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Strengthening Integrated Teacher Education Programme Through Information Communication Technology: Government Initiatives For Digital Literacy And Skill Development

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Abstract: Information and Communication Technology (ICT) plays a crucial role in enhancing opportunities, skills, and competencies essential for learners and educators in the digital era. ICT integrates emerging technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), Machine Learning (ML), Augmented and Virtual Reality (AR/VR), Blended Learning, and Open Educational Resources (OERs). These tools make the teaching learning process more creative, collaborative, and engaging. Information and Communication Technology (ICT) provides a creative learning environment that connects learners to real-world experiences and supports continuous assessment through digital platforms, thereby transforming the education system in a rapidly changing world. ICT in education involves the use, adaptation, and sharing of information while ensuring the availability of broadband networks. It also plays a crucial role in bridging the digital divide, which remains a significant challenge in India.

Through this study analyse how the ITEP fosters a variety of competencies, including critical thinking, creativity, communication, collaboration, and digital literacy. It also focuses on developing ethical and reflective practices, cultural sensitivity, and adaptability by ICT skills essential for professional growth and effective classroom engagement. ICT enable program promotes interdisciplinary learning, blending theory with practical experiences through school internships, project-based learning, and community engagement. This study therefore seeks to identify the extent to how ITEP enhances student-teachers' competencies and contributes to their overall professional and personal development, ultimately improving the quality of education.

Keywords: Information Communication Technology in Education, Digital Education, Integrated Teacher Education Programme (ITEP), Online Platforms, ICT-enable Educational Initiatives. Government Digital Learning Initiatives.

I. INTRODUCTION

Information and communication technology (ICT) facilitates immersive and simulated digital environments that require teachers to possess adequate digital skills. It supports the development of high-quality educational e-content for students and teachers, especially those who are marginalized or living in remote areas. ICT promotes a student-centered and collaborative learning environment by fostering open educational resources. It is often emphasized represents the applied dimension of Educational Technology (ET), providing a foundational structure for modern education. Whereases, ICT fosters creative and innovative learning environment while cultivating dynamic technical skills and analytical mindsets essential for learners' overall skill development and the shaping of young minds. Aligned with UNESCO's *Education 2030 Agenda and Sustainable Development Goal 4 (SDG 4)*, information communication technology in education are recognized as essential for preparing learners for the future. Institutions such as *NCERT and CIET* continue to develop digital learning platforms, e-learning systems, and e-schools to build a digitally empowered India.

Various government initiatives aligned with the *National Education Policy (NEP) 2020* aim to provide multimodal access to education through digital, online, and broadcast platforms to minimize learning losses. *The* World Bank Development Report (2021) highlighted that the COVID-19 pandemic severely impacted socio-economic and educational systems, emphasizing the need for sustained financial and human resource investment to ensure data quality and educational equity. The National Education Policy (NEP), 2020 seeks to move away from rote learning toward a more holistic and student-centered approach that prioritizes critical thinking, creativity, and experiential learning. Within the framework of the Integrated Teacher Education Programme (ITEP), this approach aims to create a comprehensive and inclusive learning environment that encourages continuous education and lifelong skill development beyond traditional schooling. In this context, ICT serves as a powerful medium for connecting people, ideas, and places, thereby reducing educational disparities and promoting equity in learning opportunities.

II. Objectives

1. To examine how the Integrated Teacher Education Programme (ITEP) contributes to the development of essential professional skills among student-teachers.
2. To analyze the importance of information and communication technology for developing inclusivity, equity and quality in ITEP
3. To analyze the government policies for strengthening teacher ITEP and ICT in education.
4. To identify the contribution of interventions for proactive step in India's digital journey.

III. Need and Significance of the Study

The study is needed to understand how ICT and government digital initiatives can improve the quality of Integrated Teacher Education Programme. It highlights the significance of digital literacy, modern teaching skills and technology-enabled pedagogy for future teachers, ensuring effective learning, inclusion, and readiness for a rapidly evolving educational environment.

IV. Alignment of ICT and ITEP with National Education Policy 2020

According to the National Education Policy (NEP), 2020, ICT is recognized as an integral part of the Integrated Teacher Education Programme (ITEP). It aims to strengthen pedagogy, improve student engagement, and enhance teacher competencies through the effective use of digital technologies. Prior to the inclusion of ICT, Educational Technology (ET)served as the foundational subject in B.Ed. and M.Ed. curricula, focusing on the holistic development of teacher trainees and introducing them to the use of technology in education. Aligned with the vision of the **National Education Policy (NEP) 2020**, the ITEP aims to revolutionize teacher education by merging academic depth with skill-based learning. It prepares teachers for the new **5+3+3+4** school structure across the Foundational, Preparatory, Middle, and Secondary stages.

The National Curriculum Framework for school education 2023 further acknowledged information and communication technology as a means to improve both information and skills with the use of technology among learners. In today's digital age, AI and other emerging technologies have transformed the ways, knowledge is created, shared, and accessed. ICT enables real-time collaboration, instant information exchange, and interactive learning experiences through high-speed internet and intelligent systems.

Therefore, NEP 2020, strengthening its importance, and the Government of India launched various initiatives such as SWAYAM, DIKSHA, PM e-Vidya, NISHTHA, and e-Pathshala to enhance the quality of education. The COVID-19 pandemic reaffirmed the necessity of ICT, and highlighting its role in ensuring the continuity and resilience of education in challenging times. Hence, Integration of ICT in ITEP is fully aligned with the National Education Policy 2020, which emphasises technology enabled teaching, digital literacy, and innovative pedagogies to prepare future ready teachers.

1. Transforming Teacher Education Through The Integrated Teacher Education Programme

The ITEP, introduced under the *National Education Policy (NEP), 2020*, aims to integrate disciplinary knowledge, pedagogical practices, and technological competencies into a unified framework of teacher education. This holistic program emphasizes experiential, constructivist, and learner-centered approach to prepare future teachers for addressing the dynamic challenges of the 21st-century classroom settings.

Moreover, ITEP's alignment with Information and Communication Technology (ICT) ensures that student-teachers are equipped with the necessary digital skills and pedagogical strategies for technology-integrated teaching. By emphasizing both pedagogical knowledge and professional skills, the Integrated Teacher Education Program aims to produce competent, compassionate, and reflective educators.

Education is the cornerstone of national development and requires educators to be creative, skilled, and adaptive to emerging global needs. The integration of technology in teacher education enhances digital literacy through e-learning platforms and innovative tools, enabling professional growth and lifelong learning. To create a student-centered and modern teacher education system, a committee chaired by **Prof. Poonam Batra** outlined a comprehensive framework in **2014**, proposing a dual-degree structure that integrates subject knowledge, pedagogical skills, and professional ethics. Subsequently, the **National Council for Teacher Education (NCTE)** introduced the **Integrated Teacher Education Programme (ITEP)** in **2019**, publishing specific regulations and a suggestive curriculum framework in the *Official Gazette*.

The four-year program, consisting of **eight semesters including internship**, integrates with major and minor courses (mathematics, science, social sciences, languages, and Art etc.) with core subjects, various professional studies, workshops, seminars and other teacher training subjects such as educational foundations, curriculum design, pedagogy, school practicum and teaching learning programmes. The program offers integrated degrees such as **B.A. B.Ed., B.Sc. B.Ed., and B.Com. B.Ed.** Launched in **pilot mode in 57 teacher education institutions** during the **2023–24 academic session**, ITEP seeks to develop reflective, technologically skilled, and socially responsible educators equipped with **21st-century competencies** and real-world teaching experiences.

2. Transformational Stages of Integrated Teacher Education Program under NCTE and NEP 2020

The Integrated Teacher Education Programme evolved through major reforms beginning with NCTE's 2014 proposal, formalized by the 2019 Gazette notification, strengthened by NEP 2020's vision for integrated teacher preparation, officially notified in 2021, and implemented as a pilot in 57 institutions during 2023–24.

Chronological Hierarchy of ITEP Development in India such as:

I. **Initial Conceptualization (2014):** The National Council for Teacher Education (NCTE) **first introduced the concept** of a *Four-Year Integrated Teacher Education Programme* (ITEP) as part of its vision to reform pre-service teacher preparation.

II. **Policy Formalization (2019):** A **Gazette Notification** was issued by NCTE outlining the regulatory framework for the Four-Year Integrated Teacher Education Programme, marking the formal policy approval.

III. **Alignment with NEP 2020 (2020):** The **National Education Policy (NEP) 2020** emphasized ITEP as the core teacher education pathway. The policy recommended ITEP for both **pre-service and in-service** teachers, offering a *graduation degree with teacher specialization*.

IV. **Official Notification (2021):** NCTE **officially notified ITEP** as a national programme in 2021. This notification aimed at restructuring and strengthening India's teacher education system in alignment with NEP 2020.

V. **Pilot Implementation (2023–24):** In the academic session **2023–24**, ITEP was **launched in 57 Teacher Education Institutions (TEIs)** across India. This pilot rollout was intended to test the programme structure, curriculum design, and implementation strategies before nationwide expansion.

3. Analysing the Importance of ICT in Developing Inclusivity, Equity, and Quality in ITEP

Information and Communication Technology (ICT) play a transformative role in enhancing inclusivity, equity, and quality within the Integrated Teacher Education Programme (ITEP). As envisioned by the National Education Policy (NEP) 2020, ICT serves as a catalyst for innovation in teacher education by integrating digital tools, open educational resources, and blended learning approaches to ensure accessible and equitable learning for all. The use of ICT in ITEP allows teacher trainees to experience diverse, technology-enhanced pedagogies that promote active participation and inclusive teaching practices.

ICT plays a transformative role in promoting equity and quality within the Integrated Teacher Education Programme (ITEP):

I. Emerging technologies such as artificial intelligence enable systems to simulate human abilities like reasoning, learning, and planning supporting adaptive and personalized teacher training. Tools like augmented reality enrich real-world environments with digital information, while virtual reality creates fully immersive learning spaces that allow student-teachers to experience simulated classrooms. Likewise, cloud computing and the Internet of Things automate processes and provide seamless access to digital resources.

II. These technologies ensure that high-quality educational content is available anytime and anywhere, reducing geographical and socio-economic barriers. ICT thereby democratizes learning, enabling teacher trainees from marginalized, remote, or underserved regions to engage with the same quality of materials and professional development opportunities as those in urban centers. By expanding access, enhancing interactivity, and supporting diverse learning needs, ICT strengthens inclusivity and elevates the overall quality of the ITEP curriculum.

III. ICT enhances the skills of teachers by fostering digital utilisation, critical thinking, and reflective practices. It enables continuous assessment, collaborative learning, and real-time feedback, thereby improving instructional design and pedagogical innovation. ICT based training also empowers future teachers to address diverse classroom needs and accommodate learners with varied abilities through adaptive and assistive technologies. Thus, integrating ICT within ITEP not only promotes inclusivity and equity but also ensures quality, relevance, and sustainability in teacher education, preparing educators who are competent, digitally skilled, and responsive to the demands of the 21st-century learning environment.

IV. ICT in education refers to the integration of digital tools and technologies to enhance teaching, learning, and educational management. It transforms traditional pedagogical methods by fostering innovation, collaboration, and accessibility. ICT enables the storage, retrieval, and sharing of information while promoting digital literacy and skill development among teachers and learners. Guided by humanistic principles, ICT creates personalized and inclusive learning environments that improve resource quality and pedagogical effectiveness.

V. The National Education Policy (NEP) 2020 emphasizes the role of ICT in promoting collaboration, artificial intelligence, and data-driven decision-making in education. Global frameworks such as the Qingdao Declaration (2015) and the Beijing Consensus on Artificial Intelligence in Education reaffirm equitable access to digital learning by 2030. Aligning with UNESCO's Education 2030 Agenda and SDG 4, ICT ensures inclusive, equitable, and lifelong learning opportunities, transforming education for a sustainable digital future.

4. Five Guiding Principles for Strengthening ITEP through ICT:

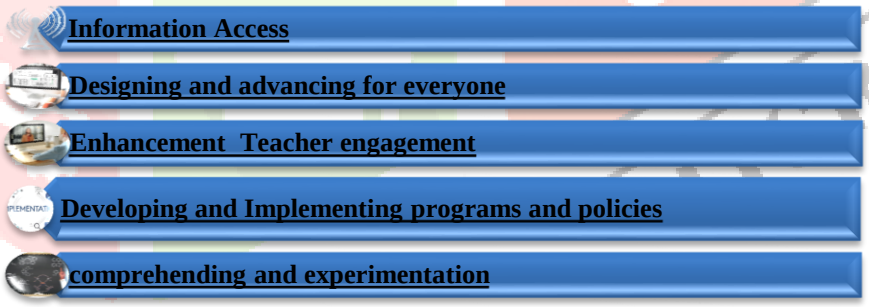
i. **Enhanced Information Access**: ICT provides immediate access to high-quality digital resources, enabling student-teachers to build strong conceptual understanding and interpersonal skills essential for effective teaching.

ii. **Inclusive and Universal Design**: Technology supports inclusive education by addressing diverse needs related to gender, disability, language, and cultural backgrounds. ICT ensures flexible and equitable learning environments for all ITEP students.

iii. **Improved Teacher Engagement and Support**: Digital tools—such as AI-powered platforms, structured lesson plans, and online networks enhance teacher preparation by offering pedagogical guidance and high-quality content, strengthening instructional practices.

iv. **Policy Implementation and Program Development**: ICT aligns with national policies by offering scalable tools for curriculum delivery, assessment, and teacher training. It strengthens ITEP through effective planning, monitoring, and educational innovation.

v. **Promoting Inquiry, Experimentation, and Innovation**: Technology facilitates virtual simulations, experimentation, and reliable data use, encouraging student-teachers to adopt reflective, research-based, and innovative approaches within real-world educational settings.



Visual infographic text of five guiding principles

5. Commissions and Committees for Strengthening Teacher Education and ICT in India

Teacher education in India has evolved through several key policy initiatives.

The Mudaliar Commission (1952–53) was the first to recommend reforms, proposing that only trained graduates with at least three years of teaching experience should enter the profession.

The Kothari Commission (1964–66) further addressed issues and challenges related to teacher training programs, emphasising on-the-job training, collaboration between schools and training institutions, improved service conditions, and curriculum renewal. Although both commissions did not explicitly mention ICT, they highlighted the need for scientific and technological knowledge, laying the foundation for later ICT integration.

Following these recommendations, **The National Education Policies of 1968 and 1986** prioritised both pre-service and in-service training. NEP 1986 led to the establishment of DIETs (District Institute of Education and Training), CTEs (College of Teacher Education), and IASEs (Institute of Advanced Studies in Education) and promoted distance learning through Indira Gandhi National Open University (1985). It also initiated the CLASS Project, POA (1992) strengthened ICT and ITEP structures indented to test the program before nationwide curriculum design and implementation strategies.

The Sarva Shiksha Abhiyan (2001) aimed to enhance teacher competencies, including the use of ICT to improve learning quality and reduce the digital divide. **National Curriculum Framework, 2005** and **National Curriculum Framework for Teacher Education, 2009** conceptualised teachers as facilitators and implicitly supported ICT-enabled pedagogy. It highlighted ICT as a key tool for constructivist and experiential learning for teacher empowerment.

The Digital India initiative, 2015 further expanded e-learning opportunities. Digital India (2015) expanded teacher education and ICT by promoting digital classrooms, online training, and e-resources for educators. It strengthened ICT integration through the **National Mission on Education through ICT (NMEICT)** under the **Ministry of Education** and was guided by the **National Knowledge Commission** to enhance digital learning access nationwide.

The **Samagra Shiksha Abhiyan (2018)**, launched by the Ministry of Human Resource Development, aims to provide high-quality e-content on digital platforms from pre-school to senior secondary levels. It treats schooling as a continuous system by integrating SSA, RMSA, and Teacher Education, while strengthening teacher-training institutions, capacity building, and professional development to enhance ICT-enabled learning.

National Educational Policy, 2020 introduced the four-year Integrated Teacher Education Programme (ITEP) to replace traditional B.Ed., focusing on holistic development, pedagogical skills, digital literacy, and blended learning. Recent frameworks emphasise ICT integration to enable student-teachers to design learning experiences, access digital resources, and effectively use technological tools.

6. Evolution of ICT Integration in Teacher Education from 1972 to 2024 in India

The government of India Strengthened ICT integration in teacher education through a series of national initiatives and policy interventions. The process began with the **Educational Technology (ET)** scheme in 1972, the **INSAT** initiative of 1983 enabled large scale use of broadcast media and satellite based networking for educational communication across the country. The **CLASS** Project in 1984, which promoted the use of computers in schools.

The **National Policy on Education (1986)** and **Program of Action (1992)** highlighted the need for technology-supported pedagogies. Further advancement came with **EDUSAT, ICT@Schools**, **and Computer Assisted learning- National Mission on Education through Information and Communication Technology (CAL-NMEICT) 2004,** which expanded digital resources and computer-aided learning, recognition initiatives such as **Schools and ICT award (2010)** for teachers using ICT in schools to recognize and encourage educators who effectively integrated technology into their teaching.

The frameworks like the **ICT Policy (2012)** to provide comprehensive, uniform, and high standards framework for the integration of ICT in all aspects of education from school to higher education. **National Repository of Open Educational Resources** (NROER) and **ICT Curriculum (2013)** Strengthened digital competencies and provide access to a wide variety of digital resources like videos, audio, images and documents in multiple languages.

Under **The Digital India Mission (2015)** government Introduced a number of educational platforms such as e-Pathshala, e-PG Pathshala, SWAYAM Prabha, MOOCs, and DIKSHA, enhancing digital access for teachers and learners. Subsequent reforms including **Cyber Safety and Security Guidelines (2018), NISHTHA** and the **Guideline for Developing e-Content (2019),** focused on capacity building and safe digital engagement. The creation of **National Educational Technology Forum** (**NETF**), **PRAGYATA Guidelines**, **PM e-Vidya, National Digital Education Architecture (NDEAR)**, and **Vidya Samiksha**

Kendra (VSK) are designed to monitor the learning process of every students and improve education outcomes by using AI and machine learning further institutionalised ICT-enabled education. Recent frameworks such as the **National Curriculum Framework for Foundational Stage** (NCF-FS) 2022, **The National Curriculum Framework for School Education** (NCF-SE) 2023, and the **Draft National Curriculum Framework for Teacher Education (**NCF-TE) 2024 continue to embed ICT as an essential component of teacher education in India.

7. Government Initiatives for ICT Integration in Teacher Education in India

Over the years, several initiatives have contributed to ICT enabled teacher education in India:

I. **National Education Technology Forum (NETF)**, an independent body created to guide the effective use of educational technology. NETF supports evidence-based decision-making, fosters research and innovation, and provides professional development opportunities for teachers by sharing best practices and technological solutions. Strengthening digital literacy, enhancing technological competencies, and integrating ICT into teaching and learning processes have become essential aspects of teaching training programs.

II. Various online training platforms have also strengthened teacher's abilities and skills of learning such as **DIKSHA** (**Digital Infrastructure for Knowledge Sharing)** serves as a national digital infrastructure offering e-content, professional development modules, and assessment tools.

III. **SWAYAM (Study Webs of Active-Learning for Young Aspiring Minds)** provides free online courses for teachers, educators, and learners from primary schools to higher education.

IV. **NISHTHA** (**National Initiative for School Heads' and Holistic Advancement)** under **Samagra Shiksha,** focuses on developing teachers' pedagogical competencies with a strong emphasis on ICT and critical thinking. International initiatives such as **UNESCO's ICT Essentials for Teachers** further support teacher professional development through globally aligned MOOC (Massive Online Open Course) based training.

V. NEP 2020 also promotes **Continuing Professional Development (CPD)** through research and innovation platforms. Projects such as the **Connected Learning Initiative (CLIx)** and the **Integrated Approach to Technology in Education (ITE)** focus on ICT-enhanced **STEM** education and digital content creation. NETF also aims to reduce the digital divide by improving infrastructure and equitable access to devices and connectivity.

VI. The **PM e-Vidya** initiative, launched under the **Atmanirbhar Bharat Abhiyan (2020),** integrates all digital and broadcast-based education efforts, including DIKSHA, SWAYAM, DTH TV channels, community radio, virtual labs, and DAISY resources, ensuring inclusive access to learning.

VII. The **Samagra Shiksha, 2018** programme plays a key role by integrating SSA, RMSA, and Teacher Education into a single framework, supporting ICT labs, smart classrooms, digital boards, and in-service teacher training through NISHTHA.

VIII. The **Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT)** now restructured as the **Malaviya Mission Teacher Training Programme (MMTTP)** continues to strengthen teacher preparation through ICT-enabled pedagogical training, faculty development centres, and teaching-learning centres.

IX. The **National Council for Teacher Education (NCTE)** align with NEP 2020 by integrating ICT competencies in Integrated Teacher Education Program and collaborating with SCERTs, DIETs, and SIEMATs to build capacity and deliver high-quality digital training at district and state levels.

X. The Government of India is implementing several pilot initiatives through **NCERT, CIET, and DIETs** to integrate emerging ICT tools within the ITEP curriculum and address present and future educational demands. NCERT and CIET are developing competency-based digital learning resources,

virtual labs, adaptive learning modules, and AI-enabled platforms aligned with NEP 2020. CIET is also leading pilots on augmented reality (AR), virtual reality (VR), assistive technologies, and digital assessment systems to enhance teacher preparedness for technology-rich classrooms.

From the foundational and preparatory to middle and secondary stages, DIETs, CIET, other institutions are piloting blended learning models, digital pedagogy workshops, teaching aid workshops and school-based ICT integration projects to strengthen pre-service and in-service teacher training programme. These initiatives support ITEP by embedding digital literacy, online teaching competencies, and technology-enabled practicum. Overall, the various ongoing and pilot projects aim to build a future-ready teaching workforce capable of leveraging ICT to meet evolving educational needs and support inclusive, high-quality learning across India.

Conclusion

The integration of Information and Communication Technology (ICT) within the Integrated Teacher Education Program (ITEP) marks a transformative shift in India's approach to preparing future educators. The collective initiatives of NCERT, CIET, DIETs, NETF, PM e-Vidya, NISHTHA, SWAYAM, and Digital India highlight a national commitment to strengthening digital competencies, widening access to quality learning resources, and aligning teacher education with global standards.

Emerging ICT tools including virtual labs, digital content repositories, AI-supported learning systems, and blended learning models are systematically embedded into the ITEP curriculum to ensure that student-teachers develop strong pedagogical, technological, and professional skills. ITEP's four-year integrated structure positions teachers to engage deeply with contemporary educational demands, promoting reflective practices, inclusive pedagogies, and technologies enabled classroom innovation.

The collaboration between ICT frameworks and ITEP enhances the teaching of all subjects by improving content delivery, fostering experiential learning, and facilitating adaptive and equitable learning environments. By bridging the digital divide and encouraging lifelong learning, ICT strengthens teacher preparedness for an increasingly digitalized world.

Overall, the synergy between ITEP and ICT not only modernizes teacher education but also ensures that future educators can lead high-quality, inclusive, and future-ready classrooms, contributing significantly to India's evolving educational landscape. India's future education system is committed to enhancing quality and strengthening teacher preparation through ITEP and ICT driven initiatives. These efforts advance digital competency, innovative pedagogy, and continuous professional development, fostering a more inclusive, technologically empowered, and future-ready learning environment for both teachers and students.

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