

Education 4.0 and the Indian Education System

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Abstract

With the evolution of mankind from nomads to modern structured societies, there has been a need for overall progression and development in all sectors. Hence, the world has been seen to progress from Industry 1.0 (Industrial Revolution) to the modern Industry 5.0 (Cyber-Physical Cognitive Systems). In order to prepare learners to build sustainable social systems, in the Indian context, there has been a paradigm shift in the educational sector from the Ancient Gurukul systems to the onset of Education 4.0 into mainstream education. This has been greatly propelled into action by the sudden spread of the Sars-CoV-2 or COVID-19 pandemic causing the sector as a whole to shift from the traditional approaches of teaching and learning to the remote and online teaching methodologies. This was done by mass mobilization of resources in order to fulfill the technological needs of the sector.

The National Education Policy (NEP) 2020 also endorses the shift from brick-and-mortar methodologies to a more technology-driven approach whether it be for learners, in-service educators, pre-service or future educators as well as other stakeholders. The NEP also addresses the industrial requirements and progress that has occurred in the world, and the need to bring its citizens and the future of the nation to meet the global standards of education. It also has implications in the quality of education in the form of methodologies, approaches, techniques, etc. in order to provide a holistic approach to education that allows a learner to improve their 21st-century skills to meet the needs of society. It is interesting to also note that the NEP 2020 seeks to create an intricate blend between a futuristic outlook technology while simultaneously conserving our national heritage. This can help India move from a developing nation to a developed nation by transforming society rather than an individual.

This paper aims to understand the relationship between Education 4.0 and Industry 4.0 and also examine the skills that will be required in order to achieve the same. It also mentions a few suggestions on the implementation of education 4.0 in the Indian context.

Keywords: - Education 4.0, Industry 4.0, 21st Century Skills, NEP 2020

Background

The development in the Indian education system over time or over many centuries is denoted as Education 1.0 (1784), Education 2.0 (1870), Education 3.0 (1969) and now we are entering the era of Education 4.0 (today). [1]

The ancient Vedic Gurukul System of India (depicting Education 1.0) was one of the pioneer establishments for the Indian education system. The educational methodologies of this time mainly involved techniques such as recitation, memorization, reflection, repetition, etc. This teacher-centric approach remained until the 1900s. This approach revolved around the use of “the chalk and talk method” wherein the teacher was considered to be the more knowledgeable individual who guides and teaches learners in their own way.

The era of Education 2.0 saw more collaboration and communication between learners and educators, and yet, the focus was still on rote memorization which was encouraged by the advent of the examination systems. The onset of using technology in education came in the mid-1990s which was then still not used to its full potential but nonetheless played an integral role in the transaction of knowledge.

Education 3.0 is currently being followed in the systems of education in India. There can be seen a shift from the previous teacher-centered approach, to a student-centered approach, where there is a two-way flow of communication between the teacher and the taught. Educators are now known as facilitators, guides, advisors, etc. Students are being given the freedom to explore different avenues of knowledge and construct their own knowledge of

the world around them. Techniques such as Flipped Classroom, online learning, courses, blended learning, experimental and experiential learning in an integrated manner, etc. are in trend during this phase.

Objectives

- To elucidate the relationship between Industry 4.0 and Education 4.0
- To understand the concept of Education 4.0
- To explore the influence of Education 4.0 in the contemporary Indian education system
- To identify the key features for synchronizing Education 4.0 with the current Indian education system

Methodology

This research was done by policy document analysis and review of pre-existing related literature. From this, insights were derived about the influence Education 4.0 has had in relation to the Indian education system. Based on this, certain criteria for achievement of Education 4.0 were suggested.

Industry 4.0

The fourth industrial revolution, also commonly known as Industry 4.0, is when the major developmental changes were seen in terms of technology.

The McKinsey Global Institute defines the Fourth Industrial Revolution as the era of cyber-physical systems - systems that integrate computationally, network and physical processes and encompass countless technologies encompassing mobile devices, the Internet of Things (IoT), Artificial

Intelligence (AI), robotics, cyber security, and 3D printing. [2]

According to Schwab [3], Industry 4.0 deals with growth at an exponential rate, as compared to a linear one. It relates to changing not only the “how” and “what” is being taught but the fundamental questions of “who” we really are.

It includes aspects of educational technology and tries to encompass the physical, biological, and digital world by bringing together Artificial Intelligence, Hologram Technology, Digital Twin Technology, Blockchain Technology, and other emerging technologies to try to give a new shape to our education system.

The word was used initially in Germany in the engineering field, but today has multiple applications in many other disciplines, like economics, management, military, administration, including that of education as well.

Education 4.0

With each Industrial Revolution, the needs of the society keep evolving, and hence new educational revolutions supersede the older methods, as can be seen in Fig. 1. To meet the needs of Industry 4.0, the society had to transform itself into an information-intensive society. Hence, the concept of Education 4.0 came to light. This revolutionary new perspective of Education 4.0 helps learners with the content by promoting the use of alternative thinking and intelligence with the use of technology, its tools, and related resources [1]. It aims to create an environment rich in creation and innovation in the teaching-learning process.

It includes software such as Augmented Reality (AR), Artificial Intelligence (AI), Internet of Things (IoT), Automation, 3D - 5D printing, Digital Simulation, Virtual Reality (VR), Virtual laboratories, Digital pedagogy and assessment, Digital Infrastructure for Knowledge Sharing (DIKSHA), Massive Online Open Courses (MOOCs), Study Webs of Active-Learning for Young Aspiring Minds (SWAYAM), Big Data Analytics, Robotics, Learning Management Systems, Satellite-Based Teaching Channels, etc.

Education 4.0 is the new revolution in the field of education which will bring about change in the holistic scenario of the Indian Education System. It will be a practical drive approach with increased real-life applications and involve a heightened level of self-learning, generating novel ideas with neoteric planning methodologies and strategies, which will give a new shape to our education system.



Fig. 1: Educational Revolutions and their pivotal ideologies

Competencies Required for Education 4.0

Internet-enabled with the advent of the 21st century, the world has been a witness to numerous transformative changes whether it be in the field of agriculture, education, business, technology, global trade, economy, etc. In order to emulate global needs at an individual level, one will need to ensure up gradation and development of certain skill sets. These skills are commonly known as 21st-century

skills, learning skills, or even transversal competencies. Therefore, these 21st-century skills will be required by individuals in order to promote holistic development and become an asset for their nation by adding to its development and giving back to society.

According to the Asia-Pacific Economic Cooperation (APEC), the development of 21st-century skills in learners is of pressing international concern. APEC defines 21st-century skills as ‘knowledge, skills and attitudes necessary to be competitive in the twenty-first-century workforce to participate appropriately in an increasingly diverse society, use new technologies and cope with rapidly changing workplaces.’ [4]

An alliance of educators and business leaders, named Partnership for 21st Century Skills (P21), identified 21st-century skills as ‘The 4Cs: communication, collaboration, critical thinking, and creativity, which are to be taught within the context of core subject areas and twenty-first-century themes.’ [5]

According to the Central Board of Secondary Education (CBSE) [6], 21st-century skills can be classified as ‘Learning, Life and Literacy’, depicted in Fig. 2.

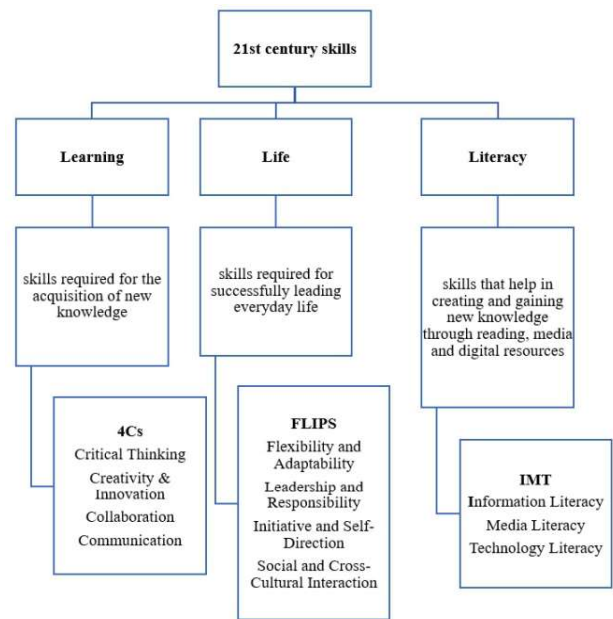


Fig. 2: 21st-century skills as per Central Board of Secondary Education (CBSE)

Influence of Education 4.0 on the Indian Education System

The influence of Education 4.0 in the educational sector is numerous and multi-faceted. The impact can be seen in all the different sectors of the educational discipline. Education 4.0 can help to transform the fragmented inputs of stakeholders into a more collaborative approach to bring them all under one umbrella. Reforms will be required in diverse aspects such as flexibility of education, curriculum development, curriculum transaction, the role of the stakeholders, student ownership, evaluation methodologies, the use of technology-based tools and resources, innovation, etc. Though there are multiple positive influences of Education 4.0, there are however negative influences as well.

Positive Influence

The Indian education system has been witnessing a monotonous, rigid, and recurring use of certain methodologies, in order to facilitate processes involved from the time a learner enters the education system, up to when they leave it. However, with Education 4.0, more flexible methods can be adapted to facilitate this from beginning to end. This can even include changes to the input (admission, orientation, etc.), the transaction of knowledge (the teaching-learning process), and even the output (in terms of computational evaluation, certification, etc).

The curriculum development is crucial in ensuring the progress and eventual success of Education 4.0. Vice versa, the changes that Education 4.0 brings will also have an impact on the curriculum. This is a continuous cycle between the curriculum and any future changes that occur in the educational sector. Every few years, the curriculum must be updated in order to keep students up-to-date with the versatile global needs and demands.

With the advent of Education 4.0, the use of technological techniques in order to assess and provide personalized education can be seen. Firstly, each student has a different style of learning as well as the pace of learning. Personalized learning, can help to make an individualized learning plan for each student that is more compatible with their learning needs. It can even be used for those who are alternatively abled in order to ensure quality education as per their requirement. Secondly, educators can also use these tools in order to gather information about learners at an individualized level. This can provide educators a chance to gain in-depth feedback on the learner's understanding

and gauge deficiencies in areas of meta-cognition. Educators can then improvise their teaching methodologies in order to bridge the gaps in the teaching-learning process. This personalized approach will help to improve the quality of education, using the use of technology, without burdening the educator.

This new version of Education gives more importance to 'why' and 'whereas compared to 'what' and 'how'. Learners are able to take responsibility and hence learn the skill of taking ownership of their own education and career paths. Since this is a way in which students can hone their ability of self-learning, it will indirectly play a role in improving skills such as critical thinking, logical reasoning, collaboration, problem-solving, time management, teamwork, etc., it can hence improve the overall development of the learner.

Since Education 4.0 brings into play a more collaborative and hands-on learning experience, the knowledge gained by students can be applied in practical situations, as compared to judging their knowledge and understanding just using a pen and paper method. With this, the learner can become more self-sufficient while at the same time ensuring that the learning occurs in a more interactive and enjoyable manner. The role of the educator will be more of guidance, in order to bring out the optimum potential of the learner. It tries to provide a safe environment to the learners to allow an association between what they learn and how to apply it in their future endeavors. The same has even been suggested by the National Education Policy (NEP) 2020 given by the Ministry of Education (MoE) in 2019-20.

With the onset of Education 4.0, the blended learning approach can be adopted wherein education becomes synchronous as well as asynchronous, online and/or offline. The use of online educational platforms (like Google Classroom, Microsoft Teams, Zoom, etc.) can be used alternatively with a brick-and-mortar method.

With the use of Education 4.0, a larger focus can be placed on the use of Information and Communication Technology (ICT) in order to improve Digital Literacy. There is a need for the larger public to learn and apply the use of Educational Technology (ET) in the education system. This can aid in promoting access to education by providing a means of education to those who otherwise may be facing shortcomings in terms of admittance to educational institutions. This can be done by promoting distance education/learning, which is on its way to becoming a widely used method of gaining knowledge. NEP 2020 is also focusing on portals such as DIKSHA, MOOCs, DIVYANG friendly educational software, National Education Technology Forum (NETF), etc. The NETF platform will allow the exchange of ideas regarding the use of technology for improving learning, assessments, planning, and administration; and seeks to develop e-content in as many as eight regional languages (Bengali, Gujarati, Kannada, Malayalam, Marathi, Oriya, Tamil, and Telugu; apart from Hindi and English).

Since Education 4.0 focuses on critical thinking, problem-solving and other 21st century skills, there is a greater focus on research-oriented and innovation-driven education. The NEP 2020, also mentions that any undergraduate course will include a Bachelor's degree along with a staunch focus on research. With this increased focus on research,

India can become a global entrepreneurship hub, expanding the possibility of our learners being given universal exposure and hence international employment opportunities as well. This can result in an individual that is a global citizen and hence, will be able to achieve a more holistic and refined society.

Negative Influence

Just as every coin has two sides, even this revolutionary Education 4.0 has shown some negative aspects in its implementation.

In India, a larger fraction of the population (833.1 million) [7] lives in rural areas, hence making access to technology highly insubstantial in nature. This can be because of the lack of awareness, lack of access, lack of infrastructure, lack of funds, etc. This will create a larger digital divide than what already exists in the country.

Ensuring that all levels of education in India have access to digital technology can prove to be a mammoth task. Even though the last three NEPs aim to provide 6% funding of the GDP (as yet achieving only 4.4%), ET or the requirements of even basic computational technology is an expensive ordeal. Most schools have non-functional basic hardware and software equipment that is not in tune with quality education or the number of students enrolled in a particular class, at any given time.

Even today, a large portion of teachers lack digital skills. In order to help them develop these skills, there will have to be multiple initiatives to provide training. It is also prudent to remember that those who are capable of conducting training workshops are also of a significantly lower number as

compared to those who need training. It will be a tedious task that will have to be undertaken by a collaboration between the Government of India as well as private organizations.

One of the main concerns of bringing technology and the internet into mainstream educational platforms is the risk of cybersecurity. According to the MoE 2015 data [8], approximately 26 crore population of students in India are enrolled in school. Exposing them to the increased use of technology can result in issues of cyber security and cybercrime. It is imperative to keep in mind that these learners are minors according to the government norms and hence they should be protected from cybercrimes.

Another point to be discussed is that each learner is different, and therefore expecting all learners to have each one of the numerous 21st-century skills, is almost close to impossible. Each student has their own competencies and abilities and therefore may excel or lack in certain areas of skills. Due to this, if it is mandatory for these skill sets to be procured, then this can make obtaining employment opportunities particularly problematic.

Insight

As schools play a major role in shaping a learner's ability to become a global citizen, the World Economic Forum created a white paper entitled "Schools of the Future: Defining New Models of Education for the Fourth Industrial Revolution" in January 2020 [9], in order to identify different educational institutions across the world which have innovative teaching methodologies, to provide futuristic models of learning. They created an online platform wherein suggestions (from different stakeholders), all around the world could be

provided regarding the futuristic developments and innovative designs of schools and from this, 16 schools were shortlisted.

These schools were identified based on 8 critical areas of teaching and learning as per Education 4.0, as given in Fig. 3.

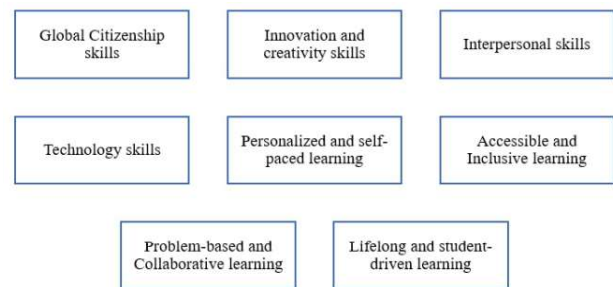


Fig. 3: Eight criteria of Innovative practices regarding Education 4.0

The 16 schools identified are as follows:

- Green School, Indonesia
- Kakuma Project, Kenya
- The Knowledge Society, Canada
- Kabakoo Academies Mali
- TEKY STEAM, Vietnam
- Accelerated Work Achievement and Readiness for Employment (AWARE), Indonesia
- iEARN, Spain
- South Tapiola High School, Finland
- Pratham's Hybrid Learning Programme, India
- Anji Play, China

- Prospect Charter Schools, USA
- Tallahassee Community College, USA
- Innova Schools, Peru
- British School Muscat, Oman
- Skills Builder Partnership, United Kingdom
- Skilling for Sustainable Tourism, Ecuador
- Partnerships: with local companies to learn real-world application skills, to provide summer internships and workplace-relevant workshops which must ensure employability; with Non-Governmental Organizations (NGOs) in order to disseminate skills
- Skills: development of communication skills with a focus on lower student-teacher ratio, disruptive innovation-driven entrepreneurship (Young Entrepreneurship Programme), cater to high quality learning with the use of tailored programming to teach technical skills along with a lifelong platform to track development skills

Some of the key features include:

Curriculum

- Sustainable Development Goals (SDGs): combines the 17 United Nations Sustainable Development Goals (UN-SDGs) with Science, Technology, Engineering, Arts, Mathematics (STEAM)
- Approaches to learning: Interdisciplinary, thematic, play-based, perspective-driven and student-driven
- Design: nature-based curriculum, multi-stakeholder approach to design and implementation, inclusive and diverse classrooms
- Technology: Innovation Hub, 3D Printing (3DP), programming, robotics, website design, multimedia communications and animation, AI, VR, etc.
- Techniques: small and large group learning, learning circles, international cultural exchanges via Skype (or other online collaborative platforms) with other classrooms around the world

Student development

- Creative thinking and Curiosity
- Collaboration and interpersonal skills
- Real-world application
- Greater resilience and higher self-esteem
- Lower levels of stress and distraction

Role of educator

- The role should be more of a guide or facilitator
- Receive training on pedagogy
- International teacher volunteers who train local teachers, using different Models such as Cascade, One-Shot, Multi-site, etc.
- Must refrain from teacher bias

Sustainable Development

- 40% reduction in their environmental footprint

- Market ready prototypes to solve local problems
- Digital Rail Project and BioBus initiatives
- Waste recycling infrastructure
- Promote the use of the iEARN collaboration platform
- Future Citizenship Program (to inform learners about global citizenship) and Young People Programme (to inform learners about civic duties)

Since these models have proven to be successful in the global market, it can be assumed that with its implementation in the Indian mainstream educational processes, the teaching-learning transaction will be in tune with Education 4.0.

Conclusion

As the world moves towards Education 4.0 and beyond, it is important to ensure that students are equipped with the tools and skills required to ensure employability in the future. Innovation, research, and development are to be of utmost importance to achieve the SDGs by the year 2030 as given by the UN. While keeping a futuristic outlook, it is also important to keep in mind the long-standing methods as suggested by some of the western as well as Indian philosophers. It was seen that philosophers such as Jiddu Krishnamurthi (who suggested eternal questioning), John Dewey (who believed in learning via doing), and even Mahatma Gandhi (who believed in Nai Talim), all worked for sustainable development in their lifetime, in one way or another. Though there is clear evidence that the Indian education system has progressed from

Education 1.0 to 4.0, there is no denying that there is a lag in the system at multiple levels, as many of our educational institutions still follow outdated and traditional methods that do not even, in the least, put the learner at the center of the teaching-learning process. Therefore, 100 % integration of Education 4.0 into our Indian education system will allow us to easily achieve the SDGs as well as achieve the global standards of this sector, which is what the NEP 2020 envisages for the nation as a whole. This can help India move from the status of a developing to a developed nation by transforming not only an individual but the society as a whole.

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