Educational value chain with industry 4.0 technologies

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ABSTRACT

The world is fast changing with immersive technology applications. In the next few years we will be seeing many new applications with Artificial Intelligence from big names, such as Google, Facebook, Amazon, Microsoft, Oracle and most recently Oracle with their cloud services. Fantasy has lured the educational environment to adopt augmented and virtual reality applications into the teaching and learning ecosystems. Today's technology has enabled us to work more effectively with learners in everyday, everyday settings and at school and helps us cultivate a collaborative learning environment, enabling us to develop and maintain the technology that the public wants, and that which can work on a community level. Springing up in the evolution, the pandemic has affected the quick implementation of digital technologies to be used for communication, sharing of data across the digital space, reaching unimaginably across all the nooks and corners of the world. In doing so, it has also allowed for the establishment of a world where the need for a single, decentralized 'platform' can be harnessed to promote social and economic growth and productivity. The content or data applications enhance the delivery capacity and understanding capability appropriately, to the specific process that is unique to the domain. The digital technologies available for our connected cities will accelerate the adoption and development of this emerging digital economy. There are more software and intelligence networked applications such as Simulations, and Big data which are systemic integrated through cloud computing, with appropriate cyber security, and comfortably assured with the 5G mobile telephony networks, propositioning accessibility, prompt delivery at and low cost and latency in connection. Thus, this industry 4.0 ages prompts to promote visualization, personalization, gamification and problem solving that are the essence in the changing pedagogy for a 24x7 erudite. The future is going to mean more growth and innovation. The past is no more over, but creates a vision which has in store something positive in the future, and hope of ever succeeding. This review paper covers the post-COVID changes involving a radical change in education across the world that impacted by Industry 4.0.

1. Introduction

Chronologically the evolution of industry happened during the year 1700–1800 when the invention of Steam engine happened, that which eventually let into the creation of Simple machines facilitating to ease the efforts of Physical or manual labor enabling the output of workers or artisans. This phase had Industrial Revolution was inadequate as it ignores the incentives of other actors in the economy to either accommodate or derail the industrialization process. New technologies when introduced wide scale has both potential for producers and factor those associated with in their best interests [1]. During the period 1800–1900, when Steel and Electricity came in, that enabled the Mass-production and Mass-transportation of goods and services. Later after the year 1950, when Computers came in the Automation of accounting and auditing practices took care of the office environment, while the manufacturing went to a precise mode using numerically controlled (NC) and Computer numerically controlled (CNC) machines. Technology intersects with trade and investment in affecting where and how production happens, where different types of jobs are being created, the extent of

productivity growth, and thus the extent of economic opportunities around the world. They need to be understood together when analyzing how the geography of production is likely to change in the future. The approaches differ in the extent of these changes, especially under a more stable trade climate, the extent and timing of which is also important for understanding the development of technological innovation. While approaches can have much in common, fundamentally changing the way that production flows to and from the production line, tending to be based around economic goals, that produces the needed output and stimulating growth [2]. Finally in the year 1983 when Tim Berners Lee invented the internet, its use started to percolate in industries through data communication connectivity accessible, anytime from anywhere. This led to the beginning of the industry 4.0, which is the enablement of the Cyber Physical System. Industry 4.0 is an economic maverick, uncluttering countless scenarios for commercial use. Right from resource maximization, enduring paybacks, yield, Return on investments (ROI) and Quality of Work life (QWL). Use of the knowledge content personalized with artificial intelligence improves the learning performance. Co-developing content that shall facilitate employable opportunities makes tutoring and learning agenda to sync and sets out the categories of capabilities required for students to flourish in their future. Digital transformation in education is the revolution affecting the infrastructure and digital readiness among the stake holders [3].

2. Industry 4.0 Skills

Emerging technologies and changing patterns of globalization are likely to affect both the feasibility and desirability of manufacturing-led development. For one thing, the bar is rising for a location to be an attractive production site. A high degree of sophistication can be achieved if you develop an automated technology to automate and process the work that needs to do its task as a customer. A significant percentage of the population, which historically has been primarily interested in retail, has now been turned off by the use of technology. Consequently there are not a large number of suppliers to begin with. The challenge in trying to change the industry landscape is, as the technology can only be done in large scale, to maintain an understanding of what happens once all the logistics and support work is done, to identify those types of suppliers and who will provide the support and the

technical support for a production process to work in tandem with the production process.

MASTER is the acronym for the industry 4.0 Competent Skills development. MASTER denotes - Machine skills, Academic excellence, Self-Management, Technological skills, Engagement Roles and Radiant [4].

- Machine Skills: Cyber physical systems architecture - Connection, Conversion, Cyber, Cognition and Configuration.
- Academic excellence: Knowledge: Basics, Applied, and Advanced.
- Analytical: Numerical, Logical, Graphs, Maps, and Charts.
- Execution: Plan, Articulate, Group Discussion, Creativity, Modelling, and Presentation.
- Self-Management – Attitudes, Perception and Motivation.
- Technology Skills: Simulation, Systems Integration (2S); Cloud computing, Cyber security (2C), Additive Manufacturing, Augmented / Virtual Reality (2A), Big data, IoTs, Robotic, Drones (BIRD)
- Engagement Roles: Operate (O), Maintain (M), Integrate (I), Leadership (L)
- Radiant – Recall, Relate and Refine

3. Pre-COVID preparation towards Industry 4.0

Pre-COVID was very boisterous, however the impacted segments of the economy post -COVID, with policies announced various by governments that amends the economic shock and places onward references for detailed segments. The risky condition that the economy was in before COVID is potentially worsened after the effect pandemic shock. In the pre-COVID the nominal values of investments were declining. The total outstanding speculation weakened, while new schemes announced also fell. The unemployment was varying and fell sharply reflecting relaxation during every lockdown restriction, significantly recovering the rate. Since then, the unemployment rate was stagnant across the world, higher than the pre-lockdown rate but significantly less than that recorded value during the peak of the lockdown [5].

4. Pedagogy Change

The context of teacher professionalism is divided into 4 main competencies, namely: professional competence, pedagogical competence,

social competence, and personal competence [6]. Fourth Industrial Revolution is related to be connected, pervasively proximate the world and its response to Covid-19. Pedagogies are being aligned with quality and changes in the nature of the student intake to formulate the future of Educational System. Considerations include students from 'non-traditional' sources adapting to existing university structures and how procedures might accommodate these students in addition to changes and disruptions resulting from Covid-19. Mobile devices allow Personal Learning Environments (PLEs) to be developed in accordance with individual students' needs [7]. Co-developing the tutoring and learning agenda sets out the categories of capabilities required for students to flourish and outline their future. Choose knowledge and skills that are worth learning. Set tasks above the base capability within achievable limits. Approach risks and stretch in learning. Encourage community of learners. Have sufficient options to pick interest areas, and model with a mentor. Online teaching is asynchronous or synchronous. Finally comprise the problem solving, Analytical, Critical, Creative (ACC) thinking, computing skills and Networking into the curriculum. Adoption of the innovative instructional approach employed in the process of teaching and learning is key to mitigate students achievement in innovative pedagogy adopted to make them become active learners in classroom subjected to pre-test and post-test [8].

5. Industry 4.0 education

Educational institutions have an edge with emerging technologies. They can facilitate right from planning, implementation, and adoption which provides easy access to the content by the people to share knowledge freely without any hazels. The pillars of Internet of Things (IOT) create a need for an education system that empowers to underpin, the societal impact of widespread adoption, and the right application of the information that is captured. Higher education programs must ensure that the next generation to understands how to design and build technological systems that reflect our altered expectations of openness and participation. The challenge is in developing new forms of scalable education that accommodate large numbers of students around the world, attract potential students with various interests, and deliver an innovative curriculum that reflects the radical changes in computing technology [9]. Technology is the main vehicle for development in the society for producing a setting filled with creativity and innovation for releasing the full potential of teachers and students cooperatively, by deploying knowledge, to the society with desirable behavior. By discovering relationships and focusing on the coordinates that are confronted with the idea which points in certain relationships having coordinates that fit a pattern. The highlights of the power of digital technology are that it provides instant feedback, which is hugely an important part of working creatively [10].

Novelty in education is with Augmented / Virtual reality (A/VR) gadgets. **Augment reality (AR)** is obtained through a wearable eyeglass or a transparent screen on which a computer-generated image is projected. When the image syncs with the line-of-sight information in the real world, then on the computer facilitates and guides more information. **Virtual Reality (VR)** is evolved for varied requirements**.** The reasons for virtual learning was initiated through the availability of technology as necessary but insufficient for effective remote learning; teachers were critical than ever; education involved intense human contact with effort; parents partnered with teachers; and influenced on a energetic ecosystem of alliance [11]. Virtual Reality is an immersive educational involvement reconstructs real life surroundings and simulates tasks giving the chance to gain on-the-job drill in a risk-free atmosphere. They learn by seeing what is being done in real workspace which when applied eventually leads to amplified efficiency.

6. Visualization

In a class room lecture, students listen and understand based on their level of perception, which normally gets distorted from reality. Hence Teachers can use examples to illuminate general principles and concepts, or emphasize the contributions of people from different groups to our collective knowledge and quality of life. Teachers thus need to develop repertoires of culturally diverse examples, the skills to use them fluidly and routinely in classroom instruction, and the confidence to do so. This ensures Quality education as part of the transition [12].

Visualization is a See-learn facilitation with displays, videos, animations, static representations or models, prototypes, laboratories, and online facilitations.

7. Personalization

This is a Self-learn technique, referring to training in which the leap of education and the didactic approach are enhanced. Learning purposes, instructional tactics, and learning content are based on needs that are personalized and available for meaningful, relevant to students, driven by their benefits and frequently self-initiated. Beyond classroom through cloud computing, mobile apps, Massive Open Online Courses (MOOC) and Social Media facilitations. There are various types such as Adaptive, Individualized, Differentiated and Competence-based learning [13].

8. Gamification

This is a fun-learn. Gamification generates a more engaging learning experience through focus on finding ways to use fun elements to create learning involvements that do not exist in traditional training. Gamification focuses on engagement with motivation, bring challenge and sense of accomplishment [14]. Activities expands creativity and innovation. This includes Puzzles, Riddles, Jig Saw, Quizzes, working circuits, and business simulations. Gamification solutions drive employee performance and behavioral change through recognition and rewards.

9. Problem solving

This is a do-learn form. The new tasks and problems which require a new set of skills are evolved essentially with skills for reasoning, problem solving and critical thinking. Problems and problem solving are contextual and discipline precise, but the idea and progression have all-encompassing mechanisms and likenesses across circumstances [15]. This includes On-the-job experience, performance, and prospective insights.

The evolutions of organizations are following digitalization as their foothold for development. Digital Manufacturing is still a nascent field of thought but more than that it is an active and growing sector. m Industry 4.0 stands for the fourth industrial revolution which is defined as a new level of organization and control over the entire value chain of the life cycle of products; it is geared towards increasingly individualized customer requirements. Industry 4.0 is still visionary but a realistic concept which includes Industrial internet of Things (IioT), Smart manufacturing and Cloud based Manufacturing. Industry 4.0 concerns the strict integration of human in the manufacturing process so as to have continuous improvement and

focus on value adding activities and avoiding wastes. The following fig. 1 - Organizational evolution, depicts the evolution of it management from Simple teams to Self-Managed teams and now on to the industry 4.0 structure. Thereby the levels of measure have progressed from productivity to efficiencies and now onwards to effectiveness of the resources being employed in the organizations. To achieve this the pedagogy change requires, See-learn, Self-Learn, Fun-Learn and Do-Learn to achieve the evolving organizational demands.

Fig. 1 – Organizational evolution

Source – [16], Industry 4.0 Pedagogy,
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10. Post-COVID initiated changes to Industry 4.0

We cannot return to the world as it was before as more efforts are required to reinforce education as a shared good; the right to education; e-teaching occupation and teacher relationship; affecting student, youth and children's involvement and privileges; social places provided by institutions; e-free (internet free) and open source technologies available to teachers and students; scientific literacy within the curriculum; global solidarity to end current levels of inequality; and financing of education. Thus, involving all stakeholders to monitor the resources used serve purpose of advancing the capabilities of teachers and students [17]. It is dubious that thrifts and cultures will return to pre-COVID outlines; the disaster has intensely confirmed the latency of digital skills and some fluctuations will inverse. Confronted with forthcoming trades, schooling, wellbeing, administrative services and even social connections are reliant on digital skills, deteriorating to guarantee

prevalent and dependable digital access and actual practice hazards ranges wide disparities, and delay efforts to occur tougher after the pandemic [18]. The extent to which the COVID crisis has compelled establishments to inquire into the traditional practices, evaluating readiness in surviving future disruptions and preparing the basis for future-proofing. The transformations are difficult to be predicted. Pandemic has already accelerated changes thus speeding up a shift from structured workspaces to remote engagements decreasing the demand for space and utilizing those available for mixed-use.

11. Emerging technology applications in Education

Lifelong learning includes, all the educational activities designed to upgrade occupational and professional skills, to assist business, public agencies, and other organizations in the use of innovation and research results, and to serve family needs and personal development [19]. AI applications through emerging technologies lead to exciting innovations in teaching and learning. This change entails to learn-unlearn and relearn the didactic process, by inquisitive probe to the instruction content appropriately preparing learners to the future. Then examine data on teacher experiences of what it means to be a teacher at this unusual school and of learning, unlearning, and relearning in professional development program. Later explore the role of professional communities of practice in the process of learning, unlearning, and relearning [20]. Virtual mode of teaching and learning is the new normal for the educational community squeezed out by COVID-19. Use of the knowledge content processed with artificial intelligence shall improve performance in employable opportunities. Education has changed dramatically, with the distinctive rise of e-learning, whereby teaching is undertaken remotely and on digital platforms [21].

12. Social Development

During the COVID-19 pandemic, the e-learning infrastructure got a good impetus by default. Thus, the outlay to education is offering a considerably greater rate of return, and loosens the stress for economic upliftment by accentuation of education in the Millennium Development Goals. When Parents, Students and Teachers build a strong positive association through clarity of communications with the institution's, and build parent's confidence, then

their children would achieve their learning goals [22]. This offers a moral, fairness and tenable engagement to an extensive range of harmonizing perspectives to the students through multidisciplinary teams in coaching and erudition with methodical precision. People interconnected world, gets redefined roles, with technology and future skills thereby unlocking emerging technology applications for education. Common scales for evaluation using ttechnology-enabled assessments support learning and teaching by communicating evidence of learning progress and providing insights to teachers; administrators; families; and, most importantly, the learners themselves. These assessments can be embedded within digital learning activities to reduce interruptions to learning time [23].

13. Conclusion

The future of industries is continuously evolving towards industry 4.0 and necessitates the importance of skills and quality as the important parameter for providing cutting edge deliverables to industries. Opportunities to education in post pandemic period have influenced educators internationally to obligate with changes that are affecting the education of the future generations. This entails to learn-unlearn and relearn, by inquisitive probe to the instruction content. During the pandemic, the e-learning infrastructure got a good impetus by default offering a greater rate of return on technology investments to edge with planning, implementation, and adoption to share knowledge freely without any hazels. Technology development provides the society with creativity and innovation for releasing the full potential of teachers and students cooperatively. Delivering a Quality education by deploying knowledge, with desirable social behavior transitions the information economy, with profound systems and strategies for a nation's development. Thus Institutional capacities are tuned with the resources availability, with participation and inclusion of marginalized and excluded communities, to also align with the driving joints of the economy. Interconnecting people with redefined roles, technology and future equipped skills unlock the community squeezed out by the COVID-19.

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