General Article

Developing Competencies for Technology- Pedagogy Integration among In-service Teachers: Reflections

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Abstract

National Education Policy, 2020 (NEP-2020) of India emphasises the interplay of education and technology. The policy notes that one of the central principles to steer 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'. In this context, ICT intervention in the school system to leverage the outcome of education is also a goal. To achieve this goal, human resources, i.e. teachers, are the game changers, and hence the emphasis lies on the capacity building of teachers. NEP 2020 recommends rigorous training in learner-centred pedagogy, teachers becoming high-quality eContent creators, and also integrating technology in the teaching-learning process. It also emphasises the teacher's role in facilitating active student engagement with the content and with each other through the use of technology.

Training teachers in the use of technology was emphasised through the ICT@School Scheme under RMSA, and also funds were provided for establishing infrastructure for technology in schools. The fourteen studies done as a third-party evaluation of the ICT@ School Scheme reveal that there is no systematic way for holistic training of teachers in the use of technology. Most of the training has focused only on office packages which couldn't transform the teaching-learning process. Even when the Samagra Shiksha was launched, the ICT component in the Samagra shiksha clearly elaborates on the need for training teachers on the use of ICT and recommends systematic training. The budget announcement emphasises developing every teacher as a digital teacher. In this context, developing the competencies of teachers to integrate digital technology becomes the core goal of achieving quality education.

Curricula for ICT in Education for School System developed by the Central Institute of Educational Technology (CIET), a constituent unit of the National Council of Educational Research and Training (NCERT) is a national curriculum to define the focus, content, and strategy for in-service training to build the competencies of teachers in integrating ICT in Education. This curriculum is being implemented to build the competencies of teachers in integrating content, pedagogy, and ICT in teaching and learning. It proposes a blended approach for training integrating face-to-face and online modes. This article brings out the features and scope of ICT in the education curriculum for teachers through the lessons learned for its implementation at various levels. Reflections based on the implementation bring out the need for systematic planning in training teachers, the content that can support the development of their knowledge and also the strategies to be followed for effective implementation. With this competency-based curriculum, it is possible to prepare teachers to face the expectations of the current digital era.

Keywords: ICT training, CPD, Capacity Building, In-service teacher training, ICT in Education

Introduction

Digitalisation of education is becoming an ongoing phenomenon (Szyszka et al., 2022). In the world of technology, there is a revolution in the education system having an impact on the expected competencies of a teacher. Teachers are not just expected to be a knowledge repository but also to keep pace with the advancement in technology and build competencies in integrating those into the teaching-learning process Digital skills have become more important in the 21st century, having a significant impact on social interactions, education, work, and other areas of life (Niyazova et al., 2023). The ICT proficiency of instructors within the academic community or institution is one of the fundamental prerequisites for providing stakeholders with high-quality teaching and learning. When using new technology to deliver successful education, individual skills are a crucial component. Technological and pedagogical advances in ICT and Education have highlighted the need to support teachers' professional development (Santiañez, 2023). In order to effectively use information and communication technology (ICT), teachers need to have sufficient proficiency in employing a range of media and expertise to present the material to their students (Farisa et al., 2023). The mastery of Information and Communication Technologies (ICTs) abilities and competencies is now crucial for the efficient administration of studies or teaching (Molero Jurado et al., 2022).

Pre-service teacher education is gaining a lot of momentum towards improving its quality in terms of curriculum to deliver standard teachers to society. However, the need for in-service training in building the competencies of teachers with the technological developments and innovative pedagogies is recognised, and efforts are being made in various ways. National Education Policy 2020 (NEP-2020) emphasises developing every teacher as a digital teacher to leverage digital technology to improve school education to ensure quality and accessible education to all. In the digital era, innovation is evident and its growth is exponential in nature. Hence the teacher who is well trained during pre-service on the use of Information and communication technology (ICT) in the teaching-learning process is expected to keep swimming along the changes and keep themselves sustainable during the changes. There arises the need for capacity-building programs as and when there is a change in expectations. There were several efforts in India to build the competencies of teachers in the use of technology. Based on the experiences and learning from the third-party evaluation study of ICT@ school schemes, it was realised that a holistic approach to capacity building of teachers is required for building competencies in teachers towards technology integration.

Hence, under the aegis of the Ministry of Education, Department of School Education and Literacy, a curriculum for ICT in Education for School System was developed by the Central Institute of Educational Technology (CIET), a constituent unit of the National Council of Educational Research and Training (NCERT). This curriculum for teachers defines the need, scope, content, methodology, etc, for building the competencies of in-service teachers in the use and integration of ICT. The document also guides the path for integration of this content in the pre-service teacher education curriculum. It encompasses courses that focus on skill development where knowledge acquisition is seen to be incidental. Also, it follows the blended approach for delivery of the courses which gives scope for continuous professional development of teachers overcoming

the challenge of time, place, etc. ICT in Education curriculum is a model for building competencies in teachers to integrate content, pedagogy, and ICT effectively. This curriculum was piloted in Navodaya Vidyalayas and in all four Demonstration Multipurpose Schools of NCERT at Ajmer, Bhopal, Bhubaneswar and Mysore. It was also implemented in the state of Karnataka on a large scale covering all teachers at the secondary stage of school education. Learnings and experiences from these implementations have revealed that a holistic approach to capacity building is essential and effective in developing the competencies of teachers.

Need for ICT in Education Curriculum for Teachers

The importance of using ICT in education has increased dramatically as the global environment continues to change. Teachers are required to be able to use ICT successfully in order to combine their students' learning experiences and sufficiently prepare them for the issues they will encounter in the future. While the use of ICT in education has several advantages, including the ability to design practical courses, manage a classroom, and increase stakeholder communication, its successful implementation depends on instructors having the necessary abilities, information, and motivation (Nawastheen et al., 2023). The integration of information technology and educational endeavours is getting closer in the mobile Internet era, and there are more resources available for information technology. The ability of teachers to use Information and Communications Technology (ICT) effectively has become a must in the teaching process, and the main challenge is knowing how to assess it properly (Xiao et al., 2020).

The use of contemporary digital tools by teachers, which is a crucial component of the digital transformation of the educational environment, has given rise to a new area of problem-solving in the field of education (Golodov et al., 2022). The use of ICT by teachers in the classroom is becoming more and more crucial since technology is now a necessary component of effective teaching (Bariu et al., 2022). The behavioural intentions of instructors have a significant role in determining whether they would use ICT in their classroom instruction (Moosa & Ramnarain, 2023). Due to the extensive use of Information and Communication Technologies (ICTs) in education, teachers must be extremely digitally proficient and have a positive outlook in order to efficiently manage their students (Rahimi & Tafazoli, 2022). Evidence from experiments has shown that affective-motivational factors including pre-service teachers' attitudes, have a significant effect on their pedagogical judgments about whether and how to include technology in their classroom practices (Pozas et al., 2022). Hence, it is essential for the administrators at schools to take steps to assure the dependability and accessibility of technology, such as offering timely upgrades and ongoing maintenance services. In order to help teachers deal with techno-insecurity, mentoring the teachers on constructive coping mechanisms including venting, finding social support, and attending technical training to cope with the changes due to technology in educational setup (Wang & Zhao, 2023).

It is crucial throughout the world that information and communication technology be included in educational environments. Technology in education has potential benefits. Technology in education is always evolving, presenting new opportunities (Yuting et al., 2022).

The introduction of new technology into educational settings has the potential to improve learning opportunities in terms of quantity and quality. Information and communications technology (ICT) is becoming more and more common in educational settings because it enhances learning, creates a pleasant environment, and encourages pupils to develop analytical skills and confidence (Pandey et al., 2022).

The capacity to utilise digital tools appropriately has evolved into a basic component of daily living, and the widespread use of digital tools has established its importance in educational institutions (Rohatgi et al., 2021). Many countries have realised ICT skills need to be mastered alongside reading, writing, and numeracy skills. National Policy on ICT in Education (2012) states that capacity building of teachers is key to the widespread infusion of ICT-enabled practices in the school system. Several efforts have been taken by the Government of India (GoI) to deepen the use of ICT in Education. One such initiative is the ICT component under Samagara Shiksha, through which GoI was funding the states a lump sum amount to establish infrastructure, train teachers, and establish ICT resources. Though investments have been made in these areas, third-party evaluation of the ICT@School Scheme done in several states (CIET, 2014) has revealed that there is no significant improvement in the use of ICT in classroom transactions that could impact the learning outcome of students. At several schools, ICT infrastructure is unused due to a lack of confidence in teachers to use it or due to a lack of leadership among teachers/administrators in taking responsibility for managing the ICT environment. Though five days of training has been provided at the state level on the use of ICT, a lack of competency in integrating ICT in the teaching and learning of curricular subjects was reported as one of the major barriers by teachers during interviews (CIET, 2014) and various training conducted at national and state level.

So, rather than providing ICT literacy training, it is necessary to develop competencies so that teachers can sustain themselves by adapting to the changes and building the ICT environment as per the requirement. This can be achieved only when the teacher is confident in adapting to changes. Software or hardware-based training only builds confidence in handling the specified tools rather than building skills to address their needs. Also, time and location become barriers to bringing teachers to get training as and when the requirement arises. To address these challenges, there is a need to bring a blended approach to the content to be derived as well as in the mode of delivering training.

Though the ICT component of Samagara Shiksha defines the training scheme with content, a detailed description of the content and strategy for training teachers was required for the implementers to enable effective technology integration in school education. ICT in Education Curriculum for teachers was developed by the Central Institute of Educational Technology (CIET) and acts as a model that has realised all these requirements in developing teachers' competencies to sustain themselves in the use of ICT in education in the changing world.

Guiding Principles of the Curriculum

ICT in Education curriculum for teachers is generic in nature and could be adopted/ adapted/ customised as per the specific needs of chosen stakeholders. The courses specified in the curriculum give exposure to a wide range of technological applications with a focus on educational purposes. E.g., Planning, presenting, assessing, transaction, communication, etc. To

discourage software piracy, Free and Open Source Software (FOSS) is explored across the curriculum. This curriculum focuses on learning to compute, which includes learning to create using various tools and techniques, whereas ICT literacy, i.e., knowledge about the tools and ability to use them, is seen as the incidental outcome in the process of learning.

Adequate opportunity for hands-on practice is part and parcel of methodology, and also, the opportunity is provided for open-ended exploration of ICT applications rather than imposing a specific application. The course content has an inbuilt scope for critical evaluation and sharing of learning for feedback and improvement. Peer sharing and review are built as part of the course strategy. Awareness of the social, ethical, and legal aspects of using ICT is integrated across the course content to build a healthy ICT environment and ensure the safe and secure use of ICT. It is integrated such that it is practised intentionally. Creation of original content, taking pride in their creation, and duly recognising others' contributions are the core essence of the curriculum. This curriculum aims at ensuring the full utilisation of infrastructure and resources, integrating it with the school system. This fosters a sense of ownership and also enables universal access among the stakeholders. Keeping these guiding principles as a base, the courses are developed and delivered to the teachers to instil the same principles further in action.

Learning strands of the Curriculum

ICT in the education curriculum for teachers focuses on six major strands that explain the objectives and content of the courses delivered based on this curriculum. Information is spread across the universe, and the internet is the gateway that gives access to this information in the digital space. Having access to such updated and authentic information is a boon to teachers in providing appropriate information to students. A teacher needs to develop the skill to search for appropriate information based on the requirement, access it from various resources like text, audio, video, interactive activities, etc., organise it and use it as per the need in a safe and secure manner. Such skills in terms of searching, retrieving, organising and presenting information through the internet are provided as part of the courses, enabling the teacher to be connected with the world.

ICT provides space for people to be connected with each other through various subject-based forums, groups like telegram, WhatsApp etc., and electronic communication systems like email etc. This feature provides an opportunity for teachers to interact with other teachers crossing the barrier of location, time, demographic difference, etc. It also can provide a warm environment, overcoming the fear of being tagged, named, titled, etc., with even unknown teachers across the country to clarify doubts, queries, discussions, etc., providing a better learning environment. Practising skills to connect with each other in terms of participation through various communication techniques and systems is the scope of the strand - connecting with each other.

Creating various resources using different tools and techniques supports teachers in planning the use of ICT in the process of teaching, learning, and assessment based on context. The wider the range of tools, devices, software applications, and techniques the teachers are aware of and can productively use, the wider the opportunities for developing their

imagination and expression that impact the student's learning to a greater extent. This enables a teacher also to use ICT not as a mere information delivery tool but as an enabler to construct knowledge. Thus, teachers acquire skills in creating with ICT using various tools and techniques that enable a teacher to become a prosumer rather than just a consumer.

While creating with ICT, teachers also encounter various devices where a broad conceptual understanding of how ICT devices and tools work, along with operational knowledge of safe and efficient use of ICT, is the aim; learning basic ways to troubleshoot and work around problems is developed (NCERT, 2012). By interacting with ICT, skills for handling ICT tools are developed and not through rote learning.

Understanding the possibilities of using ICT in education includes understanding the use of various resources for addressing educational needs, tapping the potentials of digital resources and tools in improving the learning outcome of students, developing a conducive learning environment, planning learning experiences effectively, implementing in a meaningful way, etc. Skills to bridge the gap that exists in terms of social and geographical differences is the sole responsibility of the teacher while providing a learning experience. Tapping the potential of ICT to bridge the gap needs exploration and understanding of the tools and techniques. Building such skills is the focus of this strand, known as bridging the gap.

ICT in Education Course for Teachers

Courses are majorly classified as induction and refresher. Induction is basically a face-to-face training where only materials are accessed from the course portal, and portfolios are maintained digitally. Whereas refreshers are delivered in blended mode or completely online. Course content is delivered in various forms in a blended mode, like face-to-face demonstrations, online sessions, video lectures, online discussions, interactive activities, etc. Induction courses focus on developing ICT skills, whereas refresher courses focus on developing pedagogical skills for integrating ICT into Education. Teachers need to practice teaching and instructional design skills so that they can engage students in constructivist thinking, experimentation, problem-solving and learning linked to real-life situations using various ICT tools and techniques and capturing them as portfolios (Kheng et al., 2000).

Courses are offered at two levels. The first level recommends mandatory courses for teachers to become users of digital technology and integrate it effectively in teaching, learning and assessment. However, level two recommends courses for developing advanced knowledge and skills in building the digital ecosystem and operating effectively to provide quality and accessible education to all.

As the course is built with more hands-on activities, the teachers who undergo this course will develop confidence from practising. Support for handhold is also devised in terms of e-groups, forums, chat rooms, etc. The approach of the course is such that activities are extended and practised in the school in real classroom setup and portfolios are maintained to provide timely feedback for improvement. Advanced courses are delivered online.

Insights from the Pilot Study in Demonstration Multipurpose Schools of NCERT

Demonstration multipurpose Schools of NCERT at Ajmer, Bhopal, Bhubaneswar and Mysore act as lab schools where all innovations are piloted and shared for further implementation in schools

across the country. The major research questions for the pilot were:

- Whether ICT competency of teachers can be developed through Induction and refresher courses?
- Whether attitude towards integrating technology in education changes after the intervention of induction and refresher courses?

During the pilot, the focus was also to study the time requirement for implementing these courses and also to check the suitability of the course content towards developing the competencies. The courses suggested by ICT in the Education Curriculum for teachers were implemented in all four schools, and all teachers were trained in induction and refresher courses. The induction course was implemented for 10 days, refresher course -1 was implemented for 11 days and refresher course -2 was implemented for 5 days in face-to-face mode. The effectiveness of this training was studied in terms of ICT competency and the attitude of teachers towards the use of technology. Data was collected through the ICT competency and attitude scale at the start of every training.

The data reveals that there was no significant change in attitude at the end of the first training, where teachers were trained on using technology for creating and sharing digital information. Around 12 per cent of the teachers still showed a negative attitude towards the use of technology in terms of time and skill of teachers. However, at the end of the second training on ICT-Pedagogy integration, around 79 per cent of the teachers were found to have a highly positive attitude towards using technology in the teaching-learning process. No teachers showed a negative attitude towards technology use.

ICT competency was studied with the following dimensions: use of hardware, use of the digital application, building a digital ecosystem, integration of ICT in the teaching-learning process and safety & security aspects. At the end of refresher course 2, teachers showed improvements in all dimensions of the ICT competency. Teachers showed only a 23 per cent improvement in safety and security aspects. Whereas in all other dimensions, on average 92 per cent of the teachers were able to use technology without any support.

This pilot study revealed very clearly that a systematic, holistic approach to the curriculum supports in development of knowledge, attitude and skill in the use of ICT in the teaching-learning process.

Insights from the Implementation of Induction Course in the State of Karnataka

The induction course was implemented in the state of Karnataka for teachers working at the secondary stage of school education. The training was implemented in a cascade model where the CIET team (National level experts) trained the State Resource Groups (SRGs), SRGs trained the Key Resource Persons (KRPs), and in turn, KRPs trained the teachers. To implement the training successfully, the following strategies were implemented:

1. A training manual was prepared so that the content is shared uniformly

2. SRGs were trained on the content as well as the methodology of training so that the transaction of the content goes uniformly

3. The training was conducted as a residential programme so that the learners could make use of their time in more practice

4. A team of mentors doing the complete training of 10 days that supported building trust, and

continuous support was provided

5. All the handouts were provided for ready reference so that the learners were able to refer to them immediately. The text-based handout was supported by regional language (Kannada) videos for better demonstration and explanation.

6. Allocation of mentors enabled discussion and handholding of the teachers

7. Follow up at the school level in using the competencies gained during training and support by cohorts when the learner was not able to practice motivated and push the learners to use technology in classrooms

8. A baseline data collection was felt as a need to understand the growth in individuals

9. Review at the end of every year helped to address the challenges

10. Systematic planning helped in the coverage of teachers and scaling up the implementation

After implementation for two years, a short study was conducted by the state to understand the impact on classroom practices. Around 710 schools were visited by 290 field investigators observing the classroom interaction and also collecting data from 734 respondents. The data collected reveals the following:

1. Digital infrastructure is available in 75 per cent of the schools with laptops, which were distributed by the states under the ICT@School scheme

2. 52 per cent use both proprietary and Linux operating systems. Around 29 per cent of the schools use proprietary operating systems, and 19 per cent of schools use only Linux operating systems. This data shows the readiness of the school system to use Free and Open-source software (FOSS).

3. Not less than 50 per cent of schools had digital infrastructure like desktops, multimedia projectors, pen drives, printers, TVs, radios, computer labs, UPS and wi-fi facilities that enable the use of technology after the training.

4. In 42 per cent of the schools visited, at least four teachers were found to use technology on a regular basis, i.e. 4 periods in a week.

5. Not less than 65 per cent of teachers used videos and presentations as digital resources. Around 40 per cent of the teachers were found to develop their own digital resources based on the need for the content. Around 12 per cent of teachers extensively used simulations in the classroom.

6. The percentage of teachers using technology in the class increased from 41.16 per cent to 75,22 per cent as the maturity level of the teachers in using technology improved due to the training and follow-up activities. Continuous mentoring and support systems established by the state enabled the progress.

7. Digital resources from various sources were used by the teachers after the first level of training. However, teachers started developing their own resources after one year of training.

8. Even administrative efforts were taken to enable ICT integration, like mentioning log books in the use of digital infrastructure, ICT integration in school timetables, lessons the ICT integrated lesson plans among teachers, etc.

A detailed study of the implementation is required to get insights and learning

from the large-scale implementation in the state.

Conclusion

ICT in Education curriculum developed for teachers is a model curriculum encompassing innovative methodologies in integrating ICT. Thus, the curriculum aims at building the competencies of each teacher towards integrating ICT in Education to improve the teaching-learning process. As the teachers provide a rich learning environment, the students have a scope of improving and achieving the learning outcome. This curriculum focuses not just on developing skills to use ICT but focuses more on building skills for integrating content, pedagogy and ICT meaningfully. A holistic approach is required for developing digital competencies in teachers. Not only knowledge but change in attitude and also competence in skill is a requirement for effective implementation of ICT in school education. Other states/ UTs in India have also released this based on various studies done across the country and efforts are being taken to follow this holistic approach. Changes due to the pandemic have brought in new learnings and challenges that are considered, and new strategies are evolving to address the current need. There is scope for studying the new strategies being evolved and integrating them into the curriculum for a better solution in capacity building of teachers in the use and integration of digital technology.

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