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## EDUCATION AND ICT A PARADIGM SHIFT

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**Abstract:** In recent years ICT tools are developing very fast. These tools have changed all fields of life ranging from social life to corporate life. Developments in ICT have also changed to a great extent the educational field also. In fact there is a paradigm shift in the teaching and learning scenario. It has changed from Teacher Directed Learning to Learner Directed Learning. Traditional chalk board class rooms are being replaced by smart classes. Examinations are also changed from offline to online proctored examination. Latest development in the field of ICT such as IOT, AI, AR, VR, Cloud Computing, 5G, Quantum Computers, 3D Printing and Nanotechnology are ready to change substantially the teaching and learning environment. In the present article impact of these ICT tools on the education field have been described.

**Index Terms – ICT and Education, ICT Based Education, Education Innovation**

### I. INTRODUCTION

The field of education has changed tremendously due to ICT tools. Traditional chalk board is now replaced by smart classes where the students learn through ppt, diagrams, videos etc. Various new types of classes are also introduced such as Virtual Class , Online Teaching, Google Classroom, Virtual Laboratory etc. Not only teaching but the ICT has changed the way of learning, evaluation and research also. Student can see the recorded class again and again. If he or she has a doubt, can use e-books or other available sources and FAQs. One can also use videos and different types of encyclopedias and other such resources for the knowledge. The field of research is not only limited to finding the references but it includes fast calculations and analysis of the research data. It also facilitated the collection and tabulation of the data. These things has added advantages over the traditional methods. With the development and expansion of ICT facilities these newer methods find space in almost every aspect of the education system. The ICT is now inevitable. Present generation is now becoming well acquainted with these tools from very lower level classes. Apart from it in recent years ICT got a boost due to new technologies that include mainly AI and IOT etc. The New technologies of the digital world are IOT, Big Data, Robotics, AI, Machine learning etc. In India also these are being harnessed at a high rate.

The traditional teaching is Teacher Directed while the ICT base education is Learner Directed. In the Teacher Directed Environment the tools used are chalk and board while in Learner Directed Environment the tools are smart board, computer, laptop, multimedia projector etc. Now the chance of interaction of the learner with the teacher is more diversified. Requirement of the education world are education must reach to each and every citizen of the country. Second thing is effective teaching, exact teaching, and the advantage of a particular learned person must be available to any enthusiastic reader or student and knowledge update. These requirements can be fulfilled only through ICT. At present we are having different online tools for teaching, learning, evaluation and research. Teaching is being done in schools and colleges through smart devices and online classes as well as online examination and online evaluation is being done. Despite that in the light of the recent inventions in the field of ICT yet more advanced and effective teaching and learning methods are possible.

## 1.IOT

Full form of IOT is Internet of Things. This includes attaching a certain sensor on the different things so that one can know the condition of that thing. For example a heat sensor is attached to a body can give us the temperature of the body. At the same time this sensor is connected to any computer that can record that temperature over a period of time then it is said to be smart body. If the sensor is ready to send and receive data than the body with such sensor may talk to us. This thing is connected to internet becomes internet of things. In short an IOT ecosystem is smart devices connected to internet so that information of the devices may be collected and analyzed locally or using cloud computing. In the field of education IOT may be used to monitor the students, teachers and other services. It is also used in making teaching and learning smart. Now a days traditional black, white and green boards are being replaced by smart boards. These smart boards are interactive. This helps in making teaching and learning attractive, effective, interesting, showing live demos of the principles taught to the students. IOT is also used to monitor the students learning ability.

## 2.AI In The Field of Education

AI stands for Artificial Intelligence. It means to make any computer or robot to work with the data as a human being does considering emotions analyzing the data and arrive at a certain conclusion. For this certain programs are being developed that helps the computer to think. Thus the name thinking machines is coined. AI may be used in the field of education in so many ways as follows.

### 2.1.Chatbots

Chatbot is a software with the help of which any human being that may be a student can interact with the computer or any digital device through voice, key board or button etc. as if the interaction is to a human. Thus student can ask questions in the same manner as they ask to their teacher.

### 2.2.Automated Grading

Automated grading system may be developed using the sample data of checking the answer sheets by the teachers. How they evaluate the answers and grade the students. This system may help to develop an unbiased evaluation system.

### 2.3.Natural Language Processing

Natural Language Processing is an interactive program that enable the digital device to understand the language of the user in the form of text or voice and translate into another language text or voice. Working of digital devices on voice commands, making summary of a given text, removing grammar mistakes. These things are surely beneficial for the students.

### 2.4.Robot Teacher

AI can help to develop robot teachers that understand the requirements of the students and can answer the queries of the students in the same manner as the actual teacher does. So these robot teachers may help the human teachers known as humanoid teachers.

## 3.Cloud Computing

Cloud computing means using hardware and software with the help of internet, which are not available locally in the device of the user but are remotely placed at a distant place. This has made revolutionary changes in the field of computation, data storage, teaching ,learning, evaluation and research. This cloud computing make available the necessary hardware or software or both which are costly or cannot not be installed in the device due to limited power of the device. This is being done in three different ways IAAS, PAAS and SAAS. IAAS means using the infrastructure which is remotely placed. Full form of IAAS is Infrastructure As A Service. There are different service providers for the cloud service. These service providers may be open to all or to a limited environment. The services may be free up to some extent and after that chargeable. Similarly PAAS stands for Platform As A Service. When any person uses any platform available on the internet for making a software this is known as PAAS. Full form of SAAS is Software As A Service. When any person uses the software which is remotely placed with the help of internet and service providers for his/her use. These facilities are very useful in the field of education specially higher education. In the field of research it is a boon.

#### 4. Quantum Computers

In the field of computing quantum computers are making revolution. These are capable of computing at a very high speed some 100,000 times than a traditional computer. With the help of these computers information can be processed at a greater speed. The work of years for a traditional computer is possible in minutes or seconds for a quantum computer. Traditional computers work on the basis of bits 0 and 1. On the other hand Quantum Computers uses quantum bit known as qubit. Quantum computer uses 0, 1, or combination of these two. Though the number of quantum computers are now small in the world but in future their number may increase. Some of the quantum computers are now available on cloud. The computers will definitely help in analyzing complex and huge data in the field of research. The first quantum computer was made by a Canadian company in 1997 that was of 28qubit. Quantum computer are used by IBM, INTEL, Microsoft etc. Thus the quantum computers can be very helpful in huge data analysis and in research.

#### 5. Augmented Reality

Augmented Reality commonly known as AR is different from Virtual Reality commonly known as VR. In virtual reality real world things are imitated that may be actual things are virtual and the viewer or the user of VR can go through this environment. A special headset is wore for experiencing the VR. The user can interact with this virtual world. In the field of education the student with the help of VR can see the object by rotating it 360 degrees. One can understand the working of any machine using its different features. One can see the historical facts live. VR is helpful in study of different subjects. It has vast applications in entertainment, business and education fields.

On the other hand Augmented Reality (AR) is that in which real things and digital world are superimposed. Thus a user of AR can take a real thing photographed and converting it into (AR). Augmented Reality means digital or advanced version of the real world. With the help of AR, videos, graphics and sound can be included with the real world. We can add special features to the real thing or object. Unlike VR it does not require wearing a headset always. Different apps have been developed that can be installed into smart phones to make use of the AR. With the use of AR students can have interactive classrooms. Using AR virtual field trips can be arranged. Students do not see still pictures of any place or event but they can interact with that place or event. Thus the learning environment can be more interactive. It paves the way for the experiential learning. What AR can do its best example is films like Jurassic Park. Yet another application of the combination of Virtual and Real world is Metaverse in which the person is not on internet but in internet.

Photomath, Merge Cube are some mathematical AR apps that enables student to solve the maths problems interactively and study different shapes. Chem 101 AR is an app for chemistry study. Using the AR tools teacher can help students to visit any place and understand the cultural, social historical and financial aspect of that place. 360 Cities and Timelooper are tools that may be used by history teachers. Various AR apps and tools have been developed that can be used by teaching community. Initially the AR apps became famous by gaming apps so a major concern is that once the students become aware of the AR apps they may be engaged with the gaming apps and another concern is the cost of AR tools. The second one is avoided by the development of apps that can be installed in the smart phones make it easy to use.

Further development of the technology brings before us now the mixed reality which is blend of both the Virtual Reality and Augmented Reality called the Extended Reality or XR. This will enhance the area and scope of the Reality apps and tools in future. Given Below is a list of educational AR apps

1. VR Frog Dissection: Ribbit-ing Discoveries
2. Holo-Human
3. GeoGebra Augmented Reality
4. Expeditions
5. Star Walk
6. Touch surgery
7. Exoplanet
8. 4D Interactive Anatomy
9. Visible body
10. Plantale
11. 3D Bear
12. zSpace
13. Back human Anatomy Atlas 2021

### 6.3D printing

3 D Printing is an additive manufacturing process of a three dimensional object using digital model. It is opposite to subtractive manufacturing in which a material is cut using milling machine. In 3D printing object is manufactured layer by layer. One can create complex shapes using 3D technique with the material rubber, plastic or metal. Any student or engineer who has built a 3D model can get it into reality using this technique. Not only that the model can be improved also. 3D printing which uses optical scanning of the outer shape of the object when combined with the industrial CT scan which is three dimensional scan, using ICT can create an object with the internal structure of the model. Different 3D printing software are now available. Tinkercad is one such software.

3D printing is useful for people working in different areas. Mathematicians, engineers, architects, Students of science, biology etc. using this 3D technique can design their dream object. Prototypes of industrial manufacturing, prosthetics, reconstruction of fossils, replicating the ancient artifacts can be done using 3D printing. With the induction of modern 3D printing technology imaginative and creative capabilities of the students can be increased.

### 7.Nanotechnology

Nanotechnology is science of design, produce and use the novel materials by manipulation of atoms and molecules at nano scale. Nano means one billionth of a metre  $10^{-9}$ m. Nanomaterials are the materials in which the size of its constituent particles is of the order of nanometers. At this scale the properties of the materials changes drastically. These materials can be fabricated using two types of processes Top Down and Bottom Up approaches. In the top down approach a bulk material is broken to small size particles in steps down to nano dimensions. In this method some structural defects and impurities may remain in the material. Another method is Bottom Up approach. At first level nano scale atoms or molecules are formed according to desired properties Then cluster of these nano particles is formed. These clusters make the bulk material. With the advent of Atomic Force Microscope AFM which is a Scanning Probe Microscopy it has been possible to fabricate nano material of desired properties. AFM actually work in three ways imaging, measurement of mechanical properties and manipulation at atomic level. This manipulation helps in fabrication of nano materials of desired properties. Nanotechnology is helpful in developing nano materials that are used as solar cells, energy storage devices, scratch proof materials and optoelectronic materials. These all help in creating high speed computing, miniaturization of electronic devices which in turn are helpful in smart and interactive teaching and learning devices.

### 8. 5- G

First let us understand the 5Gs. G stands for generation of the wireless technology.1G means first generation wireless technology that uses analog technology introduced in 80's. In this technology voice was poor and problem of call drop encountered frequently. 2G the second generation technology is digital technology introduced commercially in 1991. 2G provided sms and mms, conference call, billing based service etc. with 50kbps speed. Thus it was beginning of data and voice both to the users. Next comes 3G that used new technology called Universal Mobile Telecommunication System UMTS introduced commercially in 2001. It started video, picture, email and web service, multimedia etc. The speed increased to 300-400 kbps. Next one is 4G introduced in 2010. In this 4th generation wireless technology which uses Multiple Input Multiple Output (MIMO) and Orthogonal Frequency Division Multiplexing (OFDM). The speed in now increased to 100 Mbps to 1Gbps.4G provided better quality, high speed, gaming service, HD mobile TV, 3D TV, cloud computing etc. After that the latest technology is 5G it means 5<sup>th</sup> generation wireless technology introduced in 2019. It increased the speed and higher bandwidth, better quality of internet. It can connect more devices to internet download speed up to 10Gbps.

These technologies made revolutionary changes in the teaching ,learning, evaluation and research in lower as well as higher education. During COVID 19 when lockdown forced the students to confine in their homes, this communication technology helped to create a virtual environment of school and college classes. Not only that most of the institutes conducted proctored online examination. This technology boost proved to be a game changer in the field of education. Online classes, online tutorials, educational videos, video conferencing, online quizzes and several other educational tools and software which was developed have been used on a mass scale by the teachers and students. Today any student have more than one online learning options. Most of them have a unique feature of any course , any time , from anywhere. Government also facilitated the use of online tools in the field of education. Government's digital initiative in the form of various programs and schemes are helping in this field. In next few decades the whole educational scenario is going to change where all the institutes will have smart classrooms.

### Conclusion

Thus we see that new technologies play a crucial role in the field of education. Several developed modern technologies have changed the educational scenario and still the new ones are in the offing. These technologies in the field of computer, internet, wireless technology, software etc. have a great potential to change the learning environment. In future it will be improved more. With the use of these technologies it has been possible to make the wall interactive. Any teacher need not use the smart board with the projector. Visualizers have been developed to teach the students that replaces the old version epidiascope. one can show the important parts, figures and diagrams of any book on the screen. New ideas come forward such as Podcast. Podcast is like a radio show. It is collection of several digital audio files on a certain topic. These can be listened at will. Podcast providers prepare these programs. Online courses can be designed by the teachers and other experts using LMS tools. One such tool is MOODLE. Full form of MOODLE is Modular Object Oriented Digital Learning Environment. The latest teaching methods include flipped classroom, gamification, thinking based learning and design thinking and much more. The area of digital teaching and learning environment is vast and fast growing it has a great potential. VARK model(Visual, Aural, Read/Write, Kinesthetic)of learning is also applied up to a certain extent using wireless technology. In future we hope that it will be possible to create highly useful learning environment using the latest technology of Augmented Reality and Extended Reality.

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