7

The Role of ICT in Education : The Emerging Indian Scenario during Lockdown due to COVID-19

Sanjeev Mahajan*

It is a well known fact that Information & Communication Technologies (ICTs), with its presence everywhere, invades all aspects of human life. It provides newer, better and quicker ways for people to interact, network, seek help from others and gain access to all sorts of information. It is in this sense that many people recognize ICTs as catalyst for change. So far as education is concerned, it is very helpful in teaching and learning. It is not only helpful for teachers to present their teaching attractively, but also students/learners are more able to grasp various educational programmes. In this digital era of 21st century, ICT use in the classroom has assumed considerable importance for giving students opportunities to learn and apply the required skills. The present paper is an attempt to examine the changing role of ICT in education during the lockdown periods due to the global pandemic of COVID-19 using mostly secondary sources. This exercise of critically examining the role of ICT in education has been helpful in identifying the major challenges of use of ICT in education during lockdowns in India. The paper also gives some suggestions as remedial measures to meet such challenges during

* **Associate Professor and Head, Department of Sociology, N. A. S. (PG) College, Meerut- 250001, Uttar Pradesh (India) E-mail: <sanjeevnas@yahoomail.com>**

CONTEMPORARY SOCIAL SCIENCES, Vol. 30, No. 2 (April-June), 2021
Peer Reviewed, Indexed & Refereed International Research Journal

pandemics like COVID-19 that force the authorities to close down all educational institutions right from primary to higher ones.

[**Keywords :** ICT, Education, Lockdown, COVID-19, Classroom teaching, Online classes]

1. ICT : An Introduction

Information is considered as the main key to democracy and its accreditation is fundamental to a successful democracy. The advent of IT has changed the way people live, learn, work and relate with each other. Information & Communication Technology (herein after referred as ICTs) can be explained as electronic-centred technology like computers mobile phone and tablet which is used to gather information, as well as to communicate with others. ICT is considered as the backbone of today's world. It can improve the quality of human life because it can be used as learning and education media, the mass communication media in promoting and campaigning practical and important issues, such as the health and social area. It provides wider knowledge and can help in gaining and accessing information. ICT is generally used as a general term for diverse set of technologies which enable users to create, access, disseminate, store, manage, and communicate information in a digital format.

ICT is an extensional term for information technology (IT) that stresses the role of unified communications and the integration of telecommunications (telephone lines and wireless signals) and computers, as well as necessary enterprise software, middleware, storage, and audiovisual systems, that enable users to access, store, transmit, and manipulate information. The different types of communication in ICT include electronic mail, video conferencing, facsimile and telephone conferencing. ICT communication deals with storage, retrieval transmission and manipulation of digital information.

ICT is defined as any technology used to support information gathering, processing, distribution and use. ICT includes any communication device or application encompassing radio, television, cellular phones, computer and network hardware and software, satellite systems, as well as the various services and applications associated with them, such as video-conferencing and distance learning. Electronic textbooks, instructional software, email, chat, and distance learning programs are also examples of ICT. General ICT tools for teaching and learning include desktop and

laptops, projector, digital cameras, printer, photocopier, tablets, poppet (a tool that allows users to visualize ideas), pen drive etc. According to UNESCO (2002), ICT is a scientific, technological and engineering discipline and management technique used in handling information, its application and association with social, economic and cultural matters.

In last two decades, advances in ICT have heralded a major transformation in human communication, giving rise to new trends of media for social communication. Social media has become part and parcel of our daily life. From Facebook to Twitter and blogs, social media tools are an integral and important part of society, and these tools are here to stay. although ICT and social media are conceptually different, they are intertwined and inextricably connected. They converge when mobilized as resources for or employed as means in social change, a process that entails altering social patterns of a society, which can involve economic development, political progress, cultural change, social revolution, etc.

2. State of ICT in India

As compared to developed societies, south Asian societies, including India, are quite less developed in ICT sector. For example, the proportion of south Asia's Internet users is too far behind the users in North America and users in Western Europe and even some of the Asian countries. This has led to digital divide and is fast raising concerns among nations in the developing world as it allows some individuals or nations to benefit more from the use of such technologies than others. As a result, efforts are being made by some of the poorer countries to catch up with technology by pumping resources into communication hardware and software. However, these efforts so far have not achieved much in bridging the gaps in ICT development among various south Asian countries. The impact of the ICT in this region is going to differ from one country to another as the deployment of this communication technology varies accordingly in different societies. It is worth mentioning that the development of this sector has been comparatively faster since 2010.

Though the term 'information technology' evolved in the 1970, however, its basic concept can be traced to the World War II alliance of the military and industry in the development of electronics, computers, and information theory. After the 1940s, the military remained the major source of research and development funding for

the expansion of automation to replace manpower with machine power. The evolution of information technology and the development of computers have been grouped into five different stages or generations (https://www.zimegats.com/the-history-of-information-echnology-past-present-future/) as follows :

- **The First Generation (roughly from 1940-1956) :** Computer systems used vacuum tubes, they were huge, relied on machine language, consumed a large amount of electricity generating a lot of heat which did result in malfunctions. These systems were expensive to operate. The ENIAC is considered an example of first generation.
- **The Second Generation (roughly from 1956-1963) :** In this generation, a major improvement was that the vacuum tubes were replaced with transistors cutting the size of computers, which become faster, cheaper, reliable and more energy-efficient. High-level programming languages like COBOL and FORTRAN made them more accessible, they replacing cryptic, binary machine language to symbolic, assembly languages which programmed written instruction. Also, the magnetic tape and disks replaced the punched cards.
- **The Third Generation (roughly from 1964-1971) :** Development of integrated circuits and programming languages (lile BASIC) increased the speed and the efficiency of computers in this generation. Transistors were made smaller and installed on silicon chips. Keyboards and monitors were created which allowed computers to operate many different applications at one time with one main program to monitor and store information. This is the generation in which society as a whole had more and more access to computers.
- **The Fourth Generation (roughly from 1971-Present)** : A number of transistors, microprocessors containing memory, logic and control circuits (central processing unit) on a single chip further revolutionized the computer technology in this generation. Computers like IBM and Apple PC (personal computer) were created for both personal as well as business purposes and language softwares like Word for Windows made them still more accessible. Networks, handheld devices and finally the internet were also developed subsequently.

Information and communication technology has now become not only essential to our lives, but has the part and parcel of our daily routine. Desktop computers, laptops, tablets, mobile phones, smart tvs, game consoles, wristwatches, e-book readers, digital cameras, smart home security systems etc. are some of the main examples of digital technology to which more and more people are adopting now globally, including India. For example, only smartphone penetration has increased manifold from 5.5 per 100 people in 2013 to 24 percent in 2016, 26.2 percent in December 2018 and has now reached 42 percent in financial year 2020. It is estimated that the penetration rate of smartphone in India would reach 51 percent in financial year 2025. It may also be added that there were 1.10 billion mobile connections in India in January 2021 (an increase of 23 million, i.e. +2.1% between January 2020 and January 2021; equivalent to 79.0% of the total population).

There were 524.9 million mobile users in India in 2013. This number increased to 684.1 million in 2016, 696.07 million in 2020 and is expected to reach 973.89 million in 2023. Similarly, the internet penetration rate in India was only 15.1 percent, which rose to 34.8 percent in 2016 and 20.0 percent in 2020. With over 560 million internet users, in 2020 (now the penetration rate is 624 million), India has become the second largest online market in the world ranked only behind China.

There were 448.0 million social media users in India in January 2021, which is 78 million more as compared to 2020 (an increase of +21% between 2020 and 2021; 32.3% of the total population in January 2021).

At present, we are currently in the fifth generation. A lot of today´s research focuses on the following :

- Artificial intelligence,
- Creation of intelligent machines that function and behave like humans,
- Speech or voice recognition,
- Learning, planning and problem solving more efficiently,
- Develop devices that respond to natural language input and are capable of learning.

However, the fact must be underlined that the poorer countries countries are far behind in ICT as compared to the developed ones

leading to real danger that the global information society will remain global in name only if no assistance is rendered to poorer countries. Many studies have demonstrated that GDP per capita income, basic telecommunication infrastructure, urbanization and more importantly the political stability correlate with ICT penetration in a country. Not only this, ICT has increased digital divide among the haves and have-nots within the country. With a better understanding of the various factors affecting ICT diffusion, it is hoped that developing countries will better target their efforts in reducing the digital divide, both across and within nations, and make the ICT a truly global information network. We should also not forget that ICT has been successfully used in poverty alleviation, improving living standards and uplifting marginalized sections of society by providing important commercial, social and educational benefits in remote and rural areas. This implies an approach to developing strategies for information systems and technology that are derived from and integrated with other components of the overall development.

According to Asian Development Bank, the strategic and effective use of ICT-combined with a reform-oriented mind-set, necessary set of skills, institutional structure and capacity, appropriate business models, as well as policy and regulatory environments can facilitate fast and efficient delivery of public services in key sectors.

3. The Role of ICT in Education

ICT can improve the efficiency and quality of education at all levels. The use of ICT in education can strengthen self-learning, and there is no doubt that ICT is one of the key instruments to strengthen 21st century knowledge and skills. ICT connects teachers and students to audio-video learning resources and information related to their curriculums. Teacher, students, administrators and every one related to education are now using ICT in various forms.

A general consensus has emerged among practitioners and academics over the years that integration of ICTs in education has a positive impact on the teaching-learning environment. It has been underlined that ICTs can be successfully employed to reach out to a greater number of students in diverse socio-economic and cultural context. ICT helps not only in promoting learning among students, but also exposes them to the technical skills required for many occupations. Geographical distance has no longer remained an

obstacle to obtain education with the help of ICT. This ia the reason that The role of ICT in education has become more significant today than ever before as it is powerful and capable enough to enhance the learning environments available for education (Pajo & Wallace, 2001).

In fact, ICT has the potential to transform the nature of education by improving teachers' design work, enhancing the roles of students and teachers in the learning process and helping to create a collaborative learning environment, etc. Many scholars (like Volman and Van Eck, 2001; de Corte et al., 2003) hold that the use of ICT offers powerful learning environments and can transform the learning and teaching process so that students can deal with knowledge in an active, self directed and constructive way. At present, ICT is considered as an important means to promote new methods of instruction so far as teaching and learning are concerned.

With the introduction of online education services, students can learn from anywhere using the internet; this has helped in spreading of essential education materials to all students across the globe. Online education is also being enhanced by the creation of a mobile application which enables students to access education material via their mobile phones. Bhattacharjee and Deb (2016) have rightly stated that the teachers are at the core of any living society. Technologies play an important role in training programme of teachers. Students' accesses knowledge and information through TV, digital media, cable network, internet and social media i. e. Facebook, Twitter, Whatsapp, Linkedinn, Igo, Line, Wechat etc. ICT is very important for pre-service teacher education programme in the 21st century.

e-learning helps to bridge the gap between teachers and students. It also promotes distance learning. e-learning is a learning programme that makes use of an information network- such as the internet, an intranet (LAN) or extranet (WAN) whether wholly or in part, for course delivery, interaction and/or facilitation. Web-based learning is a subset of e-learning and refers to learning using an internet browser such as the model, blackboard or internet explorer (Tinio, 2009).

Mumtaz (2000) and Hattie (2009) have also stressed that the research findings over the past two decades provide some evidence to the positive effects of the use of information and communications technology on students' learning. Sanyal (2001) has stated that there are four ways ICT can support basic education :

- Supporting education in schools,
- Providing non-formal education for out-of-school children and adults,
- Supporting pre-service distance education of teachers and their in-service professional development, and
- Enhancing The management of schools.

Likewise, Ehrmann (1994) has identified four distinct faces of quality education, which can be supported by ICT :

- Learning by doing,
- Real time conversation,
- Delayed time conversation and
- Directed instruction.

Rosswall (1999) has stressed that ICT enhances higher education in following ways :

• It enables the effective storing/sorting of information, and can offer new fast ways of communication;

• It enables the reduction of information quantity towards a higher quality and better structure;

• It can be integrated into teaching and learning strategies – and used to support relative learning theories; and

• ICT can be used to create new types of interactive learning media for improved quality, equity, and access in higher education.

Today's most of the educational institutions in India have well-developed social media strategies, and use a suite of social media tools for various purposes including internal and external communications, recruitment, sharing research findings, and highlighting exciting student initiatives. ICT can improve equity and inclusion by enabling access to high quality instruction and learning materials through, for example, massive open online courses (MOOC), open educational resources (OER) and personalized learning software. ICT can also improve effectiveness and efficiency of education systems through robust Education Management Information Systems that provide quality and timely data for evidence-based policies.

It must be mentioned here that for the betterment of the education system in India, all the stakeholders and participants in the system (teachers, faculties, leaders, researchers, parents, policy-makers, financers, promoters, technology innovators and developers, society, community and organizations) have to adopt and use

technology. A proper, more suitable and rational choice has to be made to use the available ICT aids of e-learning for education from among the following :

- **Blended learning** (a combination of teacher, pedagogy, E-technology and learners; a learning model that combines the face-to-face classroom practice with e-learning solutions),
- **Active learning** (learning according to the desires, needs and requirements of learners that involves engaging the learners actively with the course material in various forms like discussions, problem solving, case studies, role plays etc.),
- **Collaborative learning** (a learning model which develops a deep and sound relation among the learners, teachers and experts, irrespective of their caste, class, ethnicity, religion, etc.),
- **Creative and innovative learning** (a process of sharing informations, views and experiences to gain knowledge and to promote the students' experience),
- **Evaluative learning** (a process of learning which is directed and diagnostic in nature and that changes the affective evaluation of a previously neutral stimulus by associating it with another positive or negative affective stimulus),
- **Learning through blogging** (learning through informative websites),
- **Learning through podcast** (learning through series of audio or video files in form of episodes combining learning with entertainment),
- **Ubiquitous learning or U-learning** (a flexible mode of learning to facilitate participation, learning and acquiring information and knowledge at any place and anytime),
- **Constructivism** (a model to learning that holds that people' actively construct/make their own knowledge based on their previous experiences),
- **Open and distance learning** (an effective way of providing learning opportunities to the scattered learners and/or who for some reason or the other can't become regular students),
- **Web seminar learning** (facilitating learners to participate and interact with experts through web seminars),

- **Mobile learning or M-learning** (a new way to access learning content using mobile devices) and
- **Digital citizenship** (using technology to become active citizens and to make one's community better).

Besides, the initiatives taken by Government of India for the digitalization of school education like **NROER** (National repository of open educational resources), **DIKSHA** (Digital infrastructure for knowledge sharing), **NISHTHA** (National initiative for school heads' and teachers' holistic advancement), **e-PATHSHALA** (Learning on the Go) as well as higher education like **SWAYAM** (Study webs of active learning for young aspiring minds), **NPTEL** (National programme on technology enhanced learning), **SWAYAM PRABHA** - The 32 Educational DTH Channels, **e-PG PATHSHALA** (an initiative of the MHRD under its National Mission on Education through ICT and being executed by the UGC), **e-Pathya** (one the verticals of e-PG Pathshala which is software driven course/content package that facilitates students pursuing higher education), **e-Books or e-Adhyayan** (a platform to provide e-Books for the post-graduate courses), **NDL** (National Digital Library), NAD (National Academic Depository), **Shodhganga** (a platform for research students to deposit their Ph.D. theses and make it available to the entire scholarly community in open access), **e-ShodhSindhu** (access to e-resources to universities, colleges and centrally funded technical institutions in india), **e-Yantra** (Engineering a better tomorrow) and **Virtual Labs** (remote-access to Labs in various disciplines of Science and Engineering) are also proving quite helpful to the learners.

The use of the above ICT aids of e-learning for education are for both the educators to supplement and strengthen the classroom teaching and learners/students who mat take help of them through internet at anytime sitting in their homes. On the one hand, ICT is exerting its considerable impact on pedagogical approaches in the classrooms vis-avis teaching practices, school innovation, and community services, whereas, on the other hand, it has helped higher education and research by providing all type of knowledge to students/researchers at their disposal. It may also be stressed that all these ICT aids for education are helpful in learner-centred learning environment that requires personal engagement to the learning task using the desktop computer/laptop/tablet/i-pad /mobile and the internet connection.

In short, we may say that ICT has played a catalyst role in promoting the education globally and India is no exception to it. Chandra and Yadav (2020 : 10) have rightly stressed in this context that digital initiatives taken by Government of India are transforming the traditional education system as well. These e-learning platforms are very effective in terms of availability of diverse range of courses and their significance in building one's skills and capabilities. It has bridged the gap between schools and homes as it is easily accessible and brought the transparency that can be easily monitored and hence making it reliable.

4. Lockdowns due to COVID-19 in India

The global outbreak of coronavirus since a patient in the city of the wet market of Chinese city Wuhan reported pneumonia-like symptoms on December 8, 2019, had turned into a global pandemic in 3-4 months and threatened the lives of millions of people across the globe. This virus has put the world on standstill until few weeks/ months earlier. It created the World War situation across the globe as most of the countries were blaming China for this pandemic for hiding the facts and misleading WHO. At present, majority of the countries in the world are fighting the menace of coronavirus (changing its form constantly) which has disturbed the safety, security and well-being of their citizens, besides paralyzing the economies. All the countries were forced to impose various restrictions on their own people, which probably they have not even imagined before. The world battled with COVID-19 during lockdown to save their citizens as well as economies (Mahajan, 2020 : 64). Emphasis of policy makers shifted to take radical measures, including social distancing and hygienic practices, to slow the contagion. Hence, it becomes imperative to investigate the impact of lockdown due to COVID-19 on education system as educational institutions at various levels were closed during first wave in 2020 as well as second wave in 2021. This closure of educational institutions has resulted in both challenges and opportunities for them as they shifted to virtual and remote course delivery.

India faces multiple major challenges on the COVID-19 front as its position is quite different from other countries in terms of dense population. Social distancing without total shutdowns is unimaginable, especially in the big cities with crowded streets, trains, buses and offices. Besides, India has a population of 1·35 billion and

the largest concentration of COVID-19 cases initially had been in the metropolitan cities of New Delhi, Mumbai, Ahmedabad and Chennai. The government response has included prolonged lock- down, public awareness campaign and a series of innovations including a novel smartphone application called *Aarogya Setu* for contact tracing and aiding in quarantine and related containment measures.

During the first wave of infections in India during March-May 2020, the Government of India implemented the "world's strictest lockdown" (Hale et al., 2020) to curtail the spread of COVID-19. The period of lockdown during first wave in 2020 in India was initially from March 25 to April 15, 2020 (19 days) and then from April 15, 2020 to May 3, 2020 (19 days). Even during the subsequent unlock periods, all types of educational institutions remained closed for a long time. When they started opening for regular classes and/or getting ready to conduct pre-board examinations in the year end and the beginning of new year, the sudden spurt in cases again forced the state governments to shut them again. Subsequently, with the start of second wave in 2021 in India, various states and union territories were given freedom by the central government to declare lockdown in April according to local situation as regards the number of cases and its spread as well as positivity rate. This resulted again in disruption of regular classes and the conduct of examination. The most of the institutions at various levels are still closed in various states and union territories.

5. The Changing Role of ICT in Education during Lockdowns in India : Challenges and Prospects

Prolonged lockdowns due to COVID-19 has far reaching and severe impact on educational institutions as they were closed indefinitely, as a logical solution to enforce social distancing, leading to the danger of disconnect among students and teachers. In fact, no one ever imagined before the pandemic that the face of the Indian educational system could change so drastically in India. The pandemic prompted a shift from classroom teaching to online education in the form of all the classes, tests, examinations, parent-teacher meetings, admissions, etc. In fact, there was no option except online education (virtual education) as a result of closure of all types of schools, colleges, universities and coaching institutions during the lockdown due to COVID-19 to continue education and to accomplish the set aims and objectives and to allow instruction to continue.

However, we have not developed suitable infra-structure in educational institutions required for the online education. Not only this, this sudden shift to electronic learning/e-learning resources led to different problems/challenges for the teachers, students and the respective authorities of all the educational institutions to necessitate training, facilitation, or orientation sessions to acquaint with this unexpected and sudden shift. Even this could not materialize in India, as in all other developing countries in the short and medium-term.

In short, we can say that undoubtedly ICT has the great potential to improve the educational system to a great extent, but we remained far from reaping these benefits because of certain specific challenges as enumerated below :

- The challenge of making available different digital apps for providing online education like Zoom, Google meet, Google classroom, Webex, Microsoft team etc.,
- The challenge of making available different digital platforms for online education like Swayam, Webex, Impartus etc.
- The challenge of training teachers/educators to develop e-contents/notes/synopsis of the topic/PPts etc. related to courses & deliver them to students un-interrupted,
- The challenge of providing such electronic gadgets like mobiles/desktop computers/laptops/tablets/i-pads etc. to students and making them familiar to access e-contents, interact with teachers and participate in discussions/deliberations with others through these gadgets,
- The challenge of making available reliable and high-speed internet at both the ends, institutions and homes so that none struggle to participate in digital learning,
- The challenge of creating a safe and conducive learning environment virtually and at homes,
- Lack of basic facilities, external distraction and family interruption during online teaching at learners' homes,
- The challenge of lack of training, a lack of technical support and a lack of clarity and direction to teachers in educational institutions,
- The challenge of supporting such barriers as the budget for purchasing advanced technologies in educational institutions, especially the primary, middle, higher secondary schools and colleges in remote rural/tribal/backward areas,

- The challenge of allocation of sufficient funds/grants for the educational sector by the state and central governments for strengthening and using the ICT infrastructure, which does not seem to be a priority and very attractive to the political leadership,
- The challenge of training and bridge the digital divide in different states and union territories (i.e. the country as a whole) and move closer to achieving sustainable development goals,
- The challenge of endorsing the digital revolution in the education sector in India during pandemic when most of the resources are diverted to expand and strengthen health sector which has been hitherto neglected in the country in the past,
- The challenge of creation of a dedicated unit to devise the development of digital infrastructure, digital content, and capacity building to supervise the e-education needs as envisaged in National Education Policy 2020 because not only its implementation has been delayed due to pandemic, but also the allocation of less than 10 percent of GDP to education sector, and
- The challenge of eliminating the digital divide due to differential access of ICT to different sections of society (23.8% of Indian households had internet access as revealed by the National Sample Survey, 2017-2018) and expanding ICT- based educational initiatives in India.

Due to the above challenges, the importance of online education has not only been realized, but it is also now acknowledged by the various stakeholders in the education community. A number of studies have been conducted on online versus classroom teaching in India (as well other developing countries) highlighting challenges and remedies for smooth functioning of education system during the pandemic, which disrupted the education of millions of students in different contexts.

Khan et al. (2012) have enumerated many barriers posing challenges to the use of ICT in education in Bangladesh which apply to other developing countries also. These include ICT supported infrastructure and lack of resources, insufficient funds, vision and plan of schools/colleges/universities, stakeholders, educators,

business leaders and government, political factors, social and cultural factors, corruption, teachers' attitudes and beliefs about ICT, lack of knowledge and skill of teachers, lack of time, etc. Many scholars like Williams (1995), Pelgrum (2001), Mamun and Tapan (2009), Ihmeideh (2009) also hold that Teachers' lack of knowledge and skills is one of the main hindrances to the use of ICT in education both for the developed and underdeveloped countries. The students' isolation has the potential to unsettle them (de Oliveira Araújo, de Lima, Cidade, Nobre & Neto, 2020) or could contribute to their lack of self-discipline.

As regards social and cultural factors, differential gender access to ICT is foremost. In this context, Sharma (2003) has stated that one of the most significant factors influencing the use of ICT in developing countries is the low social status of women. This is the reason that educating or the use of ICT to women is not considered paramount. Even if women were educated having the necessary hardware and software for the use of ICT, they may find very little time to use them due to the burden of domestic chores.

Saksham Mahajan (2020), in his study on "Online Education : Emerging Substitute of Traditional Classroom Teaching due to COVID-19", collected information from 384 students studying for their graduation, post-graduation and Doctorate degrees in various streams using structured questionnaire ('Google form') in the month of August. His findings revealed that three convenient platforms (Google Product, Zoom and Youtube Live) were mostly used by 92% of students in order of preference and almost three-fourth (76.6 percent) used Android as operating mobiles for accessing online classes. The study also showed that online teaching was considered good substitute of traditional classroom teaching only by one-third (32.8 percent) students only. Not only this, only half of the selected students agreed that the traditional classroom teaching supplemented with online teaching by providing e-study material could be more effective.

A study of 232 students in West Bengal by Kapasia et al. (2020) on the impact of lockdown on learning status of undergraduate and postgraduate students during COVID-19 pandemic, has shown that they were using android mobile for online classes, facing various problems like depression, anxiety, poor internet connectivity, and unfavourable study environment at home. These problems were

faced much more by those students who belonged to remote areas and marginalized sections of society.

Jena (2020) has elaborated the merits and demerits of online learning platforms and highlighted tools and techniques for online learning which can ensure the continuity of education. The effect of the COVID-19 pandemic on higher education, according to him, might be long lasting. He has highlighted some of the tools and techniques for online learning which can ensure the continuity of learning and given many suggestions. One such suggestion was to adopt the policy to provide free internet and free digital gadgets to all learners by the government and/or educational institutions. This is important to curtail the digital divide among the learners as many scholars (such as Manzoor and Ramzan, 2020; Singh-pillay and Khumalo, 2021 among many others) hold that the online mode of the teaching-learning process is not only discriminatory to poor and marginalized students, but also for hearing-impaired students.

Mishra et. el. (2020) have emphasized that online teaching-learning has become a massive challenge for the stakeholders to deal with as they were neither ready to adjust with the sudden change nor technologically competent to embrace the changes in the system due to the current situation of lockdown in COVID-19 induced time. They have suggested that the governments must ensure the the following for digital transformation :

- Ensure the availability of reliable communication tools,
- Ensure high quality digital academic experience,
- Promote technology-enabled learning for students to bridge the disparities originated in the education system before and after COVID-19 catastrophe which is also inevitably necessitated for uninterrupted learning,
- Develop suitable curriculum reflecting the perceptible change in the content knowledge and learning experience of students as well as enable them to think critically, and
- Bridge the gap between the haves and have-nots, remote rural and urban affluent as students come from different socio-economic backgrounds and applying the same pedagogical approach may not yield the desired results.

The survey conducted by Naik et al. (2021) with various stake holders of all higher education courses to know the efficacy of teaching-learning process has shown that paradigm shift from

traditional face-to-face teaching method to online teaching has posed technical difficulties affecting the efficacy of teaching-learning process. Their study revealed that more than 60% of the students were not ready for the online classes due to lack of technical, infra-structural, and high-speed internet access, and power supply, limited network data per day etc.). Online sessions of problematic subjects were considered difficult, but theoretical subjects were easy to understand by the students. Study also revealed that the most of the students found morning time (8 am to 12 noon) more effective for online teaching and stressed the need of revision of portions covered duringin online classes with face-to-face classroom teaching after reopening of institutions.

Referring to the positive side of use of ICT in education in India, Mathivanan et al. (2021) have stated that although the online education can't transform traditional classroom education, which is based on personalized attention and face–to–face communication, still it can be a more effective supplement to the education system model in India. Educational institutions have started moving to a blended learning approach where both face-to-face delivery and e-learning model have become standard practices; modern standards of learning management systems may deliver more; a definite improvement in learning material has been noticed; collaborative work has risen due to lots of academic web meetings, workshops, and conferences at university, state, national and international levels. This is the reason that e-learning seems a viable solution to fill the void made due to the lack of classroom learning in present scenario.

It is evident that the students did experience many challenges/ obstacles in opting with online classes, as they were not accustomed with this new method of learning. They were not able to interact with their teachers effectively through online learning. Not only this, even the teachers were not able to give attention to all the students equally. However, it must be remembered that the students take their own time to adapt and adjust to the new platform of learning and deal with the situation effectively as it has been imposed on them suddenly like other stakeholders in education system.

6. Conclusion

It may be safely concluded that the use of ICT in today's scenario has become very much helpful in education. ICT seems to function as a 'bridge' to break the dis-continuity in education during

lockdown due to COVID-19 in India as elsewhere throughout the globe. Earlier, the ICT was used for making classroom teaching more effective for students. ICT, at present, has become indispensable and inseparable part of the education system. It is in this sense, that ICT is said to have started transforming educational society gradually into the knowledge and information society, which in turn, is reconstructing economy to knowledge economy and supporting nations to create wealth by exploring knowledge.

However, a universal and an acceptable fact is that ICT is no substitute of teachers as it cannot replace them. Teachers are and will remain core part of quality teaching. ICT cannot succeed in education without them. The only thing which can be changed, modified and upgraded keeping in view the present scenario, is way, method and mode of teaching with the applications of advanced technology. In other words, this is possible only with adoption and integration of ICT with teaching and learning in the system of education.

7. Recommendations

On the basis of this study, I would like to make following recommendations which may be helpful in long run to make the use of ICT in education system more effective for transforming Indian society :

1. Development, expansion and infra-structure required for digitalization of education in schools/colleges/universities for preparing them to deliver online teaching during the time of crisis/pandemic or even otherwise more smoothly and effectively. For this special grants may be provided by state and central governments by allocating more funds for this purpose at priority basis. This includes the facility of fast internet also.
2. Appropriate training to teachers and students for becoming accustomed for online teaching. It has been revealed by many studies that majority of teachers at all levels of education are neither equipped with gadgets like tablets and laptops, nor they are trained to develop e-content in the form of PPTs, brief synopsis and complete lectures for delivering to students via online classes. Facilities for crash courses, small duration workshops, refresher and/or orientation courses for such training should be started by the state and central governments and make them mandatory for all the teachers to enable them to

prepare e-contents and teach students on digital mode (virtual classrooms, virtual learning and teaching). Such trainings should be made the part of minimum requirements for recruiting the teachers in future. Educational planners and authorities have to understand that online education/class is not possible unless the teachers adapt to technology and become competent for virtual engagement of students. Until the teachers become 'tech-savvy' through training, crash courses, small duration workshops, refresher and/or orientation courses, the government should play the role of a subject-specific, contextualized, and age and grade appropriate content curator- facilitator with the support of experts in each subject to provide them through portals started for this purpose.

3. Students have to be provided with digital gadgets like smart phones, tablets, laptops, i-pad etc. by each state government. Central government/central government funding agencies/ HRD ministry, state education departments should grant sufficient funds for this purpose. Though, it may impose additional financial burden on governments, it is worth implementing it for the bright future of our young generation. Moreover, it is not impossible because a number of political parties in India have been promising and distributing free laptops to students to influence their families during elections. Besides this, necessary training has to be ensured to students to enable them with the ability to use digital platforms to receive e-contents and learn through online classes.
4. Students of marginalized and vulnerable sections of society as well as those with disabilities need still more attention as a number of studies have demonstrated the difficulties being faced by them in digital education. They don't have necessary tools to access online classes and reliable internet and/or technology. Similar is the position vis-a-vis gender. This has already started broadening the gap and expanding digital divide among haves and have-nots as well as that of gender to an alarming scale. Members in Lok Sabha have already pointed out this gap and raised their concern on March 17, 2021 during a discussion on demands for grants of the education ministry. It was brought to the notice of government that there is in-adequate infrastructure for the education sector at present. Government should take appropriate steps for bridging this

gap on priority basis. Earlier the better as there are many news of suicide by brilliant students as they did not have resources to buy a digital gadget due to the financial position of their family. If possible, help should also be taken from NGOs who may be happily willing to do this noble job of providing digital aids to marginalized and vulnerable sections of society, including those with disabilities. Even UNESCO (2020) had proposed that the governments could assist these vulnerable individuals by providing them with learning technologies (like laptops or tablets, if necessary) and support them with internet connectivity and other issues.

5. Parents also have to do the needful for providing their wards an appropriate and highly conducive atmosphere for online classes. WHO has already voiced the concern about the development of such feelings among some children and young people as being more isolated, anxious, bored and uncertain during pandemic. They may feel fear, and grief, over the impact of the virus on their families. Parents have to take steps for safety during open digital communication for online learning; ensure that the privacy settings and parental controls, including safe search, are always on in the device being used; instruct them to keep personal information private from strangers who may pop-in during online classes; help the children to recognize and avoid misinformation and age-inappropriate content by spending some time with them; and should remain in touch with the teacher/mentor/institution concerned. It is worth mentioning that even a slight exposure of students to porn contents available on web may be very harmful for their wards and derail the entire process of online education (teaching and learning). Parents also have to teach their wards COVID appropriate behaviour regarding preventive measures and practices in a sustained manner so that they get accustomed and don't feel any difficulty in their schools/colleges/universities whenever they assume regular classes and/or examinations.
6. Positive attitudes towards digital education, self-regulation and intrinsic motivation for teaching/learning among both the teachers and students do play an important role in improving performance in general at schools/colleges/universities and are very important for online learning to continue during lock-

downs due to pandemic like COVID-19. Keeping in view the danger of third wave of corona in the near future, it is necessary to strengthen positive attitudes and motivation towards digital education so that they are ready for it in the long run.

Camilleri (2021) has rightly stressed the need for further research that investigation on the impact of remote teaching through digital and mobile learning technologies on the students' learning journey using different methodologies, sampling frames, and analytical techniques to shed more light on the implementation and executiveness of remote learning. These studies can also examine the effects of having fully virtual and remote course delivery on the students' experience and their learning outcomes.

References

Bhattacharjee, B. and K. Deb, "Role of ICT in 21st Century's Teacher Education", ***International Journal of Education and Information Studies***, 6(1), 2016, 1-6.

Camilleri, M. A., "Shifting from traditional and blended learning approaches to a fully virtual and remote course delivery : Implications from COVID-19", ***Academia Letters***, (2021) 481. https://doi.org/10.20935/AL481.

Chandra, Rangoli and Shweta Yadav, "Digitalization of Education in India", ***Journal of National Development***, 33(2), Winter, 2020, 1-10.

de Corte, E., L. Verschaffel, N. Entwistle and J. van Merrienboer (eds.), ***Powerful Learning Environments : Unravelling Basic Components and Dimensions***, Oxford : Pergamon/Elsevier, 2003.

de Oliveira Araújo, F. J., L. S. A. de Lima, P. I. M.Cidade, C. B. Nobre and M. L. R. Neto, "Impact of Sars-Cov-2 and its reverberation in global higher education and mental health", ***Psychiatry Research***, 288, June, 2020 (available at https://doi.org/10.1016/j.psychres.2020.112977).

Ehrmann, Stephen C., "Responding to the Triple Challenge Facing Post Secondary Education : Access, Quality, Costs, Report prepared for the OECD", paper presented in International Conference, December 14-16, 1994, Paris.

Hale, T., S. Webster, A. Petherick, T. Phillips and B. Kira, ***Oxford COVID-19 government response tracker***, United Kingdom : Blavatnik School of Government, University of Oxford, 2020.

Hattie, J., ***Visible Learning***, Abingdon : Routledge, 2009.

Ihmeideh, F. M., "Barriers to the Use of Technology in Jordanian Pre-School Settings. Technology", ***Pedagogy and Education***, 18(3), 2009, 325-341

Jena, P. K., "Online Learning during Lockdown Period for Covid-19 In India", ***International Journal of Multidisciplinary Educational Research***, Vol.9, 5(8), May, 2020, 82-92.

Kapasia Nanigopal , Pintu Paul,b Avijit Roy,c Jay Saha,c Ankita Zaveri,c Rahul Mallick,c Bikash Barman,c Prabir Das,c and Pradip Chouhanc, "Impact of lockdown on learning status of undergraduate and postgraduate students during COVID-19 pandemic in West Bengal, India", ***Children and Youth Services Review***, 116, September 2020, 105194.

Khan, Md. Shahadat Hossain, Mahbub Hasan and Che Kum Clement, "Barriers to the Introduction of ICT into Education in Developing Countries: The Example of Bangladesh", ***International Journal of Instruction***, 5(2), 2012, 61-80.

Mahajan, Saksham, "Online Education : Emerging Substitute of Traditional Classroom Teaching due to COVID-19", ***Contemporary Social Sciences***, 29(4), October-December, 2020, 111-122.

Mahajan, Surabhi, ***COVID-19 : Changing Social Fabric in India***, New Delhi : Nation Press, 2020.

Mahajan, Surabhi, "COVID-19 and Domestic Violence : Examining the Impact of Lockdown in India", ***Journal of National Development***, 34(1), Summer 2021, 63-78.

Mamun, A. and S. M. Tapan, "Using ICT in Teaching-Learning at the Polytechnic Institutes of Bangladesh: Constraints and Limitations", ***Teacher's World-Journal of Education and Research***, 33-34, 2009, 207-217.

Manzoor, A. and Quratulain Ramzan, "Online Teaching and Challenges of COVID-19 for Inclusion of Persons with Disabilities in Higher Education", April 2020 (pdf available at https://www. researchgate.net/ publication/340681691_Online_Tea ching_and_Challenges_Of_COVID-9_For_Inclusion_Of_Persons_with_Disabilities_in_Higher_EducationMo st of the learners were used android mobile for attending e-learning).

Mathivanan, S. K., P, Jayagopal, S. Ahmed, S. S. Manivannan, P. J. Kumar, K. Thangam Raja, S. Sree Dharinya and R. Giri Prasad, "Adoption of E-Learning during Lockdown in India", ***International Journal of System Assurance Engineering and Management***, February 24, 2021, 1–10.

Mishra, Lokanath, Tushar Gupta and Abha Shree, "Online teaching-learning in higher education during lockdown period of COVID-19 pandemic", International Journal of Educational Research (Open), 1, 2020, 100012.

Mumtaz, S., "Factors Affecting Teachers' Use of Information and Communications Technology : A Review of the Literature", ***Journal of Information Technology for Teacher Education***, 9(3), 2000, 319-342.

Naik, G. L., M. Deshpande, D. C. Shivananda, C. P. Ajey and G C Manjunath Patel, "Online Teaching and Learning of Higher Education in India during COVID-19 Emergency Lockdown", Pedagogical Research, 6(1), 2021, em0090. https://doi.org/10.29333/pr/9665.

National Sample Survey, 2017-2018, quoted by Rohit Kumar, "Lockdown Is Disrupting a Generation's Education : What Can Be Done?", ***WIRE***, April 24, 2020.

Pajo, K. and C. Wallace, "Barriers to the uptake of web-based technology by university teachers", ***Journal of Distance Education***, 16, 2001, 70–84.

Pelgrum, W. J., "Obstacles to the Integration of ICT in Education : Results from a Worldwide Educational Assessment", ***Computers & Education***, 37, 2001, 163- 178

Rosswall, Thomas, "The role of ICT in higher education at the beginning of this new millennium", 1999. Available at : http://online.kennis.org/eva/eva 06/ictslu.htm.

Sharma, R. C., "Barriers in using technology for education in developing countries", ***Information Technology : Research and Education, Proceedings of International Conference***, ITRE 2003.

Singh-pillay, Asheena and Samukelisiwe Khumalo, "Reflections on Differently Abled Students' Challenges with Online Learning amidst the COVID-19 Pandemic and Lockdown", March 21, 2021 (pdf available at https://www. https://www.researchgate.net/publication/350239555_ Reflections_on_Differently_Abled_Students'_Challenges_with_Online_ Learning_amidst_the_COVID-19_Pandemic_and_Lockdown/citation/d ownload).

Tinio, V. L., ***ICT in Education***, New York : United Nations Development Programme, Bureau for Development Policy, 2009.

UNESCO, ***Information and Communication Technologies in Teacher Education, A Planning Guide***, Paris : UNESCO, 2002.

UNESCO, ***COVID-19 : 10 Recommendations to plan distance learning solutions***, Paris, France : United Nations Educational, Scientific and Cultural Organization, 2020 (available at https://en.unesco.org/news/ covid-19-10-recommendations-plan-distance-learning-solutions).

Volman, M. and E. Van Eck, "Gender Equity and Information Technology in Education : The Second Decade", ***Review of Educational Research***, 71(4), 2001, 613–634.

Williams, B., "Factors contributing to successful implementation of computer technology in schools", ***Dissertation Abstracts International***, 56(08), 1995, 3092. ★

Article Received on May 01, 2021; Accepted on June 20, 2021