Details of Module and its structure

Module Detail	
Subject Name	Education
Paper Name	Perspectives and Issues and Research in Teacher Education
Module Name/Title	Teacher in the Digital Age: Issues & Concerns
Module Id	e-PGEDN 10.33
Pre-requisites	Basic awareness of the digital skills
Objectives	After going through this topic the students will be able to: • discuss the properties of digital information • explain the skills needed in digital age • prepare the profiles of the teachers in the digital age • identify the innovative programs in teacher education in the digital age • present a research scenario of the digital age • identify the challenges and issues faced by the teacher in digital age
Keywords	analogue, digital, synchronization, granularity, compressible, digital age skill, innovative programs, web technologies

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1. Digital Age: A Journey

The Digital Age, also commonly known as the Computer Age or Information Age, is a period in human history characterized by the shift from traditional industry that the industrial revolution brought through industrialization, to an economy based on the manipulation of information, i.e., an information society. The onset of the Information Age is associated with Digital Revolution just as the Industrial Revolution marked the onset of the Industrial Age. During the information age individuals gained the ability to transfer information freely, and to have instant access to information that would have been difficult or impossible to find previously.

The Information Age formed by capitalizing on the computer microminiaturization advances, with a transition spanning from the advent of the personal computer in the late 1970s to the Internet's reaching a critical mass in the early 1990s, and the adoption of such technology by the public in the two decades after 1990. Bringing about a fast evolution of technology in daily life, as well as of educational life style, the Information Age has allowed rapid global communications and networking to shape modern society. American engineers began developing digital technology in the mid-twentieth century. Their techniques were based on mathematical concepts suggested by the seventeenth-century German mathematician, Gottfried Wilhelm Leibniz, who proposed a binary computing system. His innovation inspired such numerical codes as American Standard Code for Information Interchange (ASCII) that described objects with digits. Digital technology is a base two process. Digitized information is recorded in binary code of combinations of the digits 0 and 1, also called bits, which represent words and images. Digital technology enables immense amounts of information to be compressed on small storage devices that can be easily preserved and transported. Digitization also quickens data transmission speeds.

Digital technology has transformed how people communicate, learn, and work. Telecommunications has relied on digital methods to transmit messages. In the early 1980s, enhanced fiber optics enabled the development of digital communication networks. Digital technology replaced analog signals for many telecommunication forms, particularly cellular telephone and cable systems. Analog-to-digital converters utilized Pulse Code Modulation (PCM) to change analog data into digital signals. Compared to analog transmissions, digitized

signals are less distorted and could easily be duplicated. In 1998, commercial digital television broadcasts premiered in the United States. Communication satellites known as Direct Broadcast Satellite (DBS) transmitted compressed digital signals for viewers to receive several hundred television programming choices. Other forms of digital information, including audio programs, were sent to subscribers via satellite. The Federal Communications Commission ordered all American broadcasts to be digital by 2010.

Digital printing with electro-photographic formatted data technologies have altered how books and magazines are published. The Library of Congress National Digital Library Project has worked to preserve and expand access to rare items. In the early 2000s, digital computers ranging from laptops to Internet networks came in many sizes and performed various tasks. Supercomputers performed complex mathematical calculations analyzing vast amounts of data. The Digital Data Broadcast System (DDBS) guided air-traffic control. Digital radiography converted analog signals of x-rays to create digital images. Digital information was stored on plastic disks with pitted patterns of 1s and 0s that lasers translated. By the early 2000s, digital cameras had transformed photography by recording color and light intensities with pixels. Also, digital compression of images and video was achieved by Joint Photographic Experts Group (JPEG) and the Moving Picture Experts Group (MPEG) codes. Animation had often been digitized with some films and cartoons being created entirely with computers. Analogue watches/clocks have a mechanism to indicate time by means of mechanical structures, such as a dial and hands (hand indication type), while digital watches/clocks have a mechanism to indicate time by means of electronic structures, such as a liquid crystal and LED (number display type).

"Digital" ("digit" as a noun), representing a finger, implies a thing that can be counted on fingers, which indicates a number. On the other hand, "analogue" originally means resemblance or similarity, which indicates a continuous quantity, as the antonym of "digital."

2. Properties of digital information

All digital information possesses common properties that distinguish it from analog communications methods:

A. Synchronization

Since digital information is conveyed by the sequence in which symbols are ordered, all digital schemes have some method for determining the beginning of a sequence. In written or spoken human languages synchronization is typically provided by pauses (spaces), capitalization, and punctuation. Machine communications typically use special synchronization sequences.

B. Language

All digital communications require a *language*, which in this context consists of all the information that the sender and receiver of the digital communication must both possess, in advance, in order for the communication to be successful. Languages are generally arbitrary and specify the meaning to be assigned to particular symbol sequences, the allowed range of values, methods to be used for synchronization, etc.

C. Errors

Disturbances (noise) in analog communications invariably introduce some, generally small deviation or error between the intended and actual communication. Disturbances in a digital communication do not result in errors unless the disturbance is so large as to result in a symbol being misinterpreted as another symbol or disturb the sequence of symbols. It is therefore generally possible to have an entirely error-free digital communication. Further, techniques such as check codes may be used to detect errors and guarantee error-free communications through redundancy or retransmission. Errors in digital communications can take the form of *substitution errors* in which a symbol is replaced by another symbol, or *insertion/deletion* errors in which an extra incorrect symbol is inserted into or deleted from a digital message. Uncorrected errors in digital communications have unpredictable and generally large impact on the information content of the communication.

D. Copying

Because of the inevitable presence of noise, making many successive copies of an analog communication is infeasible because each generation increases the noise. Because digital communications are generally error-free, copies of copies can be made indefinitely.

E. Granularity

When a continuously variable analog value is represented in digital form there is always a decision as to the number of symbols to be assigned to that value. The number of symbols determines the precision or resolution of the resulting datum. The difference between the actual analog value and the digital representation is known as *quantization error*. Example: the actual temperature is 23.234456544453 degrees, but if only two digits (23) are assigned to this parameter in a particular digital representation (e.g. digital thermometer or table in a printed report) the quantizing error is: 0.234456544453. This property of digital communication is known as *granularity*.

F. Compressible

According to Miller, "Uncompressed digital data is very large, and in its raw form would actually produce a larger signal (therefore be more difficult to transfer) than analog data. However, digital data can be compressed. Compression reduces the amount of bandwidth space needed to send information. Data can be compressed, sent and then decompressed at the site of consumption. This makes it possible to send much more information and result in, for example, digital television signals offering more room on the air-wave spectrum for more television channels."

3. Analog & Digital Information

- In most cases the number of these states is two, and they are represented by two voltage bands: one near a reference value (typically termed as "ground" or zero volts) and a value near the supply voltage, corresponding to the "false" ("0") and "true" ("1") values of the Boolean domain respectively.
- Digital techniques are useful because it is easier to get an electronic device to switch into one of a number of known states than to accurately reproduce a continuous range of values.
- Digital electronic circuits are usually made from large assemblies of logic gates simple electronic representations of Boolean Logic Functions.

- An advantage of digital circuits when compared to analog circuits is that signals represented digitally can be transmitted without degradation due to noise. For example, a continuous audio signal transmitted as a sequence of 1s and 0s, can be reconstructed without error, provided the noise picked up in transmission is not enough to prevent identification of the 1s and 0s. An hour of music can be stored on a compact disc using about 6 billion binary digits.

- In a digital system, a more precise representation of a signal can be obtained by using more binary digits to represent it. While this requires more digital circuits to process the signals, each digit is handled by the same kind of hardware. In an analog system, additional resolution requires fundamental improvements in the linearity and noise characteristics of each step of the signal chain.

- Computer-controlled digital systems can be controlled by software, allowing new functions to be added without changing hardware. Often this can be done outside of the factory by updating the product's software. So, the product's design errors can be corrected after the product is in a customer's hands.

Information storage can be easier in digital systems than in analog ones. The noise-immunity of digital systems permits data to be stored and retrieved without degradation. In an analog system, noise from aging and wear degrade the information stored. In a digital system, as long as the total noise is below a certain level, the information can be recovered perfectly.

4. Analog Digital Inter-conversion

American Standard Code for Information Interchange (ASCII- 8BIT & 128 Characters), Universal Code (UNI- 16 BIT & 256 Characters) are the standard codes for analog to digital representation, for English and All Languages, respectively. The data are compressed and communicated in a compatible format, such as, JPEG/GIF & MP3/MP4. The name "JPEG" stands for Joint Photographic Experts Group, the name of the committee that created the JPEG standard and also other still picture coding standards. The JPEG compression algorithm is at its best on photographs and paintings of realistic scenes with smooth variations of tone and color. For web usage, where the amount of data used for an image is important, JPEG is very popular.

JPEG/ Exif are also the most common format saved by digital cameras. On the other hand, JPEG may not be as well suited for line drawings and other textual or iconic graphics, where the sharp contrasts between adjacent pixels can cause noticeable artifacts. Such images may be better saved in a lossless graphics format such as TIF, GIF, PNG, or a raw image format. The JPEG standard actually includes a lossless coding mode, but that mode is not supported in most products. As the typical use of JPEG is a lossy compression method, which somewhat reduces the image fidelity, it should not be used in scenarios where the exact reproduction of the data is required (such as some scientific and medical imaging applications and certain technical image processing work). JPEG is also not well suited to files that will undergo multiple edits, as some image quality will usually be lost each time the image is decompressed and recompressed, particularly if the image is cropped or shifted, or if encoding parameters are changed. To avoid this, an image that is being modified or may be modified in the future can be saved in a lossless format, with a copy exported as JPEG for distribution. The digital communication very often has High Fidelity, because, there are no losses due to interference and adverse conditions. The data are communicated through point to point connectivity or wireless. Required protocols are observed in communication. We have both analog to digital converters & digital to analog converters. Charge coupled devices are used for digital to analog conversion.

5. Digital Age Skills

Digital Age Skills have become the basic needs of the present century, such as, Global Awareness Skills- Understanding of how countries, corporations and communities all over the world are interconnected, interrelated and interdependent, Cultural Literacy Skills- Appreciation of diversity of cultures, acculturation, enculturation and trans-creation, ICT Skills- Ability to find, analyze, evaluate and make appropriate use of information, Scientific Literacy Skills- understanding universe through observation, interaction and experimentation and Functional Literacy Skills- Use of Information & Knowledge for living healthy, happy, meaningful and long life.

6. Humane & Professional Teacher in the Digital Age

Teacher Education for preparing humane & professional teachers in the digital age needs to be wholistic. Along with content & methodology there is a need to integrate emotional competencies, such as, self-awareness and self-management, social sensitivity and social management. There is a need to integrate life skills, such as, self-awareness, empathy, interpersonal relationship, effective communication, critical thinking, creative thinking, decision making, problem solving, and coping up with emotions and stress. There is a need to integrate info-savvy skills, such as, asking, accessing, analyzing, applying and assessing. There is a need to integrate techno-pedagogic skills, such as, media-message compatibility, media designing, integration of message media and modes, realizing proximity of message forms, media language proficiency, media choice, message authenticity and media credibility, media automation, media integration and media acculturation. There is a need to integrate human development climate through trust, risk taking, openness, reward, responsibilities, top support, feedback, team spirit and collaboration. There is a need to integrate spiritual intelligence dimensions, such as, knowledge of God, religiosity, soul or inner being, self-awareness, quest for life values, convention, commitment and character, happiness and distress, brotherhood, equality of caste, creed, color and gender, inter-personal relations, acceptance and empathy, love and compassion, flexibility, leadership, life & death. The Teacher Education programs need to integrate innumerous skills & competencies.

7. Innovative Programs in Teacher Education in the Digital Age

Teacher Education Institutions at different levels, particularly in higher and technical education field countrywide, have innovated and institutionalized number of Programs, namely,

- M.Tech. Ed., NITTTR, Bhopal and Chennai
- M.Tech. Engineering Education, NITTTR, Chandigarh
- M.Tech. HRD, NITTTR, Chennai
- B.C.Ed. (1989), DAVV, Indore
- M.C.Ed. (1991), DAVV, Indore
- Master of Educational Technology (Computer Applications), SNDT University, Mumbai
- M.Tech. (Educational Technology), Kurukshetra University, Kurukshetra
- B.Sc. in Teaching Technology, Sikkim Manipal University

- Personalized Teacher Education Program, DAVV, Indore (1991)

- Personalized Teacher Education Program, Lucknow University, Lucknow (1996)

- B.Ed. (Educational Technology), AEC Teacher Training College, Pachmadhi, MP

- Early Faculty Induction Programme (EFIP) under QIP by AICTE , New Delhi

- Induction Training Programme (ITP) under QIP by AICTE, New Delhi

- IGNOU Institute of Professional Competency Advancement of Teachers (IIPCAT, 2009), IGNOU, India

- Indian Institute of Teacher Education, Gujarat (Bill 4, 2010)

Every Technology Based Innovative program has faced many challenges. Very often such programs are not found to be under the purview of apex regulatory bodies. At times the educational institutions are found not to be risk taking. Very often the top administrators of the universities & institutions fail to appreciate these programs. But if the programs are demonstrating their worth we as teachers should continue.

8. Emerging Technologies in the Digital age

Following are some of the emerging technologies in the digital age. It is expected of the teachers to be intimate with these technologies.

A. I Pad

- Large device with capacitive multi-touch screen of 24.6cm measured diagonally

- Device specification includes a 1GHZ processor with graphics processor

- 16-32-64 GB storage based

- High definition video playback up to 720p

- Opens all video, audio files and documents

- Wi-Fi models available on April 3, 2010

- Wi-Fi + 3G models available in late April

- iPad has a 9.7-inch, LED-backlit IPS display with a remarkably precision

- Multi-Touch screen

- 0.5 inch thin
- Easy to carry & Use anywhere class-room, home, garden

B. Mobile Web 2.0

- Walking around with an MP3 player, an e-book reader, a digital camera and a digital camcorder
- An augmented reality
- Multimedia playing
- M2M interface,
- e-Book
- Several books in the pocket ready to read whenever one wants

C. Web Conferencing & Webinars

   i. Web Conferencing

- Live meetings, training, or presentations via the Internet
- Each participant sits at his or her own computer
- Connected to other participants via the Internet

   ii. Attendees access the meeting by clicking on a link distributed by e-mail (meeting invitation) to enter the conference.

   iii. Webinar

- Specific type of web conference
- Typically one-way, from the speaker to the audience with limited audience interaction, such as in a webcast
- Collaborative and include polling and question & answer sessions to allow full participation between the audience and the presenter.

D. e - Reader Devices and Software for eBooks

   a. eBook reader e-paper devices

Device that uses epaper are mostly LCD or Touch Screen, such as. iPad, Sony eReader, Amazon Kindle, iRex iLiad, Hanlin eReader, CyBook by Bookeen, the Barnes & Noble nook. There are various software for eBook reading, such as, adobe, Office tools, Novel B&N eReader etc.

- Text can be searched automatically and cross-referenced using hyperlinks.
- A single e-book reader containing several books is easier to carry around (less weight and volume) than the same books (or sometimes even a single book) in printed form.
- Mobile availability of e-books may be provided for users with a mobile data connection, so that these e-books need not be carried around.
- E-books can allow non-permanent highlighting and annotation.
- Font size and font face can be adjusted.
- E-books may allow animated images or multimedia clips to be embedded.

b. Digital Library Revolution

For the first time in history, all the significant literary, artistic, and scientific works of mankind can be digitally preserved and made freely available, in every corner of the world, for our education, study, and appreciation and that of all our future generations.

c. Open Source Educational Websites

In an effort to improve upon the quality of Science Teaching in Maharashtra the Homi Bhabha Centre for Science Education has launched an Open Source Educational Website that provides educational material in Mathematics & Science in Marathi from Class 1 to Class 10. The 5 year Project received Rs. 69 lakh from the Rajiv Gandhi Science & Technology Commission (RGSTC). These concepts would be better understood in the mother tongue.

d. Tablets: Small Size Laptops

Small book size Laptops Android Operating System based having all connectivity ports, Touch Screen Wi-Fi & Blue Tooth have come up in the market.

e. Windows 8.0

Windows 8.0 having Touch Screen facility has come up. It is very compact. It's booting time is 5 to 10 Seconds.

9. Research Scenario

ET and ICT in Education

A sizable number of studies on effectiveness of CAI developed through various computer languages employing either pre-experimental design or quasi experimental design reveal significant mean score gain from pre-test to post-test. Studies on the effectiveness of CAI reveal favorable reactions of students and teachers towards the CAI. (Prabhakr 1989; Himani 1990, Mahapatra 1991, and Adhikari 1992, DAVV, Indore; Khiwadkar 1999, Zyoud 1999, Yadav 2000, Goel Khirwadkar Tomar Das & Joshi, 2000, Macwana 2004, Sharma 2005, Barot 2005, Pradesi 2005, and Rathod 2005, MSU; Suwanna 2004, SGU; Upadhyaya 1999, MJP Rohilkhand University, Bareily; Sanjana 2001, MDU and Pandian 2004, DU) There have been found rare studies on the pedagogic/techno-pedagogic analysis of the computer based educational instructional programs. These studies reveal that there should be added focus on production variables, pedagogic principles and spatial and temporal contiguity of various message forms (Patel, 2001, MSU; Chaudhari, 2005, MSU). Computer as a medium has been found to have the potency of addressing the heterogeneity in terms of variables, namely, IQ, Interest, Motivation, Language level (Zyoud, 1999, MSU). There are rare studies on effectiveness of CALM in various modes, namely, text, graphics, text & graphics, text, graphics & music. It has been found that the composite modes may not always ensure higher level of language learning (Das, 1998, MSU). Very few studies have been conducted on the relative effectiveness of CAI with peer interaction in mono, diad and triad (Pardesi,2005, MSU). Attempts have been made for designing, developing and implementing computer based Learning Resources Management System (LRMS). The automated LRMS has been found definitely more effective than the manual LRMS (Beryah, 1995, DAVV). A few studies have been conducted on the relative predictivity of various variables with respect to the criterion variable, namely, Educational Proficiency (Mishra, 1993, DAVV; Goel, 2003, MSU). A study conducted on Time Space Personnel Management System revealed that the computer based TSPM system was found relatively more acceptable and better functional than the manual TSPMS (Biswal, 1995, DAVV).

Though studies have been conducted on the automation of examination system, yet these studies find rare expression at the functional level. Teacher Education Institutions need to promote Choice Based Credit System and on demand examination (Mahajan, 1993, DAVV; Joseph, 1993, DAVV; Shinde, 1993, DAVV; Goel, 1997, MSU). A sizeable number of teacher education institutions in India have initiated into ICT in Education either as a core course or as optional course. Inspite of the impeding factors, namely, limited staff, inadequate laboratories with maintenance problems, sizeable classes, the courses have been found to realize their objectives reasonably (Goel, Das, and Shelat, 2003, MSU). A sizeable number of teacher education institutions have been found lacking facilities, such as, Internet, MS Publisher, Acrobat Reader (Goel, 2005, MSU). A few studies conducted on the use of Internet in Teacher Education Institutions revealed that the student teachers largely lack in info-savvy skills and techno-pedagogic skills (Joshi, 1999, MSU; Dhodi, 2005, MSU)**.** Some of the teacher trainees make use of Internet for surfing, e-mail, research, core courses, special areas. But, the Internet is rarely used for web designing, reflective dialogue and outsourcing. Measures of Internet safety are rarely employed. There is a need to develop Net-Savvy Skills in Teacher Educator Trainees (Goel, 2006, MSU). Some Studies have been conducted on bridging the gaps between teaching styles and learning styles. The studies are appreciable but there is a need to conduct many more studies Rathod, 2005, MSU). Studies conducted on language instruction through Power Point Presentations on realizing communicative and functional languages have been found to go a great way in establishing the effectiveness of learning various languages (Yadav, 2005, MSU; Rathod, 2005,MSU). There have been rare studies on developing language learning strategies and learner autonomy through weblogs. Blogs not only provide teachers with an exciting new way to approach communicative language learning, these also give students a new reason to enjoy reading and writing. Goel C. & Goel D. R. (2006) conducted a study on Use of Internet in Teacher Education. Goel C. & Goel D. R. (2007) conducted a study on Thematic Apperception of the M.Ed. Students through Technology Based Package and another study on Reflective Dialogue on Peace & Harmony through Technology enabled Narrations. Goel C. & Goel D.R. (2008) conducted a study – Technology for wholistic Education. Nayana Dhodi (2011) demonstrated very well how the info-savvy skills of Asking, Accessing, Analyzing, Applying

and Assessing were developed in the Pre-service Teachers of India. Pinkal C. (2012) conducted a study on e-learning approach to train novice teachers through Blended Approach. He used ,both, synchronous & asynchronous modes, that is, CDs, Web Based & other Learning Resources Face to Face and online discussion through Web-forums, respectively. Online discussions were found to be very joyful & useful. The Biology Teachers could generate new ideas. It was really an exhilarating experience. ***Educational Technology and ICT in Education have demonstrated their values. But, Technology in Education is not yet fully integrated.***

10. Teacher in the Digital Age: Challenges & Issues

The world is going digital. But there are many challenges & issues.

A. Shift to more powerful learning Paradigms

There is a need to shift to more powerful learning paradigms, such as, linear to hypermedia learning, instruction to discovery and construction, teacher centered to learner centered education, learning how to navigate and learn, teacher as transmitter to teacher as facilitator.

B. ICT illiteracy

It is an age of Information & Communication Technology, but a large number of teachers at all levels are ICT illiterate. The students being latest generation are excelling the teachers in ICT, being better exposed to ICT. Thanks to the Program Intel Teach to the Future which has had massive coverage of the teachers for ICT literacy.

C. Information Explosion & Knowledge Poverty

There is information explosion & media implosion in all facets of life & living, but still we teachers have knowledge poverty. It is because we have more of a media crowd than media culture. Most of us do not know where from & how to access information. We do not have adequate knowledge base of the URLs. Also, most of us are not skilled on surfing skills, such as, selecting, skimming, scanning, switching and authenticating.

D. Technology Alienated Education

We do not have Technology Integrated Education. On one side we have International Standard Digital Network, at the same time we do not have interconnected networks. Even now the Technology has Guest Appearance in our Education. Be it digital lesson designing, use of MS Office, Web Based Educational Instruction, Educational Social Networking, e-Learning Resources Management System, Computer Based Time-Space-Personnel Management, Computer Based Teaching-Learning & Evaluation. Even in this Digital Age a large number of our Teachers from pre-primary to higher education are not Techno-savvy, Info-Savvy & Net-Savvy. At the same some efforts, such as, Electronic Data Examination Processing (EDEP) by the Jawaharlal Nehru University of Technology, e-B.Ed. by MKCL, Computer on Wheels (COW) by the Intel, B.C.Ed. & M.C. Ed. by the DAVV, Indore is remarkable.

E. Analog to Digital: Fast Conversion, but, Slow Transition

Everywhere, we have digital products-wrist watch, wall clock, Radio, TV, Computer,   I-Pad, I-Pod. But very often we teachers do not know how to reset a wrist watch or wall clock, what to talk of the high -tech. We do not know how this digital time is generated and displayed. Digital Technologies ought to be introduced right from the pre-primary level.

F. Thin Population of Techno-Savvy, Net Savvy and Info-Savvy

We have very thin population of techno-savvy, info-savvy and net-savvy teachers. It is because the education system as a whole has been relatively indifferent towards techno-culture. Our Educational Radio, Educational Television, Educational Computers, EDUSAT, SIETs have lost their Educational identities. But, still there is hope because some of the EMRCs are sustaining & enhancing their identities. It is because these have had a rich cultural heritage as well as will and zeal to modernize.

G. Rare expression of ICT Aided Constructivist Approaches in Education

The latest catchword in educational circle is constructivism which is applied to both learning theory & epistemology. Here the role of a teacher is as a facilitator who encourages learners to reflect, analyze, design and develop the process of knowledge construction and the learners are active agents who engage in own knowledge construction by integrating new information into

their schema. Learning can be seen as a process that of understanding and contextualizing socially, culturally, historically and politically relevant issues. Hence it is important that the teachers' role has to be revitalized and the teacher education system has to inculcate the culture of germination of new ideas, incubation, innovation, creation and construction. Various models can be emulated, such as, 5E model-Engage, Explore, Explain, Elaborate & Evaluate, 7E model-Elicit, Engage, Explore, Explain, Elaborate, Evaluate & Extend. Every novel construction brings with it a novel approach.

H. Open Education Resources not fully functional

Open Education Resources for Learners & learning- Content (Geogebra, Google earth), Creativity (hot potato, C-map), Evaluation (R-campus & Mahara), Open Education Resources for Teachers, Teacher Educators & Facilitating Learning - Learning Management System (Moodle & Wiki spaces), Teacher Managed Communication Platforms (Classroom 2.0 & Web Quest) , Statistical Tools for data processing, e-Journals, e-books, e-News Letters, Webinars & Web Conferencing are appearing . These need to be thoroughly inter-woven into our education system.

I.   Rising Digital Learning Resources & Diminishing Creative Production

There is producer consumer dichotomy. The consumers have changed their tastes as per the tastes of the producers. Many a teachers have become dependent on what is available ready made. Earlier it was scissor cut and paste method. Now there is a shift to copy, block and paste. There is very often a gross lack of creativity in the Papers produced by the Teachers at all levels. In this digital age we as teachers need to learn to be presumes. There should be an equation between downloading and uploading. We should be human source than resource. We need to exercise various system design considerations very carefully, such as, whether to build a system or buy a system, whether to go by a prototype or design a fully functional system, whether to use our own processor or use ready made calculator, whether to set a bio-clock or to set a digital clock.

J. Digital Learning Resources System & Slow Pace

Most of the Libraries countrywide are house of hard books and Journals. There is a need to enrich the libraries through e-books, e-Journals, e-newsletters, CDs, DVDs and Digital Networking. Information explosion and constant geographical space demands storage of the learning resources to be in the digital form, the e-form. There is a need to modernize School, College, University and Public Libraries. The Educational Surveys by the various agencies and apex institutions, such as, NCERT, ICSSR should obtain digital forms for easy storage and retrieval. Teachers & Scholars should orient themselves in producing the learning resources & research resources in digital forms.

K. 3Rs to ICT literacy

Gone are the days of merely Reading, Writing and Arithmetic. Modern Society needs ICT literacy. Creation & Communication of any message far & wide demands technology base. Any new valuable message should find technology base. Electro Magnetic Waves can travel with the speed of light which is $3*10^{10}$ cm/Sec. It is 7 times the circumference of the earth. Any teacher can reach out from north pole to the south pole within $1/14^{th}$ of a second in the digital form. Not only speed, but, quality of production can be realized in the near natural form by generating view compositions through audio, visuals, animation, color-hue & saturation.

L. Comprehensive Teacher Profile for Inclusive Education in digital age

Teacher for inclusive education in the digital age has to be highly versatile, resourceful and Techno-literate, because, the inclusive class may be composed of audio impaired, visually challenged, deaf, dumb & children with learning difficulties & disabilities. In such a state a teacher has to provide differential inputs to this critical mass of the inclusive class. What my nation is doing for inclusive education? Not much. Packages like JAWS & Open Book are available for the Visually Challenged, with difficulty, but in English language only. Inclusive Education demands multi-sensory throw in the class setting, as well as, personalized education, and Group Education. Technology can be a big support for a teacher for realizing inclusive education.

M. Rare Info-Savvy Teachers

The digital age teacher has to be info-savvy. The teacher ought to be fully skilled on info-savvy skills, such as, Asking, Accessing, Analyzing, Applying & Assessing. Dhodi (2011) conducted a doctoral study on development of info-savvy skills in Secondary Student Teachers. Her study demonstrates very well how the info-savvy skills were developed in the Pre-service Teachers of India through surfing on Cultural Heritage of India, Buddhist Heritage of India and on the domains of their respective discipline methods. Various surfing skills were employed, viz., skimming, scanning, authenticating, and hyper-linking, switching, skipping, culminating into educational immersion for seeking solutions. But, the info-savvy teachers are very rare.

N. Teacher as a Techno-pedagogue

The digital age teacher ought to be a techno-pedagogue. He should be fully proficient in applying the principles of techno-pedagogy, such as, Media Message Compatibility, Proximity of Message Forms, Integration of Message, Media & Modes, Media Language Proficiency, Message Authenticity & Media Fidelity. But, technology finds more of integration in other fields than in Education.

O. Teacher & Participatory Approach of Problem Solving

- The M.C.Ed. Class (1992), DAVV, Indore was very often given a problem to be solved through a computer program.
- Number of different programmes would emerge from the entire class.
- Each program was presented by one of the programmers to the rest of the class and rated by all the students on different criteria, namely, compactness of source code, fetch and execute cycle size, response time, memory used, programming discipline level and programme intelligibility.
- Also, the students developed programme to calculate Kendell's Coefficient of Concordance through 'C' language. They then computed Kendell's coefficient of concordance individual criterion wise and with respect to the comprehensive criteria.

There is a significant cognitive development through cognitively mapping the algorithms and solution to a problem. This approach cuts across students of varied profiles, simultaneously. Participatory approach may be introduced in various disciplines to enhance learning in all domains. It facilitates creative production and independent thinking. Also, it provides scope to experience and appreciate the cognitive maps of others.

P. Technology Integrated Teacher Education

There is Technological revolution in Teacher Education. There is a shift from Bachelor of Teaching to Bachelor of Learning, that too, Bachelor of e-Learning. There is a shift from e-Learning 1.0 (Online learning) to e-Learning 2.0 (Twitters, Face-book)   to e-Learning 3.0 (Semantic Web) , that is, from content to community to Artificial Intelligence. There is a quick shift from web-1 to web-2 to web-3. We have initiated into Open Education, Open Course Ware, Open Source Software, Open Content and Open Research. There are proposals for e-Teacher Education. Smart Classrooms are emerging, where in, we have e-learning and e-testing. Terms like Wi-Fi, iPad, e-Book, e-Reader, e-News Letter, Webinar are widely used. Digital Lesson Designs and e-Portfolios have become common features. There are compendiums of e-abstracts and Surveys of Educational Research in India on the World Wide Web. The NCTE is expediting Teacher Education on e-Technologies through an MOU with the Intel. There is wide scope for transformation of Teacher Education through Technology.

Q. Media for Equitable Education for All

There are a variety of media available everywhere. But, in this age of media crowd there is a problem of media culture. In this world of media implosion there is a problem of media choice. What to interact with, what not to interact with, what to view what not to view, is a big problem. Could media be used for equitable education for all?

R. People with Disabilities and Computer Technology

People with disabilities meet barriers of all types. However, technology is helping to lower many of these barriers. By using computing technology for tasks such as reading and writing documents, communicating with others, and searching for information on the Internet, students

and employees with disabilities are capable of handling a wider range of activities independently. Still, people with disabilities face a variety of barriers to computer use. These barriers can be grouped into three functional categories: barriers to providing computer input, interpreting output, and reading supporting documentation. Hardware and software tools (known as adaptive or assistive technologies) have been developed to provide functional alternatives to these standard operations. Every teacher employing Computer Technology for People with disabilities should be educated on such tools.

S. Teacher & Educational Technology

Every teacher in this information age ought to be Educational Technologist. Education has not been in a position to keep pace with the technological evolution. Technology is there in the industry, technology is there in commerce & business, technology is there in medical field, technology is there with the vendors & hawkers, but, rarely with teachers. We still have the luxury of chalk & talk.

T. Developmental Challenges & Technological Determinism

There ought to be Technological Determinism by the Education System to meet the developmental challenges in many a ways as follows:

- Computer Aided Admissions
- Computer Based Time-Space- Personnel Management Systems
- Computer Assisted Learning Material & CAI
- Mass Media in Education
- EDUSAT Programs
- Integrating ET & ICT in Teacher Education
- Computer Based Learning Resources Management Systems
- Networking of Educational Institutions
- Computer Based Evaluation
- Technology Based Guidance & Counseling Labs
- Educational Process outsourcing
- Identification of & Training on Techno-pedagogic skills

- ICT for the disadvantaged
- Development of various directories
- Development of CDs and Web Pages
- Studies on Media Challenges in Education

U. Development of Media Culture

Media & Technology in this digital age are the extension of human beings. These should be optimally generated & utilized for the realization of Happy, Productive & Peaceful life. Digital Technology has a lot to offer to the present day society. But, it demands civilized media culture. It is our choice to decide to make or mar ourselves through digital age. A digital age child has to be highly sensitive to the digital implosion. Teachers can educate a lot to surf & survive in this information ocean of tides & tornados.

V. Media Intimacy

A large majority of we teachers are not educated to identify most of the modern media. Neither we know their composition, nor do we know about their characteristics & functioning. We do not have Media Language Proficiency. So, we fail to receive through media & vice-versa.

W. Black & White Dichotomy

Should we use black board or white board? Should we use multiple touch or single touch screens? Can we compromise with the chalk & talk? Has it become a basic necessity to be fast? Do we like real? Can we afford to live in the virtual realm? Both the extremes are socially undesirable. Let us learn to achieve a balance between the real & virtual.

X. Technological Evolution & Teacher Renewal

The technology is evolving very fast. The information explosion is expected to be exponentially fast, because, the creation of the Creator is so deep & vast. By virtue of Teacher Identity, a Teacher has to be the embodiment of all knowledge to sustain & disseminate the beauties of Nature. The Teacher ought to renew every moment.

11. Concerns

A. Techno-friendly Teacher & Teacher-friendly Technology

We teachers should learn the latest technology. We ought to be interested in technology, value technology & have favorable attitude towards technology. At the same time the Technology ought to be Teacher Friendly. All forms of technology, such as, lap- tops, LCD Projectors, Radio, TV, Computers, Internet iPad, Mobile web 2.0, e-Book & e-Reader should be accessible & intelligible to the teachers. In this age of globalization teachers everywhere ought to acculturate, Trans-create and modernize them. Present day students are starving & striving for that.

B. Digital Technology Integrated Teacher Education

Teacher Education ought to be Digital Technology Integrated. ICT in Education, Digital Lesson Designing, Educational Web Designing, Web Based Instruction, Computer Based System Analysis & Designing in Education, Electronic data processing in Education, Production of Computer Assisted Learning Material, Digital Technology Based Courses & Programs should be integrated in Teacher Education Curricula.

C. Courses & Programs on Digital Technology

There should be courses & Programs on Digital Technology, such as, Digital Lesson Designing, Web Based Instruction, Designing e-News Letter, e-Book, e-Reader, Diploma of Digital Technology in Education,   Bachelor of Digital Technology in Education , Master of Digital Technology in Education, There should be due focus on Digital Technology Education and Digital Technology in Education.

D. Professional Development Programs for Teachers & Teacher Educators on Digital Technology

There should be Professional Development Programs for Teachers & Teacher Educators on Digital Technology Education & Digital Technology in Education.

E. Employing Management Information System Series in all the Educational Institutions

Management Information System Series- constituted of admissions, Time-Space-Personnel Management, Digital Libraries, CAI/CBL, WBI/WBL, Computer Based Evaluation, On line Testing, Paperless office & Digital Communication and full networking should be realized in Educational Institutions.

F. Choice Based Credit System & Sharing of Credits Between Teacher Education & Faculty/College of Technology & Engineering

There should be sharing of credits amongst Teacher Education Institutions & Faculties/ Colleges of Technology & Engineering on Technology Education till the Teacher Education Institutions become independent.

G. Specialization of Teachers on Technology for the Disadvantaged Students

There should be provision for specialization of Teachers on Technology for the disadvantaged learners, such as, Visually Challenged, Hearing Impaired, Deaf & Dumb, Autistic, Disabled. These teachers require very intensive & exhaustive education.

H. Technology Culture in Educational Institutions

There ought to be Technology Culture in the Educational Institutions. Every Teacher ought to be Techno-savvy, Net-Savvy & Info-Savvy. ICT Aided Constructivist Approach should be practiced by every teacher for promoting Innovation, creation & construction.

I. MOU Between Technology Agencies & Apex Educational Institutions

There should be MOU between Technology Agencies, such as, Intel, NCTE, UGC, for developing rich Educational Technology Culture in India.

J. Developmental Challenges & Technological Determinism

There should be technological determinism for meeting the developmental challenges. Such an agenda should be scientifically decided by the Nation through various Institutions and agencies for various areas, such as, rural education, tribal education, girl child education, urban education,

slum dwellers education, vocational education, education on health & hygiene, environmental education, life skills education, education for equity & equality.

K. Educational Technology for Equitable Education for All

All sorts of Technology should be explored for equitable Education for all. Teachers have to flow through Radio, TV, Computer, Satellite, CD, DVD, Internet, world Wide Web to reach all. Now the question is what should be the profile of a teacher to reach through many varied media. A Teacher has to be fully technology literate. The Teacher has to be proficient on audio scripting, video scripting, computer programming, Software programming, Web Designing & Communication Protocols. The teacher has to be highly skilled on, both, production & consumption, uploading & downloading.

L. Teacher as Educational Technologist

Every teacher ought to be Educational Technologist. The teachers should have workable depth in all disciplines, Physics, Chemistry, Biology, Geology, Geography, Mathematics, Sociology, Psychology, Philosophy, Polity, Economics, Arts, Commerce, Humanities, Management, Group Dynamics, and Learning Theories. Over & above a teacher ought to be a good creator & communicator. Digital technology can facilitate, both, Creation & Communication of Information. The effectiveness of any communication depends upon the correspondence amongst sender, message, medium & receiver. Every teacher ought to be a communicologist.

12. Concluding Remarks

A large number of the teachers feel alienated and alone in this digital age of networking & globalization. It is because we do not have Technology integrated Education. We, the 21st Century Teachers are lost in the realm of technology. We are neither techno-savvy nor info-savvy. We travel through the media crowd without being sensitive to it. We need to modernize temporally, spatially, logically, epistemologically, and technologically. Technology can facilitate our transition from dot to globe and point to morphology. Radio is extension of our voice, TV is extension of our Views, Computer is extension of our brains, motorbike is extension of our feet, clothes are extension of our skin, cell phones, i-phones, multimedia, i-Pads & e-Books & all

other forms of technology are our extension. Technology can multiply the speed & life span. It can facilitate fast, full, meaningful life & living. At the same time, to overpower technological disease & discomfort we need to be sensitive to our basic values. If we fly high speed & high, then we need to learn cybernetic ally when to & how to exercise breaks. Technology is well woven in almost all walks of life. But Education is relatively technologically backward. Every teacher should put in efforts to be techno-savvy, because it is Education and Education only which can deploy and integrate technology faithfully with a service motive. Indian Teachers are highly adaptive & highly innovative. Very willingly, and passionately they are living the technological era of information explosion & media implosion. How can life be a network of arrays of innumerous skills, where, ideas spring, feelings flow, motor creates, spirit reins, and the self resonates with the sphere in this digital age? We teachers need to learn what to twit, whom to twit, how to twit, when to twit. How do I value face book? How should I construct my face book? Which messages should I yahoo via messenger? What should I SKYPE? What should I email? What should I Blog? Less Well's Model- Who, Says What, To Whom, Through Which Channel, and With What Effect needs to be employed in each communication. The communication has become very fast through email & g-mail. We need to exercise instantaneous communication control, because, we cannot not communicate & communication is circular & irreversible. Internet- the World Wide Web is a universal network. Innovators & Creators, Crackers & Hackers all reside here. The 21st Century Teacher has to be really perfectly fully complete, otherwise, how to teach the innocent, dedicated, cultured, but, bewildered challenging learners.