

ICT Tools and Resources-A Study of Higher Education in India

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Abstract: Information and Communication Technology ICT-enabled education includes infrastructures like computers, the internet, telecommunications infrastructure, digital technologies such as smartphones and tablets, and applications used for information processing. Quality Education can be achieved at anytime from anywhere. ICT environments will allow learners and teachers to improve their skills. Mobile-based Apps and tools also can be utilized. Though capital Expenditure for implementing ICT is high, it improves efficiency. It involves the integration of data and analysis and can be used in research and evaluation.

The study reviews various ICT tools and resources in the educational process and shows that they significantly improve the educational process. The review covers various e-journal Consortia, e-content Development, and management. The study goes through various planning periods of UGC and ends with current trends in ICT. AI is one of the fastest-growing areas in ICT.

Keywords: ICT Initiatives, NMEICT, e-Journals, OER, INFLIBNET, LMS

Introduction

The growing enrolment in higher education shows specialization is vital. Creating intellectuals of world-class caliber necessitates training many skilled personnel without sacrificing educational quality in order to achieve excellence in higher education institutions. Information and Communication Technology (ICT) is indispensable across various sectors due to its capability to adjust to evolving requirements.

There is a shortage of educational resources, faculty members, and remote learning facilities in India, leading to a high dropout rate. The low enrolment rates in higher education in India is influenced by various socio-economic, cultural, and policy-related factors.

Both teachers and students benefit from the use of ICT. Enhancing the quality of education through experiential learning, guided instruction, autonomous learning, and problem-solving can create a more engaging, effective, and comprehensive educational experience. By integrating these methods, educators can better prepare students for academic success and real-world challenges. The use of ICT also increases the ability to communicate, collaborate, and learn.

II. METHODOLOGY

Literature Review

The advantages of using ICT in education concerning students are that they can access the material from anywhere at any time so that they can do both learning and

earning simultaneously. ICT assures a Learner-centered approach without compromising the quality of education and interaction. Teachers could improve their skills and avoid the repetition of producing resource materials with less cost.

To reach education in remote areas of villages, India uses ICT in combination with Open-source software, local language interface, satellite technology, digital libraries, etc. The Indian government's measures to enhance educational access, quality, and equity by leveraging the potential of digital technologies have laid a strong foundation for a more inclusive and modern educational system. The measures include:

1. Delivery of content

Gyan Darshan

Launched in 2000, Gyan Darshan is a bouquet of channels that broadcasts educational programs for school kids, university students, and adults. Courses are contributed by IGNOU, UGC CEC, IITs, etc.

Gyan Vani

It is a bouquet of FM radio channels that broadcast programs contributed by institutions such as IGNOU and IITs.

UGC Countrywide Classroom

Under the country wide classroom initiative, education programs are telecast on Gyan Darshan and Doordarshan's National Channel (DD1) every day.

E-Gyankosh

It is a knowledge repository launched by IGNOU in 2005 that aims at storing and preserving digital learning

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resources. Almost 95% of IGNOU's printed material has been digitized and uploaded to the repository.

National Programme for Technology Enhanced Learning (NPTEL):

The National Programme on Technology Enhanced Learning (NPTEL) enhanced the quality and accessibility of engineering and science education in India [1]. CDEEP- the Centre for Distance Engineering Education Program uses real-time interactive satellite technology to enhance the ability of students to engage with course material in a meaningful way [2].

2. Enabling access to resources

E-journal consortia

"UGC has also launched its Digital Library Consortium to provide access to peer-reviewed journals and bibliographic databases covering subjects such as arts, humanities, and sciences" [3].

Interconnecting higher education institutions

"Education and Research Network (ERNET) promoted by the Department of Information Technology, Government of India, provides communication infrastructure and services to academic research institutions in India" [4].

Sakshat portal

The Sakshat portal by expanding its reach and capabilities, it aims to support the whole study group to facilitate informed decision-making, and ultimately enhances the quality and accessibility of education in India [5].

Creation of new digital content

Virtual Technical University (VTU) aims to facilitate the education and training of undergraduate and postgraduate students, as well as new teachers, with a focus on disciplines such as science, technology, management, and related fields.

Quality assurance

National Resource Centers (NRC) have been established to ensure a standard and quality management of digital resource materials in colleges, universities and Engineering and Technology segment. Non-government sectors also used the system to enhance knowledge infrastructure and utilized ICT to augment their potential. Example: Amity University.

3. Achievements of the Tenth Five-Year Plan:

Some of the measures taken in the Tenth Five Year Plan to enhance ICT are UGC- INFONET, e-Journal

Eklavya initiative: Uses Internet and television to promote distance learning (EKLAVYA Technology Channel). <http://web.iitd.ac.in/eklavya/index.htm/>

Consortia, e-Content Development and Other digital resources with access granted to approximately 4400 e-journals.

Major repository for valuable academic content within universities and colleges across the country that stays unexploited. Preserving this wealth of knowledge in digital form can greatly enhance the knowledge base, facilitating its distribution through digital networks. By incorporating UGC- INFLIBNET, and Consortium for Educational Communication, in collaboration with ERNET, India has made notable strides during the Tenth Five-Year Plan.

UGC-INFONET Connectivity

UGC-INFONET initiated by the University Grants Commission is aimed at constructing a fast national connectivity network for academic institutions. UGC-INFONET Digital Library Consortium is now part of e-ShodhSindhu.

ERNET/INFLIBNET conducts a series of Network governance training classes for IT staff in academic institutions. These programs equip participants with skills needed to operate and sustain UGC-INFONET in their institutions.

4. ICT in Eleventh Five-Year Plan

In this phase, ICT coverage is extended to all universities and colleges. The gains achieved through programs in the previous plan period will be sustained and utilized to rejuvenate and empower intellectual centers (universities and colleges) within society. This will involve utilizing networks, digital educational content, virtual classrooms, international educational materials, archiving content by using communication techniques. This will also encompass Audio/Video communication infrastructure at universities and Human resources development.

5. Interuniversity Centers (IUC)

The Inter University Centres established by UGC serve as hubs for multiple universities, offering shared facilities that are economically unfeasible to replicate individually. These centers are recognized as centers of excellence and focus primarily on enhancing human resource development capacity.

The IUCs have significantly empowered the university community by providing access to cutting-edge research facilities that are otherwise unavailable. Three of these centers—IUAC (IU Academic Council), IUCAA (Inter University Centre for Astronomy & Astrophysics), and UGC-DAE CSR (UGC-Department of Atomic Energy

Consortium for Scientific Research)—are primarily focused on research and have made substantial contributions to high-quality research endeavours.

The remaining three centers CEC (Consortium for Educational Communication), NAAC (National Assessment and Accreditation Council), and INFLIBNET (Information and Library Network) are dedicated to maintaining and enhancing educational quality and excellence.

5.1 Centre for Educational Communications (CEC) www.Cec.nic.in

CEC utilize technology-enabled systems to promote e-learning resources in formal education, enhance educational quality, and increase student enrolment with existing resources. Educational Multi Media Research Centers (EMMRC) were established to enhance knowledge packaging in video and e-content development.

5.2 Information and Library Network (INFLIBNET)

It is used to network libraries in various academic institutions to provide online access to a wide range of academic and research materials to ensure the availability of high-quality digital resources, supports research activities, and fosters a collaborative academic environment.

6. Twelfth Five-Year Plan

Various measures incorporated in this period are:

1. Digital Infrastructure Initiatives:

It included upgrade of connectivity for universities and colleges, enhance computer labs, initiate smart classrooms with video conference facilities and implement basics for cloud computing.

2. Content Initiatives:

The aim was to develop virtual labs and promote user-generated content, establish a national-level consortium for proprietary content, create open-access content repositories and interoperable institutional repositories and launch a single portal for access to all content.

3. Governance Initiatives:

It included implementing institutional Enterprise Resource Planning (ERP) systems, computerization of examination wings across universities, establish online linkage between affiliating universities and colleges, develop an online data collection system and automate library systems.

4. Training and Capacity-Building Initiatives:

Provide faculty training in instructional design and content creation and conduct extensive capacity-building efforts for technology-mediated pedagogy in classrooms.

ICT can be integrated into education to improve content, methods, and access, but it cannot be considered as a substitute for classroom teaching. Faculty web pages can be incorporated without making it mandatory, to make the educational process visible. A blog is created where you can interact with the teacher. Photos can be uploaded.

The teaching and learning of certain subjects can be transformed by incorporating ICT tools. [6]:

By utilizing free software such as Scilab, Python, and LaTeX, mathematics can be presented visually, offering a significant opportunity to completely transform mathematics education. Chemistry is another example where molecular visualization with free software like Rasmol can be incorporated into teaching. Similarly, a language lab for English teaching exemplifies the potential of ICT integration. This will necessitate teacher training and the enhancement of ICT infrastructure. Additionally, all lab experiments can be conducted using www.vlab.co.in.

Open educational resources (OER) :

“OER: NMEICT, NPTEL, ePG Pathshala, NDL are defined by the United Nations as any type of educational materials in the public domain or introduced with an open license. Critical to supporting open knowledge and open access, OER are learning materials supporting legal and free (a) copying, (b) usage, (c) adaptation and (d) sharing. Creative Commons is a global, collaborative movement for the sharing of free, international, easy-to-use materials.” [7]

Learning platforms:

Learning Management Systems (LMS) is an application for creating, managing, and delivering educational content in an online method. Learners progress in accessing the content can be tracked. Faculties or trainers can create various courses integrating notes, audio video, video conferencing, and assignments and let students to enrol into their courses. A collaborative learning can be achieved. There are open source and licensed or free LMS are available. The most popular LMSs include Moodle (Australia) Open Source: www.moodle.org, Google Classroom (USA) Licensed/Free (For Limited Users): <http://classroom.google.com> and Blackboard (USA) Licensed: <https://www.blackboard.com> [7].

ICT Initiatives of the Ministry of Education (MoE)

1. SWAYAM (Study Webs of Active Learning for Young Aspiring Minds):

It is a free massive open online course (MOOC), providing quality education to students across India and they can earn credits where online courses are developed by faculties.

2. SWAYAM Prabha:

SWAYAM Prabha democratize education by utilizing the reach of television to deliver educational content which is available in multiple languages, catering to the linguistic diversity.

3. National Digital Library of India (NDLI):

A digital repository containing a vast amount of academic content in various formats and languages.

4. e-PG Pathshala:

An initiative for developing e-content for postgraduate courses in various subjects.

5. Shodhganga

This repository serves as a digital platform for the submission and storage of theses and dissertations by research scholars.

6. Virtual Labs:

Laboratory education is made easy and accessible by combining simulation-based learning with traditional laboratory practices. Virtual Labs contribute a lot to advancing scientific education, research, and innovation globally. Students can practice lab sessions from their space and time.

7. FOSSEE (Free and Open-Source Software in Education):

Open-source software can be used in educational institutions which can reduce costs and increase accessibility. Some of the software's are Libre office which can be used for word processing, spreadsheet and presentation. GIMP a graphics editor etc.

8. E-Yantra:

"It is a robotics outreach program funded by the Ministry of Education and hosted at IIT Bombay. The goal is to harness the talent of young engineers to solve problems using technology across a variety of domains such as agriculture, manufacturing, defence, home, smart-city maintenance, and service industries. e-Yantra build labs in colleges to facilitate training and to connect students and teachers to a wider innovation community served by e-Yantra" [8].

9. Spoken Tutorial:

It is offered by IIT Bombay. It Offers comprehensive, self-paced learning modules covering various software, programming languages, and technical subjects. Students can learn various open source software at free of cost

without earning a certificate and 4 credit certificate can be earned by spending a nominal fee and writing online exam. Student development programs and Faculty development are available under self-learning programs.

These initiatives aim to improve access of education using ICT [6].

A-VIEW - a virtual interactive e-learning platform.

e-Acharya – an integrated e-content portal.

Baadal - an open-source project helping institutes set up their private cloud.

e-Kalpa - creating digital learning environment for design.

Collaborative tools:

In Google Drive Google Docs can be used to create a document and edited and accessed by multiple users. Similarly, presentation can be done in collaboration using Google Slides. Etherpad is an open-source text editor for collaborative work on a document.

Activity tools:

Padlet, Miro, Whimsical, etc. are some of the activity tools that can be used by teachers to engage in teaching.

Virtual Class and Meeting Room:

appears similar to that of a real environment. Several virtual classroom applications are available that help in conducting the meeting and delivering a lecture in online mode: Zoom, Google Meet, Cisco Webex, Adobe Connect, WizIQ, Blackboard, etc. are the leading applications gaining wide support, particularly during lockdown. Teaching tools such as whiteboard, screen sharing facility, etc. are available similar to that of the classroom. Equipped with the recording functionality, the lecture once delivered can be recorded. Due to its recording feature, it offers a high degree of freedom in terms of accessibility from anywhere at any time and any number of times, according to the audience requirement" [9].

The website [10] is dedicated to teaching ICT and Computing at all levels. Students can access revision notes to study ICT subjects, along with numerous quizzes, competitions, and polls to make learning engaging.

FOSS for visually challenged teachers

Free and Open-Source Software (FOSS) based screen reading software named ORCA can be used for ICT for visually challenged. NVDA (Nonvisual Desktop Access) is a free, open-source screen reader for Windows that enables visually impaired teachers to access and interact with computer applications. BRLTTY can be used to access the console in text mode. Thunderbird with Accessibility Add-ons is a free, open-source email client

that, when paired with accessibility add-ons, provides an accessible email experience. Eclipse IDE with Accessibility Plug-ins is an integrated development environment that can be customized with plug-ins to support visually impaired users in programming and software development.

Requirements for implementing ICT in education

Implementing ICT in education requires infrastructure like High-Speed Internet Connectivity, Hardware like computers, laptops, tablets, smartboards, and other necessary devices for students and teachers and software for accessing to educational software, Learning Management Systems (LMS), and other digital tools. Other requirements are Educational Resources, Training and Capacity Building, Policy and Planning and Curriculum Integration.

Implementing ICT in education requires support from both government and institutional authorities. However, it has been observed that, due to the high fixed costs associated with technology adoption, institutions are not able to maintain and expand in future.

Demerits of using ICT in education

ICT can create a digital divide in institutions as students who are familiar with ICT will do better than those who are not as technology-savvy. As all faculties are not fluent in technology, it is hard for them to learn and create course online in very limited time. It can make a lag in teaching and learning at times. Students will have a tendency for copying instead of improving themselves. Training is required to enhance the capacity of technology for both teachers and students. Some may not be able to tolerate the expenses and facilities needed for online learning and teaching.

Summary and conclusions:

Changes in the curriculum cause social transformation in society. By integrating ICT in education, transformations can be made easy by incorporating various skills. Learners can access education at anytime from anywhere using ICT. Collaborative skills and knowledge creation skills can be developed using ICT and earn more jobs. Using ICT in education can enable democratic education. ICT policies are increasingly recognized as vital elements of broader development policy initiatives. ICT acknowledges the challenges posed by AI and emphasizes the requirement for more virtual learning environments. Some of the AI tools for teachers are diffit, copilot, curipod, Quizlet, etc. AI is one of the fastest-growing areas in ICT and future study can be based on AI in teaching learning process.

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