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TECHNOLOGY 4.0 FOR EDUCATION 4.0: INNOVATIONS, CHALLENGES & OPPORTUNITIES IN INDIA

*Ramesh Chander Sharma**
(Ambedkar University Delhi)
https://orcid.org/0000-0002-1371-1157

*Suresh Garg***
(Usha Martin University)
https://orcid.org/0000-0002-3601-4338

ABSTRACT

There is no denying the fact that education is the greatest tool to solve our problems. Education has been transformed from centuries in its form, levels, and format. Depending upon our needs and times, be it peace or exigencies (natural or human induced), educational pedagogies, assessment strategies, infrastructural provisions, student enrolment, faculty recruitment, finances, knowledge management and technology adoption, all have changed over a period of time. Such change in teaching and learning practices is constant. Flexibility of operations, rapidity of knowledge generation and transfer, creative practices and spatial arrangements have given rise to innovations in education. New pedagogies and technologies have opened up new possibilities. Students are offered new learning paths. This article discusses the innovations, challenges and opportunities as presented to us by the technology 4.0 for education 4.0.
Keywords: 4th Industrial Revolution, Educational Innovations, Internet of Things, Artificial Intelligence, Open and Distance Learning.

RESUMEN

TECNOLOGÍA 4.0 PARA LA EDUCACIÓN 4.0: INNOVACIONES, DESAFÍOS Y OPORTUNIDADES EN INDIA

No se puede negar el hecho de que la educación es la mejor herramienta para resolver nuestros problemas. La educación se ha transformado a lo largo de los siglos en su forma, niveles y formato. Dependiendo de nuestras necesidades y tiempos, ya sea paz o exigencias (naturales o inducidas por el hombre), pedagogías educativas, estrategias de evaluación, disposiciones de infraestructura, inscripción de estudiantes, reclutamiento de profesores, finanzas, gestión del conocimiento y adopción de tecnología, todo ha cambiado

* PhD in Educational Technology from Maharshi Dayanand University, India. Head, Instructional Design at Ambedkar University Delhi, New Delhi, India. E-mail: rcsharma@aud.ac.in
** PhD in Physics from Delhi University, India. Pro Chancellor and Professor of Usha Martin University, Ranchi, India. E-mail: prof1951@gmail.com

durante un período de tiempo. Este cambio en las prácticas de enseñanza y aprendizaje es constante. La flexibilidad de las operaciones, la rapidez de la generación y transferencia de conocimientos, las prácticas creativas y los arreglos espaciales han dado lugar a innovaciones en la educación. Las nuevas pedagogías y tecnologías han abierto nuevas posibilidades. A los estudiantes se les ofrecen nuevos caminos de aprendizaje. Este texto analiza las innovaciones, los desafíos y las oportunidades que nos presenta la tecnología 4.0 para la educación 4.0

Palabras clave: Cuarta Revolución Industrial, Innovaciones Educativas, Internet de las Cosas, Inteligencia Artificial, Aprendizaje Abierto y a Distancia.

RESUMO

TECNOLOGIA 4.0 PARA A EDUCACÃO 4.0: INOVACÕES, DESAFIOS E OPORTUNIDADES NA ÍNDIA

Não há negativa do fato de que a Educação é a maior ferramenta para solucionar nossos problemas. A Educação tem sido transformada ao longo dos séculos em suas formas, níveis e formatos. Dependendo de nossas necessidades e tempos, sejam de paz ou mais exigentes (induzidos por fatores naturais ou humanos), pedagogias educacionais, estratégias de avaliação, provisões infraestruturais, envolvimento discente, recrutamento de pessoal acadêmico, finanças, gestão do conhecimento e adoção de tecnologias, tudo tem mudado ao longo do tempo. Tais mudanças nas práticas de ensino e de aprendizagem são constantes. Flexibilidade de operação, rapidez de geração e transferência de conhecimento, práticas criativas e arranjos espaciais produziram as inovações na Educação. Novas pedagogias e tecnologias abriram novas possibilidades. Os estudantes são apresentados a novos percursos de aprendizagem. Este artigo discute as inovações, desafios e oportunidades apresentadas pela tecnologia 4.0- para a Educação 4.0

Palavras-chave: 4ª Revolução Industrial; Inovações Educcionais; Internet das Coisas; Inteligências Artificial; Aprendizagem Aberta e a distância.

Introduction

It is widely recognised that education empowers us to remain invested in the glorious heritage of the past while leveraging the exciting present for sustainable future. Two big revolutions have deeply affected us: the 4th Industrial Revolution, popularized by Prof Klaus Schwab (2016; 2017) and 4th Education Revolution (SHELDON, 2018). Schwab (2016) alerted that the technological revolution has altered the way we live, work and relate to each other. He identified this change as a progression means of four revolutions, the first being using water and steam power for production, second revolution switched to electric power for mass production, electronics and information technology brought automated production in the third revolution and currently we are in fourth industrial revolution which is characterised by artificial intelligence, 3D printing, quantum computing, internet of things and robotics etc. On the similar lines, Sheldon (2018) identified that learning from others in family

structures and from generations to generations was the first education revolution, second revolution occurred by institutionalisation of education by the establishment of schools and universities like the 'tablet houses' in Babylon in Mesopotamia in around 2500 BC.

We were ushered in third education revolution by the invention of printing technology (in Gutenberg in 1436) in the form of mass education. Modern technology opened the gates to us as fourth education revolution, Sheldon (2018) proclaims, "Education has been the Cinderella of the AI story - largely ignored in the literature and by governments, companies and educational institutions worldwide. This needs to change rapidly: AI could be the Princess Charming or the Ugly Sisters in education". Sheldon cautions us to be mindful of what is looming large on the horizon as we land ourselves in a VUCA world. The term VUCA (used as an acronym, representing Volatility, Uncertainty, Complexity and Ambiguity in the world) appeared in 1987 focusing on the leadership theories of Warren Bennis and Burt Nanus (GLAESER, 2020).

Developmental stages of education

Education has, since the very beginning, evolved with technology to meet the ever-changing needs of our societies. Development of Printing press made publication of books, research journals etc. possible and facilitated sharing of outcomes of human intellect. Availability of Internet enhanced the speed of processes tremendously and made sharing of research findings almost synchronous. However, changes in delivery of education based on technology in the last one and a half year took place at a never seen before pace because of Covid-19 pandemic. In fact, the pandemic dramatically accelerated technology adoption across all institutions. It forced us to shift from Classroom based face to face education to internet based online education overnight, though adoption of the system was painful to the teachers as well as the taught due to its newness to both groups.

As such, education has evolved through three stages of development starting from teacher disciple based Gurukula system to conventional classroom system to Open and Distance Learning (ODL) system. (The ODL system itself progressed through five generations and we are on the threshold of the dawn of the era of intelligent-flexible model.) The technology-mediated **on-line and digital education,** which is supported and delivered through Internet, is fourth stage of development in teaching-learning (GARG; SHARMA, 2010). Learners can approach the tutor instantaneously for synchronous response from anywhere on the globe, provided they have access to Internet. That is to say Geography is now History and due to robustness of technology, world has become borderless. Use of technology in education for blended learning is also one of the profound recommendations of NEP-2020 (GOL, 2020).

We now know that education evolved from rote learning and memorization model (Education 1.0) to Innovation based education (Education 4.0) via Internet based leaning (Education 2.0) and knowledge based education (Education 3.0). In India, most of the universities are still practicing Education 1.0 model (in curriculum transaction as well as assessment and evaluation), notwithstanding the recommendations to the contrary by various high powered Committees and Commissions. Therefore we are confronted with the question: Are we future ready? It is a harsh reality that rote learning and memorization continue to be bane of Indian education and our graduates lack in 21st century skills such as problem solving, critical thinking, asking probing questions, thinking creatively, forging collaborations, practicing cognitive flexibility and managing information.

While taking note of such deficiencies and the fact that data drives knowledge, NEP-2020

recommended that HEIs should use technology to promote innovation led teaching-learning to develop well-rounded graduates, who, with Indian values, can successfully compete in the world of work globally. It further recommended that to be in the front row of quality education providers, we have to make a quantum jump in ways and means of transacting curriculum and equip our learners with skills of emotional intelligence, decision making, sense of service and negotiations, among others. It is important to realise that education and R&D have led to growth in technology as well as industry and vice versa to give us quality of life of our prescription.

Education 4.0

To appreciate the intent of Education 4.0 as far as challenges and opportunities are concerned, it is important to first detail out the meaning of this term. Education 4.0 is embedded with infiltrations of technology such as smart phones, online evaluation and assessment, Artificial intelligence and big data (UGUR; KURUBACK, 2019). With such advanced technologies and automation, the future of education has been transformed for better. It is stark reality that one innovates in need and adversity and creativity is the foundation of Education 4.0 as it helps learners to take on challenges head-on. Moreover, in order to keep up with the change, we should revisit traditional paradigms with futuristic approaches; we can resolve problems of today with tools of tomorrow not yesterday.

Therefore, it is absolutely necessary that our graduates are proficient in skills needed in the fast-changing technological eco-system; they should be led rather than instructed. An important hall mark of Education 4.0 is that information should be made accessible rather than fed. That is why teachers should behave as facilitators and help navigate learners rather than sage on the stage or monolithic repository of knowledge.

Major trends in Education 4.0 include personalized learning, increased remote learning, project based learning and availability of and access to newer tools with freedom to play with them so as to invent newer processed and techniques. We now know that Artificial Intelligence has now facilitated proctored online/ open book examinations from the safety of the four walls of the study rooms but there is a serious divide across the line as far as authenticity is concerned. Similarly, technology based assessment is being used successfully but skeptics as well as employer groups have serious doubts about the entire process. Similarly, with data analytics, it is now possible to gain insight into the learning curves of the students while statistical analysis allows tutors to precisely identify where students stand and guide them appropriately with instant feedback.

Researches in learning theories in the Open education tell us that personalized teaching-learning has greater impact on students and facilitate them to achieve outcomes easily. Moreover, the tools associated with Artificial Intelligence and Cloud Computing impact the entire teaching-learning process according to individual learner's pace. As far as remote learning is concerned, Education 4.0 promotes anywhere, anytime, anyone paradigm implying that availability of e-learning tools facilitates inclusive education and respect for learner autonomy. Moreover, with active Blended Learning (ABL), students can learn beyond the classroom.

Innovations

Merriam-Webster dictionary defines innovation as a new idea, method or device or the introduction of something new. There is an element of novelty in innovations. The Oslo Manual (2018, online) defines innovation as

> [...] a new or improved product or process (or a combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential

users (product) or brought into use by the unit (process)

The Oslo Manual (2018) categorizes innovations into four types: organizational innovation (implementing new organizational strategy to change business practices, for example, due to pandemic almost all organizations have allowed work-from-home), process innovation (implementing new operational methods resulting in enhanced or better product or service, for example, using bigdata analysis for decision-making approach), product innovation (introducing new or improved product or service resulting in improved performance, for example, ergonomic computer devices or using augmented reality-virtual reality for explaining complex concepts in science subjects), and marketing innovation (adopting unique marketing strategy, for example, redesigned curricular content making it interactive, or biophilic buildings for educational institutions (SODERLUND, 2019)). Further, UN Environment with support from European Commission and the Technical University of Denmark created an eco-innovation manual (http://unep.ecoinnovation.org/about/) which defines eco-innovation in terms of sustainability throughout the life cycle of a product. This project was implemented from 2012-2017 in countries Colombia, Egypt, Kenya, Malaysia, Peru, South Africa, Sri Lanka, Uganda and Vietnam. Biophilic design are bringing a great innovation the way buildings are being designed. Some of the famous examples are The Spheres, Seattle; Ruins Studio, Scotland; Second Home, Lisbon; Karolinska Institutet gym by Biofit, Stockholm; and the Marina One, the lush garden-themed Singapore tower. Since Edward Wilson popularised Biophilia through his book in 1984, many projects have implemented this innovative practice to bring built environment close to natural world. These have great implications for schools, hospitals, work and living spaces (BERKEBILE; FOX; HARTLEY, 2008).

The Institute of Educational Technology publishes for the past few years its annual report "Innovative Pedagogy Report" to find how new applications of teaching, learning and assessment can provide useful insights to teachers and policy makers in productive innovation (https://iet.open.ac.uk/innovating-pedagogy). The Innovating Pedagogy 2021 is the ninth such report in the series brought out by the Artificial Intelligence and Human Languages Lab/The Institute of Online Education at Beijing Foreign Studies University. This report (KUKULSKA-HULME et al., 2021) has identified ten innovative pedagogies which has impact as new educational concepts, theories, terms and practices, like best learning moments, enriched realities, gratitude as a pedagogy, using chatbots in learning, equity-oriented pedagogy, hip-hop based education, student co-created teaching and learning, telecollaboration for language learning, evidence-based teaching, and corpus-based pedagogy.

Technological interventions make the teaching, learning and assessment experiences more relevant and engaging. Let us see some examples of impact integration of technology on these pedagogies. The mobile devices have transformed the learning scenario and have become the primary learning device, especially in this pandemic times. With the rise of augmented reality and virtual reality applications (SHARMA; SHARMA, 2021), mobile devices make content more engaging. The mobile devices are making learner sui generis (PANT, 2021a), resulting in well rounded education.

Robotics in education

Robotics has greatly impacted the automation and productivity in various industries. The Oxford English Dictionary defines a robot as: "A machine capable of carrying out a complex series of actions automatically, especially one programmable by a computer." Sensors play a great role in robot building. Sensors are the lifeline of Internet of Things. These innovations have made everything to remain connected and it is staying to be so in the future too. Rather the

impact of IoT will be much more in the future than many of the contemporary technologies because of their multidisciplinary applications like from the fields of computer, biomedical, mechanical, electrical and industrial engineering (RAAD, 2021).

These innovations in IoT and Robotics have immensely benefited education sector too, although their primary use has been in other industries like Health, and transport etc. Based on the operating mechanism, robots are of two types: fixed (like industrial robotic manipulators, as used for soldering or painting or assembly of a product) and mobile (those which work in unpredictable situations like taking orders at a cafe). Robots have found their good place in educational institutions being used in the classroom as well as in extracurricular exercises (DUDEK; JENKIN, 2010). Some examples of pre-assembled robots are Thymio robot from Mobsya and Dash robot from makewonder.com. LEGO introduced Mindstorms robotics kits in 1998, using LEGO bricks, motors and sensors. These were used to teach mechanical design however these were expensive robots as compared to pre-assembled robots (TROBAUGH; LOWE, 2012).

Internet of Things (IoT)

The term Internet of Things (IoT) was coined by British technologist Kevin Ashton in 1999 (VAILSHERY, 2021) as a means where people and objects are connected via network. These have become so useful and popular that they being used in many segments like smart cities, smart homes, as wearable devices and in industrial equipments. According to Vailshery (2021a) IoT device installations are predicted to be 30.9 billion units by 2025. In a very recent survey, Vailshery (2021b) found that future innovations in IoT workload would be sensor processing. The IoT and wearable devices work through sensors, actuators, computing technologies and communiation and information protocols (SAID; MASUD, 2013). These components allows these devices to communicate, process and exchange information and are very helpful for big data analytics, embedded systems, cloud computing and semantic search engines. Wearable technologies are available as eyewear (as contact lenses); headwear (as headbands); earwear (as ear inserts); bodywear (as skin patches and smart textile); arm/wrist/hand-wear (as wristbands or gloves); and footwear (as shoes and insoles).

These devices enable users to use functional and portable electronics into daily use tasks (HOLLAND, 2016). Another innovation is Machine-to-Machine (M2M) technology which connects machines, devices or appliances using wired or wireless connection minimizing human engagement (for example, smart utility meters or vending machines). These have great utility for special needs children as a lifelogger (a person who wears a recording apparatus to capture data of his or her life). Apple Watch, Google Glass, Nike+, Jawbone and Fitbit are other such devices which capture useful data on user's performance. The educational implication is evident of such devices that in 2013 Google Glass was used to demonstrate a live surgical operation by Rafael Grossmann (GROSSMANN, 2021). This has implications for people with disabilities like when using voice commands we can communicate effectively with hearing impaired students (GUO et al. 2013).

Chatbots and voice assistants

In the education sector, global voice technology adoption would see bigger impact in 2021 (VAILSHERY, 2021c). The Durham University in the UK uses "Holly", an AI based student engagement platform helping them in admission process. "Language Chatsim" is an application where students can practice speaking with an avatar at the University of British Columbia. University of Illinois Chicago has implemented

"Socrates" which is a chatbot (PELLETIER *et al.*, 2021).

Artificial intelligence

The pandemic has impacted our daily life immensely and thus it has been reported that COVID-19 has fuelled the demand for innovation accelerators, prime among them is artificial intelligence (LIU, 2020). Since in synchronous online teaching and learning we use variety of web conferencing tools, Agarwal (2020) reports about an application of real-time eye tracking using OpenCV and Dlib. Here, to observe the eyes movement in real-time, we use facial keypoints detector. Such application is very useful for online proctoring using applications of artificial intelligence. AI applications are not only helping us in teaching, learning and assessment, these are also useful in redesigning curriculum. Deep learning applications have made "self-supervised learning" a possibility in which the AI system learns by itself, say, by watching videos. There are innovative uses of AI in education.

The German Federal Ministry of Education and Research has supported AI Campus as a digital learning platform whose objective is to inculcate AI skills and competencies in the learners. Goethe University is one of the users of this platform. Researchers from Stockholm University have examined the ethical and legal challenges of using AI-based practices in education. Researchers at Mind Lab in New Zealand have tested sentiment analysis tools to find out usefulness of natural language processing for analysing online sentiments of students. Another project towards natural language processing has been carried out at Penn State University for transcripts of course to analyse the content and context of sentences spoken by the teacher in the class. The Centre for Research and Interdisciplinary, Paris has worked on WeLearn plugin (open, web based) which helps in concept mapping and sharing of semantic-localised knowledge.

Augmented reality / virtual reality / mixed reality

Augmented reality, virtual reality and mixed reality applications are gaining lot of attention in education as innovative technologies (SHARMA; SHARMA, 2021). Using these student engagement can be fostered, enabling students to explore the world and develop learning experiences through active learning (ODDONE; HUGHES; LUPTON, 2019). These applications are hailed as immersive technologies (SHARMA; SHARMA, 2021) as the next generation of media revolution.

Using these technologies, content can be presented as non-immersive virtual reality by using a computing device or a projector screen or as an immersive content where students can use a VR headset. These applications are very useful for certain situations where either the travel is not possible or the concept is dangerous in nature to be demonstrated. Teaching content like climate change, historical spots, environmental damage, science museums etc are very suitable to be dealt with using such VR technologies (GOMES et al., 2019).

Innovations in assessment during emergencies

Disasters and crisis in any form has affected millions of lives and at the same time laid severe impact on various development sectors such as; education, health and economy of a country (BAWANE; SHARMA, 2020). Earlier, conflict and natural disasters were viewed as major obstacles in achieving the 2015 Millennium Development Goal for providing universal primary education (WILLIAMS, 2006) and it is speculated that same continue to hinder in achieving the target of Sustainable Development Goals in quality education by 2030.

Disasters have also resulted in huge human, material and environmental losses, to such an extent, that a country's economic development

is delayed by almost a decade and the affected the people were unable to cope up within their own resources for an extended period, thereby causing serious disruptions in the functioning of society (DELICA-WILLISON, 2003; LOH, 2005). Many countries, however, in course of time, have definitely improved by developing relevant coping strategies to reduce risks and respond effectively to any such emergencies (BOZKURT et al., 2020), and deriving solutions and mitigation measures for the refugees. Emergencies have had negative impact on children's education and overall development (BOZKURT et al., 2020). In view of the COVID-19 pandemic, when most of the educational institutions and schools experienced closed-down, they embraced distance education and digital platforms to bring back normalcy and continue teaching learning opportunities.

Diverse coping strategies and platforms such as online platforms, MOOCs, mobile technologies, television, social media platforms, radio channels and video conferences were adopted by countries in Asia-Pacific and others (TRUCANO, 2020; WORLD BANK GROUP, 2020; UNESCO, 2020b). Schleicher (2020) revealed that China reacted fast when they were first hit by Covid-19, by launching a cloud platform, which accommodated 50 million learners simultaneously and in India, digital e-learning platforms like Diskha, Swayam and e-pathshala were strengthened to enable free access to online resources and teachers were encouraged to utilize these platforms (Government of India, 2020). Sudden transport to online or digital platform has not been smooth and many countries have realised that it was impossible to ask teachers to simply shift to online teaching. Huber and Helm (2020) based on recent pandemic study (2020) revealed that digital learning demands self-regulatory skills from the students and hence ways to promote motivational and volitional competence needs to be further explored.

Sentiments recognition

The pandemic has speeden up the transition to digital teaching to such an extent that currently online teaching has become a norm (MEDHAT *et al.*, 2014). Computer vision is an interesting field where with the help of machine learning and deep learning algorithm, we can carry out facial sentiment analysis (PATEL et al., 2020). This technology hold great promise for the understanding and analysis of human interactions, especially facial expressions. Matsumoto (1992) identifies anger, fear, disgust, happiness, sadness and surprise as six generic emotions of human.

A real time analysis of these emotions in a classroom can reveal great metrics for improvement of teaching and learning. However Patel et al. (2020) report that real-time facial expression recognition is a challenge currently and may be in future deep learning algorithms will help us in better detection, extraction and classification of these for effective performance measurement. speech emotion recognition (WADHWA; GUPTA; PANDEY, 2020) is another innovative technology as remote communication becomes essential in today's digital teaching and learning environments.

Challenges

Technology 4.0 is symbolised by Industry 4.0. Just as in education, Covid-19 pandemic dramatically accelerated technology adoption across all industries. According to one survey, 77% of CEOs reported that the pandemic sped up their companies' digital transformation plans, and as Microsoft CEO Satya Nadella noted in the early days of the crisis, "We've seen two years' worth of digital transformation in two months."

Beginning with industrial revolution in second half of the 18th century, Industry evolved with tremendous technological growth. Prior to industrial revolution, which is referred to as industry 1.0, all goods were produced using

human or animal power. The voyage from industry 1.0 to 4.0 has essentially been supported by successive improvements in technology through design of machines run by steam, electricity, electronics and Internet. That is, the first industrial revolution came with the advent of mechanization. The second industrial revolution revolved around mass production and assembly lines using electricity. The third industrial revolution came with electronics, I.T. systems and automation.

The fourth industrial revolution is associated with cyber physical systems and essentially symbolises convergence of physical, digital and biological worlds. (These include personalised medicines and smart health care autonomous systems.) The point we wish to make is that creative developments in industry 4.0 were led by advanced digital technologies. As such, it represents a new stage in the control and organization of industrial value chain. By digitizing the industry, it should be possible to further improve operational efficiency and growth--quality and quantity of produce, accuracy and speed of production, cost-effectiveness and safety, enlargement of businesses to global dimensions notwithstanding. Such developments can be limited only by our ingenuity. In fact, automation and smart machines--a paradigm shift—has been facilitated by disruptive developments in Internet based technologies (GARG; SHARMA, 2010). The machines can

- communicate intelligently with each other, analyze and guide intelligent actions; and
- monitor, detect and predict faults so that preventive measures and remedial action becomes possible to help improve quality.

That is to say, industry 4.0

- refers to intelligent networking of machines and processes with the help of ICTs; and
- is digital transformation of manufacturing/production and related industries and value creation processes.

With technological tools such as artificial intelligence, block chain and 3D printing, we should expect still better results. We can therefore say that interplay of developments in education and technology reinforced mutually and benefitted both as also industry.

While there is no reason not to believe that Technology 4.0 would promote responsible innovations and forever learning. But as far as challenges posed by the new technologies are concerned, we have to account for loss of jobs in existing skills and our inability to reverse decisions taken by machines. Moreover, preservation of ethics and values is a serious challenge today. To meet such challenges, it should be hoped that technology should promote university-industry-government partnership.

Opportunities

Our experience at Usha Martin University, India shows that Master of Business Administration (MBA) students found project-based learning more enjoyable and fruitful. They developed time management, organizational and collaborative skills, which would be important for them when in employment at a future date. This experience led the faculty to propose introduction of project work even at the undergraduate level (BBA). This suggestion was highly appreciated by the members of Academic Council, some of whom were from IIMs.

Conclusion

The World Bank (2020) forewarns us that:

> [...] education systems must confront issues of inequity front and center. They must also prepare multi-modal responses, capitalizing on existing infrastructure and utilizing a combination of different learning mediums to ensure students are engaged and learning. [emergency remote education] can ensure that students continue learning through a variety of avenues. While digital technologies can offer a wide set of capabilities for remote learning, most education systems in low- and middle-income countries,

> including schools, children and/or teachers, lack access to high-speed broadband or digital devices needed to fully deploy online learning options. As such, education systems need to consider alternative ways for students to continue learning when they are not in school, like in the current Covid-19 crisis" (p. 1).

The 4th industrial revolution and 4th education revolution has created unique challenges and opportunities for the education sector. The innovations due to these technological developments has provided new pathways for the learners to be co-creator of knowledge and become self-directed learning. In this third decade of twenty-first century, the innovative applications of artificial intelligence and quantum computing has created new pathways for all stakeholders in education where the role of teacher is more of a guide rather than sage on the stage.

These innovations have brought changes in the governance, structure and practices of educational institutions. Exciting things are on the horizon as wait for the implementation of 5G internet. That will allow the teaching and learning scenario to be the Netflix of education. Advancements in brain computer interface has immense pedagogical benefits where with the help of suitable chips implanted on or in the brain, we can find solutions to either physical problems of human body or pedagogical.

These innovative applications and developments are calling upon the education community to be ready for quantum future and make a better sense of artificial intelligence (PANT, 2021b). We are surrounded by evolutionary and disruptive technologies such as mobile phones, MOOCs, chatbots and adaptive learning algorithms which we need to pay attention and adopt them to stay relevant in the coming decade.

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