ICT - Pedagogy Integration for Pre-Service Teachers

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Abstract
The new challenge in this technology prone world lies before the teacher education institutions. They are to prepare a generation of teachers ready to teach digital natives. To achieve this they need appropriate resources, expertise of implementation and careful planning. The paper highlights use of ICT in the field of teacher preparation program and ways and means to achieve them through appropriate integration of ICT in Pedagogy. It aims to help pre service teachers and teacher education institutes to consider the possibilities for integrating technology and pedagogy. The objectives of the paper are to identify the technological resources for integrating technology with pedagogy and outline the possible challenges and barriers faced by pre-service teachers and teacher educators and suggest an appropriate model for integrating ICT and pedagogy for the pre-service teachers

Keywords- *ICT, Competency, Digital natives, pedagogy, pre-service teachers*

1. INTRODUCTION

The history of the mankind witnessed the first revolution with the invention of written language, for the first time people could store and retrieve information without relying on their memory. The evolution of Printing press brought out the second revolution that led to dissemination of information through books, pamphlets etc. to wider areas. The third revolution was brought by information and communication technology (ICT) by dissemination of information as well as knowledge.

We are leading towards a fourth revolution with the use of Wikipedia, Skype, Viber, Instagram, Face book, Twitter, Google plus etc., these have transformed the way we live, learn, work and play. In the present times learning is moving beyond the four walls of the classroom, and that new terms have been coined to express these innovative ways of learning, terms like:

- m-learning or mobile learning, and
- u-learning or ubiquitous learning

The ever increasing demand of globalized world has been a teacher well equipped with content and advanced pedagogical techniques in order to cater to the learners of 21st century. A recent development in this direction is the effort made by researchers and teachers is to integrate technology and pedagogy to the present generation learning community. The boom in the information and communication technology in the present times clearly indicates the inclination towards use of technology for the process of teaching and learning. ICT refers to all the technologies by means of which we can detect the information signals, interpret them and exchange information with others. In order to completely harness the opportunities provided by information and communication technology for teaching and learning **UNESCO document of information and communication technology in Teacher education(2002)** are

- Access to digital technologies by both teachers and students in classrooms, teacher education institutes and schools
- Availability of meaningful and high quality digital content
- Competent teachers who can use tools of ICT in order to achieve high academic standards

Teacher education institutions have a daunting task of preparing teachers to use these tools of information and communication technology for the learning process.

For this purpose the demand of competency expected from teachers for using ICT in schools is to be mapped with the teacher preparation

program in teacher education institutions, this requires availability of resources, expertise and careful planning.

Society for information technology and teacher education (SITE 2002) has outlined basic principles of effective teacher education

Principle 1 Technology should be infused into the entire teacher education programme
Use of technology in teacher education program should not be restricted to one or two subjects rather; the pre-service teachers need to be exposed to a wide range of technological implementations during their teacher preparation.

Principle 2 Technology should be introduced in context
The use of technology should not only be in terms of use of basic computational skills like use of word, spreadsheet and knowledge of devices alone but apart from these the teacher educators must also present exemplary models for technological interventions in pedagogy as well as field experience for the use of technology. Pre-service teachers need to use it as a learner for their own study purpose as well as thinking creatively about its while teaching.

Principle 3 Students should experience innovative technology-supported learning environments in their teacher education programme
Incorporation of technology by the teacher or teacher educators should aim at transformation of the learning environment. This can be best achieved by using multimedia in the classrooms for the purpose of teaching and learning.

In the Indian context the teaching and learning can be based on above principles if the teachers are competent in using technology. Further the levels of expected competency are as shown below.

2. Background

2.1 ICT Competency amongst teachers in India
ICT competency for the teachers as well as teacher educators needs to be developed in stages, as some of them are highly competent in using technology and may find it difficult to compete with their technologically novice counterparts. The document of **National policy of ICT in school education** defines ICT Literacy in terms of levels of competence.

Based on the stages of schooling at which a student or teacher is introduced to ICT, they may progress to different levels. It also emphasizes on changing the competency levels with changing times. The three levels of competency defined in this document are:

2.1. 1BASIC
- Basic Computer operations
- Storing retrieval and managing data
- Use of word processor
- Connecting to internet, surfing on net
- Basic knowledge of input output devices
- Use of e-mail
- Connect, disconnect and troubleshoot digital devices

2.1.2INTERMEDIATE
- Use of software applications for managing content and digital devices
- Extensive use of web sites and search engines to locate, retrieve and manage content as well as resources.
- Installation, uninstallation and trouble-shooting of the software

2.1.3 ADVANCED
- Use different software applications to enhance ones own learning–database Applications,
- Analysis of data and problem solving, computing, design, graphical and audio-visual communication;
- Undertake research and carry out projects using web resources;
- Use ICT for documentation and presentation; create and participate in web based networks for cooperative and collaborative learning;
- Becoming aware of issues of cyber security, copyright and safe use of ICT and take

Necessary steps to protect one self and ICT resources.

This document highlights the various means of capacity building through preservice teacher education programs in India as given below

1. Orientation of teacher educators for using ICT by sensitizing them to use ICT, also they need to be trained to use the information and communication technology in all the spheres.

2. Including the Compulsory component of ICT in Pre-service teacher education curriculum

3. In the years to come also, the ICT competency should also become the eligibility criteria for appointments of teachers.

Also National Council for teacher education (NCTE) has made it compulsory for all teacher training institutions to have ICT infrastructure availability.

At the entry level of the pre-service teachers in teacher education institutes the testing of ICT competency need to be introduced not for the purpose of selection but for deciding on the competency levels of the new entrants. After making decision on their level of competency the these pre-service need to be taken to the next levels of competency through appropriate training and help. Also, Information and Communication Technology need to be used as an integral part of the respective pedagogies of the trainee teachers. The suggested frame work for Including ICT in the Teacher Education Curriculum is discussed in the next section.

3. FRAMEWORK FOR INCLUDING ICT IN TEACHER EDUCATION CURRICULUM

According to the new NCTE frame work for teacher education ICT must become the integral part of it. The integration of ICT should not be restricted as a core or optional subject rather ICT need to be integrated at all levels along with training in ICT as per the competency level of the pre- service teachers at the entry level like

- Planning of lessons
- Projects and assignments
- Content creation
- Assessment

ICT can be made integral part of teacher education curriculum by integrating it with the pedagogy as shown below in a diagrammatic manner
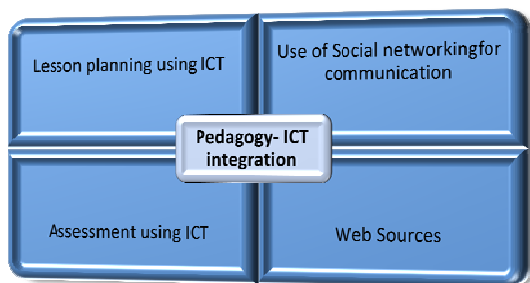

Fig 1:ICT Pedagogy Integration framework

The details of integration of ICT and means of achieving it are described in the following sections.

3.1 ICT as an compulsory elective Subject

After entering into the teacher education institutions the pre-service teachers need to be tested for their level of competency whether basic, intermediate or advanced. Depending upon the level the preservice teachers can be taught ICT Skills by introducing the following as compulsory elective subject at B.Ed/ B.El.Ed/D.El.Ed level:

ICT Basic level
ICT Intermediate
ICT Advance

The table given below specifies the offering of optional Subject of ICT for the student based on their ICT competency:

Preservice teachers			
Courses Level ⬇️➡️	ICT Basic	ICT Intermediate	ICT Advanced
Beginner	√	√	√
Basic		√	√
Intermediate			√
Advanced			√

Table 1: Frame work of ICT as compulsory elective course at different levels

The curriculum for these three courses of ICT needs to be mapped with the competency as specified by the **National policy of ICT in school education.** Apart from this ICT need to be used in each and every course of the teacher education program.

3.2 ICT in lesson Planning

Use of information and communication technology for planning a lesson can be made easy and readily accessible for the teachers as well a the pre-service teachers. Few suggestive tool that can be used for the purpose of lesson planning are given below

3.2.1 Web Quest

According to Dodge (1995) web questincludes are inquiry-based activities planned by the teachers and through which students get a chance to interact with resources suggested by

teachers on the Internet . These structures are planned to support the work done by students using appropriate sources and technology. By using Web Quests it is possible to construct collaborative activities, in order to improve critical-thinking skills as well social skill, increase level of motivation, and provides hands-on experience (Leahy & Twomey, 2005). As specified by March (1998) that Web Quests were designed to bring all the effective instructional practices together and integrate student activities. It is an ideal way to deliver a lesson over web.

The inquiry activity may be of the form such as a problem to be solved, designing or creation of product etc.. Teachers can create their own Web Quests in accordance to the curriculur needs. Also, they can use a Web Quest that someone else has created.

Web Quests have a definite structure:

- **Introduction:** For orienting the students for the inquiry based activity and also, for creating interest amongst the learners
- **Task:** It includes clear and concise description of the outcome of the learning activity
- **Process:** Lists the steps learners will take to accomplish the task and the digital, web-based and other learning resources that support learners in this process. This has to be crisp, clear and precise.
- **Evaluation:** Provides a rubric to indicate how learners' performance will be assessed
- **Conclusions:** Summarizes what students have learnt, their reflections
- **Teacher Page:** This page is for providing a link to a template in order to allow the teacher to implement the web quest design. The template comprises of

1. Top
2. Introduction
3. Learners
4. Standards
5. Process
6. Resources
7. Evaluation
8. Conclusion·
9. Student Page
10. Credits

3.2.2 Edcanvas

It is free WEB2.0 tool for creating and sharing the lessons digitally. These lessons are a visual delight. Through the use of the canvas or blending space, the teachers can create, organize, present and share the available online resources with their students. It is possible to link the relevant images, videos and other files in accordance to the requirement of the topic to the lesson plan for the students or other teachers. The resources for upload may be acquired through the built in search tool of Edcanvas. It also provides space for uploading the questions based on the uploaded content. Once the students have received the content they can give a 'thumbs up' to show that they have understood the concept or material and also, they can questions relevant to the material

3.2.3Wiki Spaces

They allow sharing of lessons, media, and other materials online with students, or lets them collaborate to build their own educational wiki on Wiki spaces. This is a very effective tool for sharing the ideas of planning a lesson amongst the pre-service and the in-service teachers. Similar tools for lesson planning are also provided through **Betterlessons.org, Soft Schools, Sparknotes, Qwiki, Gapminder, Learnboostetc**

- **Teachers Pay Teachers**: If teachers have great lessons to share or if they are looking for something to add to their classes? On this site they can do both, selling their own class materials and buying high-quality resources from other teachers.
- **Capzles:** It makes it simple to gather media like photos, videos, documents, and even blog posts into one place, making it perfect for teaching, learning, or online projects.
- **Quizlet:** Quizlet makes it easy for teachers to create study tools for students, especially flashcards that can make memorizing important information a snap.
- **Pinterest:** Teachers can pin just about any image they find interesting on this site, but many teachers are using it as a place to collect great lesson plans, projects, and inspirational materials.
- **Google Education:** Google offers a number of great edtech resources for teachers, including email and collaborative apps,

videos, lesson plan search, professional development, and even educational grants

- **Popplet:** Teachers and their students can use Popplet to brainstorm ideas, create mindmaps, share, and collaborate.

3.3 Use of Social Net working for communication

Prensky (2001) has coined the term 'digital natives' for the children born in the beginning of this century. Their world consists of television, texting, camera phones, iPads, and interactive video games. They can do multitasking with all these tools in an efficient manner. As they chat online with friends, they use a form of shorthand they have created themselves like WBU (what 'bout you), BRB (be right back), IRL (in real life), NP (no problem), LOL (laugh out aloud). This generation requires high level of social and creative engagement.

Muirhead, B., & Juwah, C. (2004) highlight the importance of interaction in learning in accordance to the modern theories of learning.

For this purpose the teachers need to be prepared for the use of social networking for the process of teaching and learning. Few such tools of social networking that can be of great use to the teachers and need to be a part of teacher training are specified below.

3.3.1 Blogging

Journal writing has long been an activity utilised in the primary classrooms. Journal writing allows students to reflect on what they are learning and how they are learning. This traditional, notebook-and-pencil activity goes online as a blog. Blogs (a short form of the weblog) are personal journal websites on which a user can type an entry, add images, video and links to other websites. Readers of a blog usually can post comments.

For primary school students, the use of blogs have been found to be an engaging and effective way to promote writing skills, particularly when student peers provide feedback to the blog's writer. It is exactly this feedback and sharing mechanism that makes the blog different to the traditional journal. In the notebook-and-pencil version, the contents of the journal are private to the student, apart from the teacher and whomever the student decides to share the journal with. With the blog, access can be provided to the teacher, the class, the student's parents and the world.

3.3.2 School Circle

This is a new web tool for facilitating communication between teachers and students. It allows teachers to create circles for their classes. A circle is a space designated by the teachers for their classes and where they can invite parents to join in. It can be used to organize class events, assign tasks, share documents, messages, files and pictures. The parents can be invited to join this class circle and there is an option to designate a 'room parent' who can be entrusted with the management of that task (e.g invite other parents, create new circles, share content with other parents…etc).

Other than these there are many tools provided by ICT for social and collaborative learning to take place a few of these have been listed below with which the teacher trainees need to be acquainted during teacher preparation programme.

- **EduBlogs:** Edu Blogs offers a safe and secure place to set up blogs for the teachers or for their classrooms.
- **Skype:** Skype can be a great tool for keeping in touch with other educators or even attending meetings online. It helps teachers to connect with other classrooms, of other countries.
- **OpenStudy**: Encourage students to work together to learn class material by using a social study site like Open Study.
- **ePals:** It lets the student connect to other students, by helping them to learn languages and understand cultures different from their own
- **Twitter:** There are so many ways Twitter can be used in education. Teachers can connect with other educators, take part in chats, share their ideas, or even use it in the classroom to reach out to students

3.4 Assessment

Black & William (1999) specified key factors for assessment as learning through assessment is possible only if there is a provision of effective feedback to the pupils, they are actively involved in learning, adjusting teaching in accordance to the feedback of assessment,

recognition of influence of motivation on learning, self-assessment by the students and scope of improvement.

ICT can be crucial in enabling teachers to make apt and accurate decisions the level of learning attainment by the learner and then predicting the achieved grades. It also plays an essential role in reporting of the assessment. It is essential for the pre-service teachers to be trained in the some such tools of assessment have been specified below.

3.4.1Socrative

It is a method of evaluation based on student response system. In this there ia a 'teachers room' which can be accessed by the students using the 'room number' and the teachers can provide MCQ, short answer question, quiz etc to the students. The students are able to see the statistics of the other students responses in their own screen. It is available for computers, mobile devices, and tablets, this student response system engages students through games and exercises on any device they have on hand. The teachers can easily assess student progress and track grades.

3.4.2.Edmodo

It is a learning management system which is liked by school students because of its resemblance to face book. It is possible to create quiz with Edmodo and give immediate feedback to the learners. It allows them to see the correct answer key once the quiz is over. Also, the teacher can show comparative statistical data of assessment prepared by Edmodo to the learners.

3.4.3.Class Dojo

It is a powerful classroom management tool for teachers for recording studentsbehaviour and building positive rapport with students in class. ClassDojo captures and generates data on behaviour that teachers can share with parents and administrators. It has also released an excellent new service that allows teachers to communicate with parents via exchanging messages. There are two types of messages teachers can send through Class Dojo :

a) **Direct messages** which are messages that can be sent to parents on an individual basis , and

b) **Broadcast Messages**, these are messages to be sent to parents as a whole group.

4. Other Pedagogical Tools for Pre-Service Teacher Training

4.1. Tools for creating Virtual Environment

Another collaborative activity is where students work together to discover a place or environment, or to understand a topic. This can be done using an online environment or a virtual environment. Some education-specific, virtual worlds have been constructed to allow students to work together to develop their understanding of a topic.

For example, **Quest Atlantis** is an online world that uses a videogame for school students to work on educational 'quests' with other students and mentors. Research with students who have used such virtual worlds have demonstrated that students engage deeply with the content and gain team work skills that support them in collaboratively and effectively solving the problems presented to them (Barab, Gresalfi & Arici, 2009).

Other tool that support collaborative learning include discussion boards, which can be used to encourage students to have discussions and debates. Apart from discussion boards the other tools are Edusim, Mingoville, Minecraft, Shaker etc.

4.2.Tools of animation

4.2.1. Slowmation

Creating a slow mation is a way for students to explain a concept or process by designing and making a stop-motion animation that is played slowly, at two frames per second. In a slowmation, the learner (or group of learners) plans how to explain the concept or process through a series of images. These images are then stitched together to make the animation. A voice-over narration helps to explain the concept or process

The other tools available online for creating animation for language as well asmathematics teaching could be

- **Educreations:** Educreations is an amazing online tool for the iPad that lets teachers (or students) create videos that teach a given topic. Perfect for studying or getting students to display their level of knowledge acquired by them.

- **Animoto:** Animoto makes it simple to create video-based lessons or presentations

for the classroom and to share them with students or anyone else.

4.3. Tools for Learning

Apart from this the future teachers must be well acquainted with the tools of learning for the students or learners available through Information and communication technology. Hence the teacher training program must include the knowledge about the following:

- **Kerpoof:** On Kerpoof, students can get creative with their learning with games, interactive activities, drawing tools, and more that are both fun and educational.
- **Study Sync:** With a digital library, weekly writing practice, online writing and peer reviews, Common Core assignments, and multimedia lessons available, this site is a fully-featured tool for teaching and learning that can be a big help in the classroom.
- **Google Earth:** From geography projects to learning about geological processes, Google Earth can be an amazing and fast way to show students anywhere in the world.

5. Challenges and Barriers

The very recent curricular changes as proposed by NCTE highlight the importance of introducing **Information and Communication Technology (ICT)**as in the teacher preparation program, however, it is true that most of the teacher preparation programs are not embedding technology into their teaching.

The major hindrances in using technology for preparing teachers may be categorized into the following broad areas:

- Resource limitations,
- Teacher trainers knowledge and skills regarding technology –pedagogy integration,
- Student teachers and teachers attitudes and beliefs towards use of ICT

Using technology effectively to promote student learning means thinking about effective learning strategies and effective classroom management. Teachers are faced with challenges and barriers all the time. Technology's place in society causes teachers educators to consider the implications for them in their role as educator and as lifelong learners themselves. The constant challenge for teachers is to draw upon their continually developing knowledge and skills about what to teach and how to teach. Technology is just one, but an important consideration in that equation.

6. Suggestions

The suggestion for future research are given as follows:

•developing a competency based regional guideline on technology-pedagogy integration by teachers
• developing course materials for pre-service teacher education and training modules for in-service teacher training
• designing model ICT-integrated e-lesson plans and rubric based evaluation tools for teachers to assess their students' learning using ICT
• Training teacher educators through 'training of trainers' workshops at regional, national as well as international level
• creating both online and offline networking for teacher trainers, heads and various teacher training institutions in integrating ICT in classroom teaching through innovative practices
• rewarding the most innovative e-lesson plans and ICT integration pedagogies, and for the inclusion of international resources.

7. Conclusion

The pace of technological change in society and in schools has been exponential and will continue to be so. Teachers are using ICT to support their role in mentoring students with structure and advice, monitoring their progress and assessing their accomplishments. When students use technology to conduct research projects, analyse data, solve problems, design products and assess their own work, they work with others to create and communicate new knowledge and understandings. This paper has presented a range of tools that need to be introduced in the teacher education program. These strategies are based on theories of learning that allow teachers to provide different experiences for their students. Technology is changing all the time and what we know about how to use that technology effectively is developing continuously. As a future teacher, student teachers need to continue to develop their understanding regarding the use of technology to help their students learn effectively in future.

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