Information and Communications Technology for Teacher Training in India

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Abstract

Information and Communications Technologies (ICTs) are making major differences in the teaching approaches and the way students are learning. ICT enhanced learning environment facilitates active, collaborative, creative, integrative, and evaluating learning as an advantage over the traditional methods. Overtime, we have learnt that integrated teacher education initiatives brought more learning resources to the classroom. The new technologies and their effective integration with curriculum and classroom processes have presented enormous possibilities and have revolutionized teacher education at all levels. The recent ICT developments have allowed teachers to be imaginative, flexible, and willing to renew their vision of teaching and learning. The possibilities of integrating ICT tools by teachers and for in-service training and teachers' professional developments have undergone a revolution in the last decade. New Educational technologies in India have encouraged the adoption of new roles by the teachers to embrace new pedagogies and approaches.

The New Education Policy 2020, gives immense importance to the interdependence of education and technology in the future. It emphasizes the role of ICT as an effective tool in facilitating teacher education and encourages the utilization of technology platforms for online teacher training. The policy calls for investment in digital infrastructure, development of online teaching platforms and tools, creation of virtual labs and digital repositories, training teachers to become high-quality online content creators, designing and implementing online assessments, establishing standards for content, technology, and pedagogy for online teaching-learning. ICT integration for pre-service teacher training programs plays a crucial to equip and prepare future teachers for the classroom, who are confident and competent about managing the change and influencing it for the better quality of teaching. Considering the future of using technology for teaching and learning is always ever-evolving and challenging. Teacher Education Institutes must create an environment for teachers to enable them to create an appropriate learning experience for teachers to enable them to create an appropriate learning experience for students in the new age of learning.

Abbreviations

ICT	*Information and Communication Technology*
SDG	*Sustainable Development Goals*
NEP	*National Education Policy*
OER	*Open Educational Resources*
NMEICT	*National Mission on Education through Information and Communication Technology*
DIKSHA	*Digital Infrastructure for Knowledge Sharing*
SWAYAM	*Study Webs of Active-Learning for Young Aspiring Minds*
MOOC	*Massive Open Online Course*
CFT	*Competency Framework for Teachers*
TPACK	*Technology, Pedagogy, and Content Knowledge*
NEP	*National Education Policy*
NCERT	*National Council of Educational Research and Training*
CIET	*Central Institute of Educational Technology*
CBSE	*Central Board of Secondary Education*
NIOS	*National Institute of Open Schooling*
NCFTE	*National Council for Teacher Education*
NCF	*National Curriculum Framework*
SSA	*Sarva Shiksha Abhiyan*
NCTE	*National Council for Teacher Education*
DIET	*District Institute for Education and Training*
B.ED	*Bachelor of Education*
TPD	*Teacher Professional Development*
NTP	*National Teacher Platform*
TISS	*Tata Institute of Social Sciences*

Introduction

Teachers enable education to achieve its transformative potential for individual communities and overall national development[1]. They constitute the core of the process of imparting knowledge in the classroom. The quality of teaching, teachers, and teachers' education is central to delivering quality education for all. Sustainable Development Goal 4 also advocates teachers as the biggest contributors in accomplishing the goal of the Education 2030(add the link) agenda – '*Providing Equitable Quality Education for All*'. The effectiveness of Information and Communication Technology (ICT) integration is impacted by the teachers' motivation, personal knowledge and experience, confidence levels, access to ICT resources and training, and technical and pedagogical support (Cabanatan, 2002). Thus, teachers, through their knowledge, beliefs, attitudes, and practices, are key agents to achieve SDG 4 targets. The recently released National Education Policy (NEP) 2020 in India, has further reinforced this notion by rightly placing teachers at the center of the education system. The possibilities of integrating ICT tools by teachers and for in-service training and teachers' professional developments have undergone a revolution in the last decade. The recent ICT developments have enabled and supported the teachers to create more 'learner-centric' learning environments. It has allowed teachers to be imaginative, flexible, and willing to renew their vision of teaching and learning.

The Indian Education sector has been adapting to the latest ICT tools to support the existing teaching knowledge and practices. The new technologies have encouraged the adoption of new roles by the teachers to embrace new pedagogies and approaches. ICT advancements have helped teachers to interact with students and improve their teaching, provide feedback, the upgrade the overall effectiveness of the classroom. The NEP, 2020 gives immense importance to the interplay of education and technology. The policy notes that one of the central principles steering the education system will be the "*extensive use of technology in teaching and learning, removing language barriers, increasing access as well as education planning and management*". It emphasizes the role of ICT as an effective tool in facilitating teacher education and encourages the utilization of technology platforms for online teacher and training. The policy calls for investment in digital infrastructure, development of online teaching platforms and tools, creation of virtual labs and digital repositories, training teachers to become high-quality online content creators, designing and implementing online assessments, establishing standards for content, technology, and pedagogy for online teaching-learning. The policy also recognizes four important components of ICT integration in school education:- 1) provision of ICT Infrastructure in schools, and institutions for teacher education and education administration, 2) professional development of teacher and teacher education and building of professional learning communities, 3) development of curricular resources (for students and teachers), as Open Educational Resources (OER), and, 4) Building state-level infrastructure to facilitate ICT integration, including OER repository, platforms for e-learning courses.

[1] https://en.unesco.org/news/no-teacher-no-class-state-education-report-india-2021

The Indian Education landscape of professional development includes pre-service teacher and in-service education programs for primary/elementary and secondary/senior secondary school teachers. Under national initiatives like 'National Mission on Education through Information and Communication Technology (NMEICT) and 'Digital India', to leverage the potential of ICT to make the best quality content accessible, various digital platforms have been launched. Digital platforms like DIKSHA, NISHTHA, SWAYAM, online MOOC courses have supported teachers to upgrade their knowledge and skills. Dedicated Modules and courses on using ICT also have been proven crucial for pre-service teacher training programs. Private tech players like Microsoft and Dell are contributing considerably to the whole digital movement with their flagship programs like 'Project Shiksha' and 'Dell Aarambh' for training the teachers. ICT has not only helped with the evolved training aspect but also the administrative processes of the various teacher education institutes of the country.

ICT Competency Framework for Teachers

Successful integration of ICT into teaching and learning requires rethinking the role of teachers in planning and applying ICT to enhance and transform learning. Education systems need to regularly update and reform teacher preparation and professional development according, ensuring that all teachers can harness technology for education - UNESCO. Integration of ICTs and their implications in teacher education programs are a means to support high-quality teaching and learning[2]. There is a strong argument that good teaching with technology also requires a shift in the existing practices both in pedagogy and content. Capitalizing on the potential of new technologies in general and digital technology in particular as a learning tool, an effective teaching-learning process is a real need in today's world. This calls for the educational communities to think about their context and go beyond technology literacy to promote educational practices that innovatively use the interaction of technology, pedagogy, and content. A well-researched roadmap from various aspects of the education domain will support the national and institutional goals. Some of the leading frameworks as a model in this aspirational direction are discussed here.

UNESCO's ICT Competency Framework

The effective integration of ICT in schools and classrooms can transform pedagogy and empower students. In this context, it becomes essential that teachers have the competencies to integrate ICT in their professional practice to ensure the equity and quality of learning. Teacher training programs and ongoing professional support must enable teachers to develop the necessary ICT competencies so they can, in turn, ensure their students develop the relevant skills, including digital competencies for life and work.[3] UNESCO has developed the ICT Competency Framework for Teachers as a tool to guide pre-and in-service teacher training on the use of ICTs across the education system. The framework is intended to be adapted to support national and institutional goals by providing an up-to-date roadmap for policy development and capacity building. Its target audience is teacher-training personnel, educational experts, policy-makers, teacher support personnel, and other professional development providers. The framework addresses the recent technological and pedagogical developments in the field of ICT and Education and incorporates inclusive principles of non-

[2] https://www.cemca.org/ckfinder/userfiles/files/ICT%20Integrated%20Teacher%20Education-Final_Low%20with%20Cover%20Back.pdf

[3] https://www.open.edu/openlearncreate/pluginfile.php/306820/mod_resource/content/2/UNESCO%20ICT%20Competency%20Framework%20V3.pdf

discrimination, open and equitable information accessibility, and gender equality in the delivery of education supported by technology. The ICT CFT framework identifies 18 ICT competencies to which teachers should aspire and subdivides these into 64 specific objectives. The competencies range from encouraging teachers to understanding national priorities as identified in national ICT in Education policies, how ICT can support the curriculum, assessment strategies, pedagogy, school and class organization, administration as well ongoing professional development.

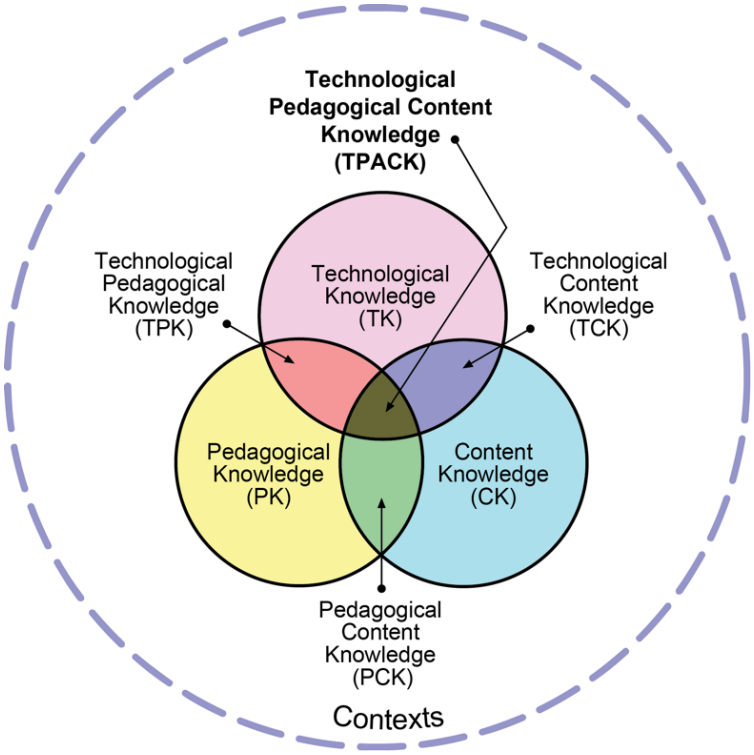
The ICT CFT Version 3

The ICT CFT advocates for the conception of teacher development as a lifelong learning process. It provides criteria when assessing national levels of teachers' ICT competence or undertaking analysis of training initiatives. The framework is intended to inform educational experts, policymakers, teacher support personal, and providers of professional learning on the role of ICT in educational reform, as well as to assist UNESCO member states in developing national ICT competency standards for teachers. It encourages an approach to teacher development that uses these crucial areas to demonstrate directly the educational benefit that can be derived from ICT. The framework provides an excellent point of reference for the creation or refinement of course development strategies[4]. Significantly, instead of presenting an ICT application approach, the framework provides a solid educational context for the development of ICT skills and competencies to integrate ICT into teaching and learning.

[4] https://www.cemca.org/ckfinder/userfiles/files/ICT%20Integrated%20Teacher%20Education-Final_Low%20with%20Cover%20Back.pdf

TPACK Framework

The Technological Pedagogical Content Knowledge (TPACK) framework describes the type of teacher knowledge required to teach effectively with technology. The TPACK framework identifies a unifying structure that not only respects this complexity but also provides guidance for appropriate technology integration (Koehler & Mishra, 2008; Mishra & Koehler, 2006). In the TPACK framework, what teachers need to know is characterized by three broad knowledge bases – technology, pedagogy, and content – and the interactions between and among these knowledge bases. In this approach, technology in teaching is characterized as something well beyond isolated knowledge of specific hardware or software.



Source: http://tpack.org

The TPACK framework describes the kinds of knowledge that teachers need to teach with technology and the complex ways in which these bodies of knowledge interact with one another. Teaching with technology requires a flexible framework that explains how rapidly-changing technologies may be effectively integrated with a range of pedagogical approaches and content areas. Good teaching with technology, therefore, cannot be achieved by simply adding a new piece of technology upon existing structures. Good teaching, with technology, requires a shift in existing pedagogical and content domains. The TPACK framework also emphasizes the role of the context within teaching and learning. Ignoring context leads to "generic solutions to the problem of teaching" (Mishra & Koehler, 2006, p. 1032). Teaching is a context-bound activity, and teachers with developed TPACK use technology to design learning experiences tailored for specific pedagogies, crafted for specific content, as instantiated in specific learning contexts. In the sections below we describe each of the components of the TPACK framework and, most importantly, their interactions with each other. The TPACK framework is a testament to the complexity of teaching. The framework proposes that tackling all of the variables at once creates effective teaching with technology.

The TPACK framework also functions as a theoretical and conceptual lens for researchers and educators to measure pre-service and in-service teachers' readiness to teach effectively with technology. For this purpose, researchers have developed a range of instruments, quantitative and qualitative, to measure TPACK (Koehler, Shin & Mishra, 2011; Schmidt, et al., 2009)[5].

National Curriculum Framework for Teachers' Education under NEP 2020

The New Education Policy 2020 (NEP), has given even emphasis on the role technology has to play in creating well-equipped teachers. It promises the availability of educational software, for students and teachers at all levels. Teaching-learning e-content will continue to be developed by all States in all regional languages, as well as by the NCERT, CIET, CBSE, to address the digital divide with the population whose digital access is highly limited, ICT tools like television, radio, and community radio will be extensively used for telecast and broadcast. A special focus on content in all Indian languages will be emphasized and, digital content will reach the teachers and students in their medium of instruction as far as possible. It also promises a continuous commitment to meaningful research and innovation. India has been aiming in the direction of having a sound framework for the healthy integration of ICT in Indian teaching practices. The NEP 2020, proposed a new and comprehensive National Curriculum Framework for Teacher Education, NCFTE 2021 to be teacher education, pre-service and in-service, of teachers working in academic, vocational & special education streams. The NCFTE thereafter will be revised once every 5-10 years by reflecting the changes in the revised NCFs as well emerging needs in teacher education.

ICT for Teacher Education

Teacher education is a means of providing teachers with the necessary skills and knowledge needed to adequately carry out their teaching jobs as well for their professional growth. It is an essential exercise that enhances the skills of learning and teaching. Inadequate teacher preparation programs result in a majority of teachers' inability to demonstrate adequate knowledge and understanding of the structure, function, and development of their disciplines. Introduction to ICT has been an encouraging move for the adoption of new teacher roles that embrace new pedagogies and approaches to teacher education. In India, teacher education is divided into two broad areas – pre-service education which is focused on preparing students for a career in teaching, and in-service teacher training that is provided by the government through the Sarv Shiksha Abhiyan (SSA) or NGOs and social enterprises. The National Council of Teacher Education (NCTE), is the advisory body for the teacher education system, responsible for the regulation and the planning of the development of teacher education in the country. The District Institutes of Education and Training (DIETs) are responsible to train all pre-primary and primary school teachers.

Successful on-going professional development models can be divided into three phases: 1) pre-service, focusing on the initial preparation on pedagogy, subject mastery, management skills and use of various teaching tools, 2) in-service, including structured face-to-face and distance learning opportunities building upon pre-service training and directly relevant to teacher needs, and 3) ongoing formal and informal pedagogical and technical support,

[5] https://www.cemca.org/ckfinder/userfiles/files/ICT%20Integrated%20Teacher%20Education-Final_Low%20with%20Cover%20Back.pdf

enabled by ICTs, for teachers, focusing daily needs and challenges. Sustained investments in teachers' education and concerted actions between pre-and in-service teacher training form the foundation of the successful implementation of ICT integration.

ICT has been tremendously significant in the way it has evolved the whole process of the creation, revision, and sharing of the curricular content. It has helped with the availability of a large pool of digital tools to create digital resources, in text, image, animation, audio, and video formats. With the world throwing new complex challenges now and then, like the recent pandemic situation around the world is facing due to the Covid-19, teachers need to be better equipped to be able to adapt to the new environments and tackle new challenges. The role of teacher education institutions becomes even important to create a new generation of teachers capable of employing a variety of technology and tools in all phases of academic, administrative, research, and extension function. A range of newly initiated professional development programs using ICT has begun to emerge in recent years, offering the following: -

1) A greater variety, and hence a greater chance of relevance and potential to meet diverse interests and needs
2) High quality of expertise directly accessible to teachers
3) Flexible to select programs and take them at one's own pace
4) Online mentoring, reflection, interaction with peers and experts, either in professional learning communities or in courses.

The focus of teacher education institutes has shifted more to provide teachers with a solid understanding of the various media, their affordance, and constraints. Such understandings emerge when teachers are actively involved in teaching and learning with technology across the various disciplines. Teachers should not be taught about technology but how to use technology for constructing, organizing, and communicating knowledge (Barron & Goldman, 1994).

ICT for Pre-Service Teacher Training

Pre-service teachers are the group of teachers who are enrolled under the teacher training program like B.Ed (Bachelors of Education) or DIET. For teacher preparation programs, it is important to strike a balance between fundamentals of computer skills and pedagogical knowledge. The student teachers must be trained in the pedagogical use of ICT. The current training programs emphasize understanding the nature of the ICT, use of subject teaching-related software tools, accessing web resources, encouraging teachers to create digital resources using a wide variety of free and open sources digital resources. There are two levels of expertise required for teachers to attain ICT integration in the classroom, one is hardware and software components and the other is the pedagogical applications of new information technologies. Both the components are crucial for the correct use of ICT in classroom teaching.

Hardware and Software Component - The emphasis of this component is to make the student teachers get familiarized with the hardware devices and various software components. The aim is to help them understand how these ICT tools, like desktop computers, laptops, tablets, mobile phones, and digital platforms, can be used for teaching and learning purposes. They

are trained to select appropriate ICT tools and training in how to use ICT in the classroom. The goal is to provide exposure to the teachers to a wide variety of ICT hardware resources.

Pedagogical Application - The focus of this approach is to train the teachers for successful ICT pedagogy integration. Training is provided to use technology for constructing, organizing, and communicating knowledge. The purpose is to get a better understanding of various mediums, their contextual usage, and constraints as well.

Thus ICT integration for pre-service teacher training programs plays a crucial to equip and preparing future teachers for the classroom, who are confident and competent about managing the change and influencing it for the better quality of teaching. The ICT innovation has been contributing not only to the evolving training curriculum and training modules but also to the administrative process as well. One such example of effectively integrating technology into large-scale educational systems is from the state - Bihar. A smaller-scale innovation was led by the Directorate of Research and Training, Department of Education, Government of Bihar, to transform the application and admission process in teacher education institutions across the state. The manual process of copying the information and calculating applicants' scores and merit lists was a process of errors, leading to complaints. To solve this, with the help of the World Bank's project, Enhancing Teacher Effectiveness in Bihar, came up with an online system of applications and admissions which made the process of enrolment into teacher train courses smooth and hassle-free

ICT for In-Service Teacher Training

Training and ongoing support must enable teachers to develop the necessary ICT competencies to ensure their students develop the relevant skills, including digital competencies for life and work. Teachers' professional development should be understood as a lifelong learning process, rather than a one-off event. Teacher Professional Development (TPD) is a journey of the learning experiences sustained over time, enabling teachers to acquire and apply knowledge, understanding skills, and abilities to achieve personal, professional, and organizational goals, to facilitate student learning. The importance of ICT for education and Teacher Education has also been recognized and well–articulated in all the national policies and programs initiated in the country. The National Curriculum Framework for School Education and the National Curriculum Framework for teacher education programs, both at pre-service and in-service levels. India has also launched the "National Mission of Education Information and Communication Technology (NMEICT). The National Curriculum Framework for Teacher Education also stresses teachers' education needs to orient and sensitize the teacher to distinguish between critically useful, developmentally appropriate, and detrimental use of ICT, in a way, ICT can be imaginatively drawn for professional development and academic support of the pre-service and the in-service teachers.

National digital platforms like e-pathshala, DIKSHA, NISHTHA, and the National Teacher Platform (NTP) have become rapidly popular among teachers. Different forms of OER run on a wider spectrum are offering tutorial videos for better remembering and understanding. Extensive teacher training modules enable and equip the teachers to overcome their technological challenges. Understanding the basics of an ed-tech interface to understand its significance, power, and benefits has been an important part of the e-education ecosystem. Continuous Professional Development enables the teachers to stay updated on new methods

of teaching, skill development, techniques to map students learning and academic progress. With the help of digital tools and devices, teachers can now track and update their teaching and assessment methods and enabling them to explore more advanced and updated techniques. The process of the whole ICT training helps teachers to understand both its benefits and limitations as well, giving them space to explore more ways of innovative teaching and exploring new educational avenues. This helps them create a positive learning environment that enables the teachers to encourage the students further towards productive tech-led learning. Ed-tech teacher training solutions supporters training this is inclusive towards social issues, especially for rural areas. With the help of online teacher training programs, awareness towards current issues like educating girl child, women empowerment, the importance of health and nutrition, and many such have been able to reach the remote areas of the country.

For training purposes, “Blended learning” has been seen as the best suitable mode of teacher training in the future. It provides possibilities of learning beyond geographic restrictions, allowing for large-scale reach and impact. Courses can be structured in collaboration with pre-service teacher education institutions, thus connecting teacher and teacher educator communities and institutions. Complementing physical workshops/meetings with virtual interactions over an e-learning forum is a new way of providing teacher education in the country. For instance, the MA course by the Tata Institute of Social Sciences (TISS) Education program provides training to students across the country and also access faculty from across the country through a digital platform Moodle. More such programs in the future will allow learners to learn at their own pace (relatively) and also reach a larger number of teachers than is possible through merely physical interactions. It also allows for greater possibilities for addressing the diverse and heterogeneous learners' needs. Thus blended model allows for diverse needs, contexts, and aspirations. Thus, a well-rounded understanding of technology determines the future of education and also empowers teachers to use technology smartly and create an effective online teaching environment.

Challenges in the Journey

The teacher education institutions in the country are now understanding the tremendous potential of digital technologies and trying their best to harness the teaching-learning process to enable the students to learn meaningfully. Utmost preference is given to the need to invest in the creation of open, interoperable, evolvable, public digital infrastructure, to solve for India’s scale, diversity, complexity, and device penetration. National level educational initiatives have seen considerable progress in the country but also have faced numerous challenges as well. These challenges could be infrastructure-related, teachers’ capacity building related, technology support related, language and context related, or overall sustainability-related.
Some of the common issues to be overcome for the successful integration of ICTs in the field of teacher education are briefly discussed here: -

- Lack of coherence in planning and leadership consequently affects the implementation aspect.
- Mindset gap between the mind setup of new-age students teachers and experienced in-service teachers through advocacy and in-service training and capacity-building activities from time to time.

- Teachers face major challenges when they are in schools due to many demands and expectations. At the same time, they are expected to be innovative in the use of ICTs in the classroom teaching-learning process.
- The course content must be constantly revised and updated as the technology is moving fast from time to time. It is essential to make the content in line with new trends in learning with technology. For example, Smartphones can be considered as the most reliable digital tool, can be used as a learning device given their accessibility, cost-effectiveness, and ease of operation.
- Issues of poor connectivity in rural and remote areas that are inaccessible.
- Lack of improvised need-based and localized courseware for capacity building of teacher educators, trainers, teachers, and students at different levels.
- Lack of integration of ICT-based materials with curriculum and course design and course planning.
- Inadequate training and capacity-building process for teachers, teacher educators, administrators, and policy planners at different levels.
- Schools located in rural and semi-urban areas face difficulties in the supply of electricity.

For the Successful ICT enabled Teacher Education Program

In the field of teacher education, the ICT-based applications and their integration with content, method, and pedagogy are potential catalysts for meaningful learning of students. Professionals associated with teacher education institutions equip them to design their educational system and prepare teachers for the future of society (Singh, 2014). A well-designed training program is essential to meet the demand of today's teachers to effectively use ICT. More attention should be given to the specific roles of technology in offering multimedia simulations of good teaching practices, delivering individualized training courses, helping overcome teacher's isolation, connecting individual teachers to a larger teaching community continuously, and promoting teacher to teacher collaboration.

Some of the important strategies to make ICT- enabled Teacher Education program a real success are:

- A well-designed technology-mediated teacher education curriculum with the appropriate mechanism of assessing and monitoring the quality of education should be in place for ensuring better implementation of integrated teacher education programs.
- Teacher education institutions should be equipped with ICT-based resources with the provision of training and orientation of teacher educators for better integration of technology with content and pedagogy.
- Availability and accessibility of technology should be made cost-effective for users at all levels.
- Professional competencies to integrate ICTs into the teaching and learning process are a continuous process to ensure meaningful participation and integration of students.
- Educational administrators and policymakers should work more closely with schools and colleges to determine the training needs of teachers and extend their support to organize appropriate training programs with better exposure at all levels.

- The effective integration of ICTs for meaningful learning needs to be constantly updated to make them current, relevant, and pedagogically sound.
- In-service and pre-service training should involve of ICTs in pedagogical analysis, presentation of content with new techniques of evaluation. Teachers in educational institutions should have a well-equipped ICT Lab with a computer, satellite communication, high-speed internet facility, and other electronic media to supplement the learning of children in this digital world.
- Curriculum and course content should be designed with an approach to ensure better implementation of ICTs and should be supported by a technology-mediated Learning Management System (LMS). The curriculum and content of teacher education should enable the students to compete globally.
- By developing a pool of world-class content and designing the content with socially relevant examples and illustrations through technology-mediated interventions for students.
- Teacher education institutions across the country must provide the leadership for pre and in-service teachers and model the new pedagogies and tools for learning with active collaboration from national and international agencies. With mutual collaboration from all around it would be easy and convenient to design and develop culturally responsive digital content for teachers and students.

As a way forward

Effective implementation of ICTs is certainly a powerful means of improving the quality of education in general and teacher education in particular[6]. Shifting pedagogies, redesigning the curriculum and assessment, and providing more autonomy to the teachers will help to optimize the use of ICT. For this, adequate time must be allowed for teachers to develop new skills, explore their integration into their existing teaching practices. Streamlining the pre and in-service teacher education programs to ensure training and support for in-service teachers building on the knowledge acquired in pre-service institutions would be beneficial. ICT should not be seen as one item in TPD, rather it should be seen as a method to strengthen. This needs structural arrangements along with the hard infrastructure, from the state level SCERTs to the regional level & district level, and block resource centers for ICT integration capacity building programs. The future of using technology for teaching and learning is always challenging. Therefore, teacher educators must update themselves with recurrent training and orientation through refresher courses and orientation programs. To foster this, teacher education institutions must create an environment for teachers to enable them to create appropriate learning experiences for students in the new age of learning. The Indian education sector should be having a sound framework in place soon to strengthen the ICT implementation in the teacher education programs.

[6] https://www.cemca.org/ckfinder/userfiles/files/ICT%20Integrated%20Teacher%20Education-Final_Low%20with%20Cover%20Back.pdf

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