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EDUCATIONAL TECHNOLOGY – MITIGATING COVID-19 IMPACT ON LEARNING

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ABSTRACT

The COVID-19 has created a historical disruption in education systems affecting more than 1.5 billion learners in about 190 countries. The crisis has aggravated existing disparities by reducing the educational opportunities for vulnerable poor students especially from far flung rural areas posing a threat to erase decades of progress made in the education sector. A switch to new normal of on line learning has impacted adversely the student centric learning practices, value education, lab based practical classes, skill based education aimed at enhancing the employability skills, practical experience in an organizational setting to acquire industry relevant skills, promotion of enterprise among the students etc. Unprepared teachers without prior experience of online teaching, and unwilling and ill equipped students have compromised the quality of teaching and learning experience. However, the crisis has also stimulated technological innovation to support education. Online education is also seen as an opportunity for motivated students to explore their interests beyond curriculum, and comprehensive understanding of the issues. Through flexibility and convenience of teaching hours and self-study, it can help to groom the students as autonomous, self-regulated, independent individuals.

This paper discusses the evolution of educational technologies over the years, the challenges posed to the education sector by the Corona pandemic and the opportunities it offers for transformation of education and its rise to the next level. The paper also discusses the path ahead and advocates a multi-faceted strategy to manage the pandemonium and to achieve a resilient Indian education system.

Key words: Educational Technology, Online Learning, Student Centric Learning, Gross Enrolment ratio, Covid-19, Pandemic.

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1. INTRODUCTION

Technology enhanced learning (TEL) has seen a significant growth both in the size and the innovative way it has been used during last about 70 years. Educational technology (EdTech) is "the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources" (The Association for Educational Communications and Technology – ACET). Thus educational technology (EdTech) is the application of technological processes and resources in teaching with a goal to improve teaching practices and learning outcomes. It involves a systematic approach to identifying the needs of students and applying technology relevant to the curriculum goals and milestones. As such, educational technology denotes integration of technology into education in a manner that promotes diverse learning environment and leads to outcome based education.

Educational technology has evolved significantly during recent times and encompasses amongst others-learning, information and communication technology (ICT) in education, multimedia learning, technology-enhanced learning (TEL), computer-aided instruction (CAI), internet-based training (IBT), web-based learning (WBL),and multi-modal instruction, cyber-learning, virtual education, virtual learning environments (VLE), online education and digital education etc.

The COVID-19 has created a historical disruption of education systems affecting more than 1.5 billion learners in about 190 countries. Around 24 million children and youth (from pre-primary to tertiary) are likely to drop out.COVID-19 pandemonium has, by bringing a complete disruption to face to face classes, has made online education the only way to continue education. Today, billions of students across the globe are attending online classes making use of educational technology. Availability of appropriate user friendly technologies, capacity building of teachers and taught to enjoy these, overcoming the challenges associated with online teaching etc. will be under keen watch of educationists and educational planners to adapt the education sector to this new normal.

2. EVOLUTION OVER THE YEARS

Wooden paddles with printed lessons (Horn-Books) found use to assist students in learning verses in the Colonial years. Over 200 years later, in 1870, technology advanced to include the Magic Lantern that could project images printed on glass plates. App. 8,000 lantern slides were circulating through the Chicago public school system by 1918. Appearance of chalkboard (1890) and pencil in 1900, made it clear that technology and advanced educational tools have a future in education.

Technology has always been at the forefront of human education as a tool to raise capabilities of educational delivery to new levels. Helping children by easier, faster, interesting and cost efficient ways of learning can be traced back to paintings, abacus , blackboards which have been used for many years. Duplicating machines like the mimeographs and stencil machines came in use from the early twentieth century. First decade of the 20th century saw the use of media for educational purposes with the introduction of educational films. Radio in the 1920s sparked a new wave of learning; on-air classes. The British Broadcasting Corporation (BBC) began broadcasting educational radio programs for schools in the 1920s. It was followed by Overhead projector (1930), ballpoint pen (1940), headphones (1950), and videotapes (1951. Teaching machines that made use of programmed learning were first used by Skinner in 1954.

Skinner's teaching machines, in fact, are first forms of computer-based learning. Cuisenaire rods found widespread use as an educational tool from the late 1950s. This period also saw the large-scale use of technologies such as documentaries and other mediated materials, like overhead projectors and slide projectors in educational institutional settings. Next to enter classrooms were photocopier (1959) and handheld calculator (1972). Experimentation with computers as a tool to teach arithmetic and spelling via Teletypes to elementary school students was first done in mid 1960s at Stanford University.

Television found initial use for general adult education and for schools in the 1960s. The use of television for education spread quickly around the world and in 1970s was seen as an effective remedy for spread of education in developing countries. Satellite broadcasting that became available in the 1980s also raised similar hopes but faded for reasons of the lack of power, cost of equipment, non-acceptance by local teachers, and cultural issues. INSAT, launched in 1983, found use for delivering educational television programs throughout the country. Tele-education still finds immense use in taking education to the remote parts of the country.

Even though Internet was yet to evolve, online education with access to information provided by linked computer terminals originated in the University of Illinois in1960.The first generalized computer-assisted instruction system (PLATO - Programmed Logic for Automatic Teaching Operations) was designed and built in 1960 by the University of Illinois computer. It witnessed tremendous growth and by the late 1970s hosted many worldwide distributed graphics terminals on several networked mainframe computers. PLATO found successful use for forty years offering coursework in a range of subjects.

First online course was offered by Electronic University Network in 1986 followed byMIT providing online classes in 2002. The number of students taking classes online is on the steady increase. As of 2009, approximately 5.5 million students were taking at least one class online. 80%, students at DeVry University in 2010 earned their requirements of two-thirds of bachelor's degree online. 2.85 million out of 5.8 million students that took courses online in 2014 took all of their courses online.

Ivan Illichin his famous book, Deschooling Society proposed "learning webs" as a model to network in1971. New Jersey Institute of Technology made notable contributions in computer-based learning in 1970s and 1980s using internal computer network. Classroom teaching was blended with online discussion forums, as 'Computer-mediated communication'. CoSy software was developed at the University of Guelph in 1980. It enabled online threaded group discussion forums which can be viewed as predecessor to today's learning management systems based forums. Internet based access to information also became available in the mid-1980s. Application of digitized communication and networking to education also started by the same time. The development was leveraged to offer distance learning courses using computer networking. The role of the e-learning system for transferring knowledge expanded later to include systems based on computer supported collaborative learning (CSCL). Access to high-speed Internet and Digital compression in the 1990s led to much reduced cost of creating and distributing videos promoting thereby the creation of lecture capture systems. This technology allowed students to use Internet connection for viewing lectures. The Massachusetts Institute of Technology (MIT) used this advancement to produce recorded lectures and their free dissemination to public, via Open Courseware project, in 2002.

Advent of the Internet and the World Wide Web, in the 1990s coupled with development of search engines, has changed the face of technology especially in the way we communicate and interact. Curbs on the Commercial use of the Internet were lifted in 1993 paved way for a technological revolution in communication methods. The increasing use of this technology especially in teaching and learning is, in fact, a precursor to the development of distance online

education and collaborative learning. Development of web-based learning management systems in the mid-1990s coupled with Digitized textual communication as communication medium facilitated Internet-based learning. The Web has, during the last decade, seen a significant transformation i.e. from a repository of hyper textual documents to a highly interactive communication media. World Wide Web also enabled teachers to use emerging technologies to create course websites with simple sets of instructions**.** Web applications have thus become important tool for educational activities, which include collaborative sessions. This important technological advancement led to interesting developments in 1990s like establishment of online high schools and emergence of portable, scalable and affordable technology-based courses. Greater flexibility and ease of communication between teacher and taught led to significantly increased enrolment in online distance learning programs during 2002 to 2005. The Distance Education Enrollment Report 2017 prepared in collaboration with Online Learning Consortium (OLC), a leading professional organization devoted to advancing the quality of online learning worldwide, revealed that the number of higher education students in U.S. degree-granting higher education institutions taking at least one distance education course in 2015 touched six million. This study shows that momentum in distance education growth has continued, even as overall higher education enrollments have declined.

The Web enabled learning management systems, (later Blackboard), an online teaching platform permitting loading of content with provision of space for student activities, and discussion forums was developed in 1995. LMS became an important means of offering online learning until lecture capture systems arrived around 2008. The first LMSs based fully online credit courses started to appear in 1995.

Later in 2008, Web technology helped to create the first Massive Open Online Course (MOOC) in Canada that linked webinar presentations and blogs by experts to participants' blogs and tweets. Year 2011 was a turning point in e-learning methodologies when MOOCs was introduced at Stanford University. Enrolment of more than 1,00,000 students in a lecture-capture based MOOC on artificial intelligence by Stanford University in 2012 and its rapid expansion across the world speaks volumes of its efficacy. Government of India has now launched schemes leveraging the advancements in educational technology like the National Programme on Technology Enhanced Learning (NPTEL) aimed at creating web and video courses in engineering and core science at the undergraduate and postgraduate levels, and Study Webs of Active –Learning for Young Aspiring Minds Programme (SWAYAM) seeking to bridge the digital divide among students and offering interactive, online courses to citizens of India.

MOOCs has great potential to address the problem of equity and access in higher education and holds promise to open up higher education by providing flexible, affordable and fast-track completion of courses, particularly in poor countries with limited resources to create enough educational infrastructure. MOOCs provide window for innovation in higher education thereby allowing exploration of new online learning models and innovative pedagogical practice. Most universities now allow transfer of credits earned through MOOCs.

Social media covering a wide range of *Internet-based applications* such as Wikis, blogs, You Tube videos, tablets, Twitter, Skype and Face book and mobile devices such as phones has its own distinct niche in the history of educational technology. It has changed the communication world and tools of mere personal communication have found use for educational instruction and outreach. Social media groups provide excellent support to instructors to communicate with students individually and in groups as also to students to communicate with each other.

Online teaching has fast emerged an option for an increasing number of people worldwide because of edge it has over traditional teaching in flexibility in working hours, reach, faster

communication, availability of online teaching material etc. Recent years have seen emergence of e-Learning Platforms suitable for transacting online classes. Technology enabling virtual interactions, online communication in audio and video mode, conducting meetings and conferences, academic delivery and dissemination of e-contents (Zoom, Google meet, Microsoft Teams, Google Hangout, and WebEx etc.) has revolutionized the promotion of online education in recent times.

3. THE CRISIS

The COVID-19 has created a historical disruption of education systems. A United Nations report tells that it has affected more than 1.5 billion learners in about 190 countries out of which around 600 million are school going students. Closures of educational institutions have affected app. 94 per cent of the global students. Around 24 million children and youth (from pre-primary to tertiary) are likely to drop out.

The crisis has aggravated existing disparities by reducing the educational opportunities for most vulnerable poor students especially from far flung rural areas. A consequent threat to erase decades of progress and education funding gaps looms large.

The crisis has however, stimulated innovation in support of education like from radio, television, and dish TV to online education, allowing credits earned through MOOCS to be transferred to regular degree to the extent of 40 percent of the total credit requirement of the program etc.

Governments should however, be cautious in preventing the crisis from attaining the dimensions of a generational catastrophe. Education is an enabling right to secure all other human rights. It permeates all 17 Sustainable Development Goals and can be ignored only at the peril of humanity.

The crisis has underlined strengthening of efforts to build resilience of education systems with a focus on equity and inclusion, enhanced consultation and communication with stakeholders, capacity building of teachers' to adapt to new normal, improved education financing through increased allocation for education sector and reinforcement of international coordination.

4. CHALLENGES

The COVID-19 pandemic and its resultant impact on our lives have raised the need to adopt innovative ways of getting education services at all levels. Student centric learning practices are the biggest causality of online teaching. Online classes are not able to generate the desired environment imperative for quality teaching. Importance of the engagement of students, especially school children, is critical. Many of the online teaching approaches can be very solitary and didactic when students are just made to sit and quietly watch videos, read documents online and that's really dull. Sitting passively just to listen is the worst form of learning. Staying connected with the institution is not only about learning subject. It has to be viewed in the light of social relationships, peer learning and interactions, developing social and socio-emotional skills, and learning to contribute to the society as a citizen. All these requirements will be seriously compromised in online teaching. Let it not be forgotten that Dronacharya-Eklavya scenarios are exceptions.

Various accreditation criteria lay emphasis on interactive learning. Accreditation frameworks are the reflection of the thought process of academic experts about excellence in education and focus on core values like contributing to national development, sensitivities towards community issues, fostering global competencies and inculcating values and commitment to society.

For example NAAC awards marks for field projects and internships (criterion 1.3.4); experiential and participative learning (criterion 2.3.1); developing entrepreneurial capabilities (criteria 1.1.3, 3.3.1 and 3.3.4) etc. Likewise criteria 3.6.1, 3.6.3, and 3.6.4 ascribe value to participation by students in extension and outreach programmes. Criterion 5.3.3 awards the participation of students in sports and cultural activities/competitions organized by the institute. Interest shown by students in activities aimed at environmental consciousness gets recognized under criteria 7.1.5, 7.1.6 and 7.1.7. Efforts of the institution towards building value system of the students get recognized under criteria 7.1.14 and 7.1.17.

Aimed at enhancing the employability skills of the technical students, the model curriculum developed by AICTE includes a compulsory internship of six months' duration to provide hands on practical experience in an organizational setting, to learn industry relevant new skills, to expose technical students to the industrial environment, and inculcate in them industry desired attributes in a student. NAAC accreditation also values internships and industry exposure. Online teaching will seriously hamper research, especially Lab based research. There will a negative effect on internships, industry attachments and experience and project work also. Student mobility and practical exposure through exchange programmes, participation in conferences etc. will be off shelf. Cancellation of flights and rail services has, in fact, restricted the movements to attend seminars, conferences, and visits for other educational and administrative purposes. It is a genuine apprehension that it will reduce further the employability of students in an even otherwise recessing economy.

Virtual classrooms work on the assumption that every student has fast access to the Internet, a laptop or smart phone, and a reliable electricity connection. Current estimates show that out of India's 1.2 billion populations, only 600 million are connected to the Internet, mostly via smart phones. The QS I-GAUGE conducted a survey of 7594 students from across the country and found that more than 50 percent of the respondents, using broadband, mobile hotspot, Internet or Wi-Fi dongle faced power issues and faced signal issues.

Poor Students, especially from far flung rural areas may not have access to desktops, laptops and smart phones, and even if they do, the quality of net connectivity and power supply may not be comparable to urban areas. It will lead to discrimination in access to education. Government school wills the worst sufferers. Urban area teachers are more tech savvy and better equipped. Elite institutions located in urban areas also have the edge of handling predominantly urban students with laptops, smart phones and proper connectivity. However rural poor students are in disadvantageous position due to poor internet connectivity and power issues. Remote learning strategies offer some ray of hope during lockdown but appears discriminatory. Richer developed world is better prepared to switch over to online learning, and if we fail to take cognizance of it, the vast inequality of opportunities that exists will be further amplified leading to serious discrimination. In a developing country like India with vast socio-economic disparities, the digital divide has further widened the learning handicap and needs urgent attention from both public and private sector players to minimize the differences in opportunities to online learning.

This abrupt shift to digital learning is going to be difficult because no one was ready until the pandemonium happened. Online learning is a special kind of methodology and not every teacher is good at it. Not all of them were prepared for this sudden transition to online learning. Besides readiness there was a lack of infrastructure for effective online learning to happen. Unprepared and incompetent teachers without prior experience of online teaching, and unwilling and ill equipped students have compromised the quality of teaching and learning experience. According to the World Bank, only half of India's teachers actually taught teaching on any given day. However, it is expected that with time things might have improved.

Another challenge of online teaching will be the holding of Lab based practical classes. It is not a serious issue in conducting theory classes especially of humanities subject. However, Lab-based practical classes will be difficult to conduct. We need proprietary software etc. and may be establishment of labs at homes, which is quite difficult. Even an elite university like Calcutta University has not been able to held online practical classes in the lab-based subjects.

Student assessment is a critical aspect of the teaching and learning process and is an integral part of teaching and buttresses critical reflective teaching. It provides useful feedback about the extent to which course learning objectives have been met. Assessment is important for advancement, placement, instructional needs etc. Covid-19 pandemic has affected examinations adversely. UNESCO's rapid global analysis (2020) based on survey of 84 countries revealed that only 22 countries held regular exams, 58 rescheduled these, 23 adopted alternative strategies such as online testing, and 11 countries cancelled these. Fairness and the feasibility of alternative modes of assessments also came under question**.** Issues related to equity in poor countries deficient in power and internet, and problems in evaluation of practical hands on skills and vocational knowledge also emerged.

Another barrier to penetration of online education is non-availability of the online learning material in vernacular languages. It is available mostly in the English language. Ed-Tech companies and academia will have to burn mid night oil to create educational material in the major vernacular languages of India. The National Education Policy, 2020 also focuses on mother tongue as the medium of instruction and making available high-quality textbooks, including in science, in major vernaculars.

The pandemic has affected the paying capacity of parents especially in the private, informal and unorganized sectors, which caters to a sizeable section of the students. Students from such families may not be in a position to continue with their studies due to impaired capacity to pay fees. It may be more prominent for higher education technical education.

Social dynamics will change since people will have to spend long time and for days together with families and in limited space. Parents may have to help children set up online learning stations, supervise them for long hours, and deal with their stress. In the case of younger students, with parents also working from home, parents will find it stressful to juggle between their own office and household work, and children's online education. As such, online classes from home are highly likely to disturb work life balance especially of young mothers with elderly people at home to take care of.

Institutions, especially smaller schools, are going to see a financial crunch, survival woes and face the threat of permanent closure. If the lockdown continues for long the revenues will dry up. There already are several PILs and Court cases regarding payment of fees. Layoffs or curtailed salaries are a distinct possibility.

Access to education is an important pillar of National Education Policy. App. 12 crore children are enrolled in the mid-day meal scheme. Primary school enrolment increased significantly (30 percent) after the implementation of Midday Meal Scheme implying thereby that food is an important motivation behind school enrolment. As such, the lockdown has brought a halt for millions of Indian students. It is feared that if the schools remain closed for long, chances of dropouts cannot be ruled out. Collateral effects of the pandemic like hampering access to nutritious food due to closure of educational institutions are also prominent.

Another problem with pandemic is the uncertainties associated with it. Owing to mass gatherings in classes, hostels, events etc, educational institutions pose a threat for the spread of the virus. Therefore unless, the infection is totally eradicated, it is not advisable to start face to face classes. At this stage, resuming normal classes is a distant possibility and unless a vaccine is there, parents may not be willing to send their wards to hostels and institutions.

5. OPPORTUNITIES

Crisis does not bring only challenges but also the opportunities for transformation and rise to the next level. No doubt, as discussed earlier, COVID-19 forced online education is accompanied by several learning challenges; if supervised properly, online education is an opportunity to motivated students to explore their interests beyond curriculum, to pursue a topic of interest that does not necessarily fit into a traditional academic curriculum, and provides them a more comprehensive understanding of the issues. It provides them flexibility and convenience of teaching hours. Self-study can groom the students as autonomous, self-regulated, independent individuals.

Likewise, a complete digital transformation at short notice is not going to be easy but is an opportunity to leverage technologies such as Augmented Reality (AR), Artificial Intelligence (AI), Virtual Reality (VR), and Machine Learning (ML), which enable smart interactive experiences, engagement with students in an interactive 3D model, and assistance in using algorithms to take data-driven decisions. It can be a lesson in resilience, if planned and executed right. It will require teachers to go technology savvy enriching their teaching capabilities as also the learning experiences of the students. Utility of Social media for teaching has always been debated but pandemonium compelled online pedagogy provides an opportunity to standardize the use of Real-time Social Media Channels for education.

The teaching community gets an opportunity of collaborative working across the nation. They stand to benefit from each other and learning can take on new forms. The opportunity can even be monetized since teachers can deliver courses to students from many institutions. A concept of Virtual Faculty, available to more than one institution, will emerge and Regulatory bodies must provide for such faculty in their norms. Students get access to best of faculty and to quality knowledge. On the whole, it's a great opportunity for the education sector to unite, collaborate across countries and continents, and evolve a global way of working. Digitalization thus also provides a valuable opportunity to combat inequity in education through improved and facilitated access. It will make the education system more equitable.

If the nation wants to grow in terms of gross enrolment ratio (GER), online education is the answer. It also provides opens a big door of scalability by improving reach and availability of teachers making thereby the task of a GER of 50 percent by 2035 as envisaged in NEP-2020 achievable. Allowing 100 top NIRF ranked universities to impart online courses comes handy in this regard.

6. THE PATH AHEAD

A multi-faceted strategy is required to manage the pandemonium and to achieve a resilient Indian education system**.** The situation has created appreciation for and necessity to explore digital learning platforms. The Government should provide support for capacity building of both teachers and students for digitization. Deferring the repayment of bank loans, provide loans for ICT and broadband up gradation, soft loan at lower interests targeting parents for school fee payment etc. are the need of the hour. Measures should be taken to minimize the adverse impact of the pandemic on placements, industrial internship, and research projects. It is important to integrate face to face learning with online learning modes to evolve a unified learning pedagogy through flipped classrooms and blended learning. In this context, the educational institutions should, rather than reverting to face to face classes, consider adopting a "flipped classroom" and "blended learning/teaching" approach. It will have to be accompanied by redefining of quality assurance mechanisms and quality benchmarks for online learning and assessment like accreditation and ranking parameters. An active cooperation among software developers, teachers and researchers to identify the features and develop high-quality software, e-contents and programs that are truly effective at promoting learning is the

need of the hour. A paucity of contemporary teachers able to handle the new norm will emerge Strategies must be evolved to build capacity of teachers and students to adapt to blended learning. If the Indian government wants to truly enable online education for all, it should consider supplying free or at subsidized rates basic smart phones and data plans for under-resourced people in rural areas. It could even offer tax breaks for companies and individuals to donate funds for these much-needed devices and data. Lockdowns has posed an abrupt interruption of unexpected magnitude to the learning trajectory of students and the pandemic highlights the need to find solutions to keep children motivated. The onus of finding solutions lies primarily with the academia. The government's plans lack clarity as of now and a clearer idea of its plans to revive the education sector could help stakeholder to contribute better. Remote learning encompasses mixed media learning and the power of Radio and TV should be leveraged. They are already contributing their might which can be further improved. Institutions can align their time tables with the programs beamed on these channels.

Given travel restrictions and health risks, there is a distinct possibility that the numbers of students destined for foreign universities will decline significantly. These students would be looking for quality institutions within the country. It offers a remarkable opportunity to public and private sector to establish institutions offering quality education at par with global standards as also invite Foreign Universities to open campuses in India. NEP has in fact recommended establishment of such campuses.

The job at hand is to mitigate to the best possible extent the negative impact of the crisis. However, the thinking of how its recovery can be fast paced and how can we build on this experience to get back to normal must begin. It must not be lost sight of that this oft quoted "New Normal" is in fact "New Abnormal" and concerted efforts are required to be made at every level to adapt to it for best results.

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