In many households, investment in education or technology is prioritized for male members, reinforcing gender disparities.

#### 5. Institutional and Policy-Level Challenges

Educational institutions and policy frameworks often fail to address gender-specific needs in tech-enabled learning:

- **Lack of gender-sensitive curricula and pedagogy:** Teaching materials often ignore or marginalize women's experiences, leading to alienation.
- **Limited representation of women in EdTech leadership:** Women are underrepresented in the design and development of digital learning tools, resulting in platforms that are not inclusive or responsive to women's learning needs.
- **Weak regulatory frameworks:** Inadequate monitoring of online education quality, certification, and data privacy can affect the credibility and safety of women's learning experiences.
- **Insufficient government support:** There is often a lack of targeted financial aid, digital literacy programs, or scholarships specifically aimed at women in professional education.

#### 6. Pedagogical and Design Limitations

The way digital education is delivered can itself act as a barrier:

- **Passive and non-interactive learning formats:** Many online courses rely heavily on one-way content delivery (e.g., videos, slides), which reduces engagement and learning outcomes.
- **Lack of contextual relevance:** Content that fails to reflect women's lived experiences, especially in non-Western contexts, can limit relatability and effectiveness.

- **High attrition in MOOCs and online programs:** Many women drop out of online courses due to lack of support, motivation, or time, which underscores the need for mentorship and follow-up mechanisms.

#### 7. Safety, Privacy, and Psychological Barriers

Concerns around **online safety and psychological wellbeing** are major, yet often overlooked:

- **Cyber harassment and trolling:** Women are disproportionately affected by online abuse, which can deter them from participating in forums, live classes, or discussion groups.
- **Lack of safe digital spaces:** Few platforms offer secure, women-centric learning environments that foster open participation.
- **Imposter syndrome and low self-confidence:** Societal messaging that devalues women's capabilities in professional and technical domains can erode confidence and hinder engagement.

#### 8. Intersectionality and Marginalization

Women are not a homogeneous group—factors such as caste, class, ethnicity, disability, marital status, and location further shape their experiences:

- **Multiple layers of exclusion:** For example, a disabled woman in a rural area may face compounded barriers—physical, digital, economic, and social.
- **Neglect of intersectional needs:** Most interventions and EdTech platforms use a “one-size-fits-all” model, ignoring the nuanced needs of diverse women learners.

#### 5. Empirical Evidence & Case Studies

- **Scoping review outcomes** — Mackey & Petrucka (2021) establish that ICT interventions in education among women contribute to empowerment but measurement is inconsistent.
- **Vocational & Technical Education in India** — The study “Women's Empowerment Through Vocational and Technical Education (VTE)” highlights how VTE under NEP2020 can contribute significantly but faces challenges related to enrolment, resources, retention.
- **ICT Education & Self-Confidence** — “Role of ICT Education for Women Empowerment” in Jaipur (India) shows that training increased self-confidence, sense of independence.

#### 6. Policy, Institutional, and Pedagogical Recommendations

Empowering women through technology-enabled professional education demands a multi-pronged strategy that involves coherent policy frameworks, transformative institutional mechanisms, and gender-responsive pedagogical innovations. The following

recommendations are categorized under three major domains: policy-level, institutional-level, & pedagogical-level interventions.

### 1. Policy-Level Recommendations

Governments and policy-making bodies play a pivotal role in shaping an enabling environment for women's technological empowerment in professional education. Key policy-level actions include:

#### A. Expand Digital Infrastructure and Access

- **Universal internet access:** Prioritize broadband and mobile internet expansion in rural, tribal, and underserved urban areas, where women are disproportionately affected by digital exclusion.
- **Subsidized or free devices:** Provide digital devices (smartphones, laptops) at subsidized rates for girls and women pursuing professional education, especially in low-income households.
- **Public Wi-Fi hubs:** Create safe, women-friendly digital access points in community centers, libraries, schools, and women's hostels.

#### B. Promote Gender-Sensitive EdTech Policies

- **Gender-responsive budgeting:** Allocate specific funds for gender-focused digital literacy, professional training, and mentorship programs.
- **Regulatory frameworks for online safety:** Strengthen laws and enforcement mechanisms to address online harassment, data privacy violations, and cybercrime targeting women.
- **Recognition of online credentials:** Mandate equivalence and credibility of certified online learning (e.g., MOOCs, ODL programs) to traditional degrees in public and private sector employment.

#### C. Incentivize Industry and Public-Private Partnerships

- **CSR initiatives:** Encourage corporations to fund digital upskilling programs for women under Corporate Social Responsibility (CSR) mandates.
- **Collaborative platforms:** Foster partnerships between government, academia, and EdTech companies to co-develop inclusive and affordable learning solutions for women.

#### D. Integration with National Programs

- Align initiatives with national and global frameworks such as:
  - **Digital India**
  - **Skill India Mission**
  - **Beti Bachao, Beti Padhao**
  - **National Education Policy 2020 (NEP)**
  - **Sustainable Development Goals (SDGs)** — especially SDG 4 (Education) and SDG 5 (Gender Equality)

Educational institutions, including universities, professional colleges, open and distance learning (ODL) providers, and vocational training centers, must take proactive steps to foster women's empowerment through technology.

#### E. National Digital Inclusion Policies for Women

- Governments should establish targeted **Digital Inclusion Policies** focusing on gender equity in access to digital tools and platforms.
- Implement schemes for subsidized or free **devices, broadband access, and data packages** specifically for female learners, particularly in rural or marginalized areas.

#### F. Gender-Inclusive EdTech Frameworks

- National education and technology policies (such as NEP 2020 in India) must explicitly integrate **gender-responsiveness** in their goals, budgeting, and implementation guidelines.
- Ensure gender-focused EdTech strategies in collaboration with ministries of education, women & child development, and ICT.

#### G. Funding and Incentives

- Launch **grants, fellowships, or incentives** for educational institutions to develop women-centric digital professional education programs.
- Support Public-Private Partnerships (PPPs) to scale innovative digital solutions for women's skill development and employability.

#### H. Monitoring and Evaluation Mechanisms

- Develop a comprehensive **gender-disaggregated data system** to track women's participation, retention, and progression in digital professional education.
- Mandate **impact assessments** of government and NGO-led EdTech programs based on measurable empowerment indicators (e.g., income gain, job placement, leadership roles).

#### I. Legal Protection in Digital Spaces

- Enact or strengthen legislation on **digital harassment**, ensuring safe virtual learning environments.
- Promote awareness and enforcement of online rights for women learners.

### 2. Institutional-Level Recommendations

#### 2.1. Technology Infrastructure & Support

- Institutions must ensure **equitable digital access** within campuses through computer labs, Wi-Fi hotspots, and device-lending programs.
- Partner with tech companies to offer software and tools (e.g., coding environments, design software) free or at discounted rates for women.

## 2.2. Institutional Gender Inclusion Units

- Establish **Gender Equity Cells** or **Women Empowerment Units** in universities and training centers to guide, support, and monitor women's participation in tech-based education.
- Develop **institutional charters** that mandate gender representation in curriculum design, faculty recruitment, and academic leadership.

## 2.3. Mentorship and Networking Support

- Institutionalize **mentorship programs** pairing female students with professionals, entrepreneurs, or faculty mentors, especially in STEM and professional tracks.
- Facilitate **peer learning circles** and online communities to reduce isolation and enhance persistence among women in digital education.

## 2.4. Career Guidance and Placement Integration

- Strengthen **Career Services Units** to support women's transition from education to employment or entrepreneurship.
- Integrate entrepreneurship incubation hubs and digital freelancing support centers within institutions.

## 2.5. Institutional Accountability

- Require institutions to publish annual **Gender and Digital Inclusion Reports** highlighting achievements, challenges, and plans.

## 2.6. Inclusive Enrollment and Retention Strategies

- **Flexible admissions and academic pathways:** Allow for rolling admissions, re-entry options for women who take academic breaks (e.g., due to childbirth or caregiving).
- **Scholarships and fellowships for women in STEM and professional courses:** Particularly for first-generation learners, rural women, and those from marginalized communities.

## 2.7. Establish Digital Support Ecosystems

- **On-campus digital resource centers:** Equipped with internet-enabled computers, study materials, and trained facilitators to help women students navigate online platforms.
- **Digital literacy and orientation workshops:** Mandatory induction programs for new students to develop ICT skills and familiarize them with digital tools.

## 2.8. Promote Women's Leadership in EdTech

- **Hire and promote women educators in digital education leadership roles:** Ensures representation in course design and decision-making.
- **Support women-led EdTech start-ups and research:** Through incubators, innovation hubs, and seed funding.

## 2.9. Mentorship and Peer-Support Networks

- **Alumni-led mentoring:** Connect current students with successful female graduates in professional fields.
- **Peer-to-peer learning groups:** Encourage collaborative learning and emotional support among women students.

## 2.10. Institutional Safety and Digital Ethics Policies

- Develop and enforce strong **anti-harassment and data privacy policies** for virtual learning environments.
- Appoint gender-sensitized digital grievance officers and create confidential reporting mechanisms.

## 3. Pedagogical-Level Recommendations

### 3.1. Gender-Responsive Curriculum Design

- Revise curricula to include **inclusive case studies, female role models, and gender-sensitive language** across subjects.
- Promote interdisciplinary learning where women can apply digital skills in fields like healthcare, environment, law, and entrepreneurship.

### 3.2. Flexible Learning Models

- Develop and scale **modular, asynchronous, and mobile-based learning** options to accommodate the time constraints faced by women due to domestic and caregiving responsibilities.
- Promote **blended learning models** combining in-person support with online instruction.

### 3.3. Digital Literacy and Foundational Tech Skills

- Integrate foundational **digital literacy modules** as compulsory in the early phase of professional programs.
- Offer **remedial and bridge courses** for women returning to education after career breaks or those without prior tech exposure.

### 3.4. Collaborative and Experiential Learning

- Incorporate **project-based, experiential, and collaborative learning** strategies using digital platforms to build confidence and engagement among women learners.
- Leverage tools like **virtual labs, simulation environments, and gamified learning** to create interactive experiences.

### 3.5. Faculty Sensitization and Capacity Building

- Conduct regular **gender sensitization workshops** for faculty and staff to eliminate unconscious biases.
- Train educators in **inclusive EdTech pedagogy**, effective use of Learning Management Systems (LMS), and culturally responsive teaching practices.

### 3.6. Culturally Responsive and Gender-Inclusive Content

- **Contextual relevance:** Develop learning content that reflects the realities, aspirations, and experiences of women across socio-economic and cultural backgrounds.
- **Gender-balanced representation:** Ensure course materials include examples, role models, and visuals that reflect gender diversity.

### 3.7. Flexible and Modular Learning Design

- **Self-paced modules:** Ideal for women managing household responsibilities or employment alongside education.
- **Micro-credentials and digital badges:** Recognize small learning achievements to build confidence and encourage continued learning.

### 3.8. Active and Experiential Learning

- Use **interactive tools** like simulations, gamification, discussion boards, case studies, and real-world projects to foster deeper engagement.
- Encourage **collaborative projects and team-based learning**, especially with a focus on leadership and problem-solving.

### 3.9. Building Digital and Life Skills

- Integrate modules on:
  - **Digital literacy and cybersecurity**
  - **Professional communication and networking**
  - **Leadership, negotiation, and career planning**
  - **Entrepreneurship and financial literacy**, particularly for women entering business, law, or technical domains.

To fully realize the empowering potential of technology for women in professional education, a **multi-layered approach** is necessary—one that integrates inclusive policy frameworks, responsive institutional mechanisms, and transformative pedagogical practices. The following recommendations address these three critical dimensions:

## 7. Discussion

- **Balancing Opportunities and Risks:** While technology opens doors, there is risk of reinforcing inequalities if only better-off women benefit.
- **Intersectionality:** Women are not homogeneous: intersection of gender with class, caste, race, rural/urban, disability matters. Interventions must consider these.
- **Sustainability and Scalability:** Scaling effective programs requires stable funding, institutional commitment, and capacity building.

- **Changing the Narrative and Culture:** Empowerment also requires changing mindsets in institutions, policy, households.

## 8. Conclusion

In the contemporary era of rapid digital transformation, **technology has emerged as a powerful enabler of educational access, participation, and professional development.** For women—particularly those constrained by geographic, socio-cultural, or economic barriers—technology offers a lifeline to empowerment through professional education. It opens doors to fields and careers that were historically inaccessible or male-dominated, allowing women to acquire credentials, skills, and networks necessary for leadership, economic independence, and social mobility.

Realizing the transformative potential of technology in advancing women's empowerment through professional education requires **coordinated, inclusive, and sustained efforts** across policy, institutional, and pedagogical domains. Policies must ensure access and equity; institutions must create enabling environments and accountability; pedagogy must reflect inclusivity, flexibility, and empowerment at its core.

Without systemic interventions across these domains, the digital divide may persist or even widen existing gender disparities. However, with thoughtful implementation of the above recommendations, technology can become a powerful equalizer and accelerator of women's social and economic mobility through professional education.

This paper has explored the **multifaceted role of technology** in women's empowerment within professional education, identifying **key opportunities, barriers, and pathways forward.**

### The Need for a Holistic and Inclusive Approach

Women's empowerment through technology in professional education cannot be achieved through isolated interventions. A **systems-level transformation** is necessary—one that recognizes and responds to the **intersectionality of gender, class, caste, geography, and ability.**

Governments, educational institutions, EdTech companies, civil society, and local communities must work in collaboration to:

- Design inclusive digital learning environments
- Eliminate socio-cultural and economic barriers
- Institutionalize support structures that facilitate lifelong learning for women
- Ensure that women are not just consumers of technology but **creators, leaders, and decision-makers** in tech-driven education systems

## The Way Forward

To move beyond token inclusion and towards **true empowerment**, future interventions must focus on:

- **Digital equity and justice:** Equal access must be accompanied by equal opportunities to succeed, participate, and lead.
- **Local solutions and contextualization:** One-size-fits-all models fail to address the lived realities of diverse women learners. Programs must be localized and culturally responsive.
- **Scalable and sustainable models:** Pilot programs must be scaled with sustainable funding, policy backing, and ongoing community engagement.
- **Data-driven decision making:** Collect gender-disaggregated data to assess the impact of digital education initiatives and to inform continuous improvement.

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