

TECHNOLOGY INTEGRATION IN EDUCATION 4.0 AND BEYOND TO ALIGN WITH INDUSTRY 4.0

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Abstract—The objective of Education 4.0 is to generate the digital workforce to meet the expectations of Industry 4.0. Higher education sectors initiated and implemented various innovative teaching learning practices to prepare their students to achieve the greater height of Industry 4.0. Education 4.0 is a paradigm shift. The outcome of this process results in technologically advanced and globally competent citizens who can actively contribute towards the sustainable growth and development of country in the voyage of Industry 4.0. This paper discusses various initiatives taken by higher education institution (HEI) at large. It also highlights the integration of technology in teaching learning process in order to develop the abilities of scientific thinking, spontaneous problem solving and rational decision making among the students. The framework of education 4.0 gives importance to the 6 levels of Bloom's Taxonomy such as, - Knowledge, Comprehension, Application, Analysis, Synthesis and evaluation. In addition to this HEIs have also included blended learning in their digital infrastructure to become more productive in the journey of Industry 4.0 and to cater to the need of Industry 4.0. At the end the paper derives research gaps in different areas.

Keywords: Education 4.0, Industry 4.0, Blended Learning, Digital Infrastructure, Bloom's Taxonomy

1 INTRODUCTION

Industry 4.0 opens a new technological era which brings revolutionary transformation in functioning of the industries. It mainly aims at developing and deploying cyber physical systems. These systems are meant for conducting entire work process such as regulation, monitoring and managing the processes by computer programs and algorithms. To implement this process rapidly and widely, the industry needs the skilled digital workforce who can test and design appropriate programs and algorithms in order to fulfil the demand of Industry 4.0. The major contributor in this paradigm shift is the education sector. Higher education sector plays an important role in creating such highly demanded digital workforce by restructuring the present teaching-learning process. Education 4.0 can be thought as a design approach to align with Industry

4.0. In the process of implementing Industry 4.0, it is observed and analysed that to cope up with the current industrial revolution, it requires higher education institutions to rethink and redesign the traditional way of functioning. At first it demands, reframing the syllabi as well as restructuring the curriculum delivery. Nonetheless, the higher education institution also needs to strengthen their digital infrastructure to provide equal access and opportunities at any time to the learners. Along with this, in order to increase the learning potential, the higher education institutions must emphasize on synchronous as well as asynchronous mode of teaching learning practices. In this regard it is worth to mention, Blended learning also provides an effective and efficient way of content presentation to the learners. It also leverages learning in diverse platform. To achieve the greater height of education 4.0, every higher education institution must be equipped with excellent digital infrastructure. Digital Infrastructure not only specifies high speed internet connection and stable network but also includes technical efficiency, content creation and deliberation, innovative pedagogical intervention. Every higher education institution must foster in achieving excellence in providing digital literacy.

2 TECHNOLOGY INTEGRATION

Technology integration is the key to success in implementing education 4.0. Considering student engagement as well as student active participation the following activities are implemented to bring a paradigm shift in effective teaching-learning process. As a result it is found that, these mechanisms are proved to develop scientific thinking and problem solving skills among the students at various levels. Now days, student learning levels are enhanced by integrating technology in education in following ways.

2.1 Inclusion of Disruptive Technologies –

Disruptive technologies include Artificial Intelligence (AI), Machine Learning (ML), Deep Learning, Internet of Things (IoT), smart devices, smart interconnections etc. Education 4.0 can include various AI driven methods in implementing regular curriculum. It needs new skills with flexible new learning to transform

the learner from a novice to be industry ready.[1]

2.2 Integrating Challenge Based Learning via project- It is based upon 3 things- Engage, Investigate and Act. It provides an innovative way for learning by attaining and solving a real life problem. This can be treated as project based learning. The outcome of this learning could be innovation. Exploring a new idea, new app, new business model etc. If the students are given opportunities to learn via challenge based learning they will be able to recognize day to day real life problems and come out with a solution to support Industry 4.0.

2.3 BYOD Technology (Bring Your Own Device)- To make education available to all levels of learners, the BYOD technology is to be used. It makes learning flexible as well as accessible. Learners can easily and comfortably access the learning materials using his/her own devices. Every institution must be flexible enough to allow their students to use BYOD in order to increase productivity, satisfaction and efficiency.

2.4 Introducing Self-Paced Learning (MOOCs-Massive Open Online Courses) - The advancement of technology provides various supplementary and alternative ways for knowledge enhancement. One of them is self-paced learning [2]. A slow as well as a fast learner can benefit from this. A learner can opt for any course of his/her choice to get an idea about any advanced topics. To achieve this higher education institutions are tied up with many premier institutions through common platform. For example, SWYAM-NPTEL. In this platform a higher education institution can easily get connected with premier institutions like IITs, IIMs, and AICTE etc. Other than SWYAM platform if the learner wishes to get a MOOC certification from foreign universities that are also possible through platforms like EDX, Course era etc.

2.5 Incorporating Collaborative Learning through academic activities- Learners are divided into different teams and asked to propose an alternative/new solution for a given problem. The best example for this is Hackathon. It's an event where programmers are divided into various teams are asked to collaborate with each other to provide a better solution for a problem. This type of learning helps learners to work in diverse platform.[3] It encourages innovation and inspires the learner to understand the problem deeply and propose a better alternative for the existing solution. Higher education institution encourages

collaborative learning to encourage creativity and innovation among students.

2.6 Integrating Virtual Lab- It is observed that some instruments are very expensive to be offered by any specific Higher education institution. With the present day internet facility and computer technologies well equipped labs which are located remotely can be easily accessed by learners. These labs are known as Virtual Labs. One of the examples here is Virtual Lab facility offered by Bombay IIT. Learners can use this lab remotely and get the result of the experiment via computer interface. Under such framework, multiple initiatives can be carried out.[4]

2.7 Gamification- Employing technology in developing games for learning environment increases the learner performance. The introduction of leader design board proved to be more effective in team based learning in comparison to individual learning.[5]

2.8 Moodle- This helps in organizing things in a better way. In Moodle platform not only the instructor gives the feedback or guidelines but also the peer group shares their views and ideas. So the learner develops a better collaborative skills and finds to be engaged throughout the activity.[6]

2.9 Reverse Engineering - The focus of reverse engineering is to design and develop a teaching module, which combines the features of a product teardown with the integration of new products. This combined approach gives new information to the learning environment [7]. This new information can serve as a source for further development in teaching-learning process aligned with industry 4.0.

2.10 3D Printing – 3D printing gives 3 dimensional view of an object. The industry 4.0 is aiming at incorporating this technology in production for its less time consumption nature.[8] 3D printing enables to produce complex designs and graphics using less materials compared to traditional printing methods. 3D printing does not need tooling and very faster in designing geometric shapes and figures. 3D printing is very much useful for problem solving, design and creative coding. In order to deploy this technology in the sustainable growth of industries skilled professional is required.

3 OPPORTUNITIES IN EDUCATION 4.0

Education 4.0 offers a wide variety of opportunities to the learners as well as to the teachers. The below mentioned features are highlighted at the learners end.

- **Time Management** – It is observed that technology integration in education 4.0 systems have made content presentation and content delivery much easier. Result of it, lots of time can be saved in comparison to traditional classroom management system. More responsibility with learner.
- **Learning environment-** Traditional classroom setup can be designed to have both spaces for individual learning as well as collaborative learning. Technology integration with the advent of augmented reality, virtual reality can make the teaching learning process more innovative. Gamification also played an important role in creating lively classroom environment for learners. [9][11]
- **Assessment Method-** While in learning process the learners get certified and also acquires knowledge after completion of submitting assessment or project.
- **Collaborative learning-** In education 4.0 students get chance to work on project or experiment in a collaborative way. The learners become part of various communities. They share their experiences among peers and learn effectively.
- **Time to explore new things-**The lots of opportunities lie with students to utilize their time in exploring new things and new concepts towards innovation.
The features highlighted down are from the instructor's point of view.
- **Teacher becomes facilitator-** Most of the technologies integrated in education 4.0 are leaner engagement techniques. So the teacher's responsibility is to be the instructor and facilitator for the activity.
- **Creative approach in content development-** Teacher needs to integrate more technologies in developing content and managing the same, by keeping the student engagement level high.
- **Attractive content creation-**Teachers need to create interactive content and prepare videos to maintain learners interest level consistent and engaged.

4 CHALLENGES IN EDUCATION 4.0

Education 4.0 redefines the nature of work by reskilling workforce and reshaping workplace [10]. So it may be challenging in many other ways like social, economic, psychological and environmental.

- **Social Challenge** – The new paradigm shift demands to work on cross functional and virtual platform. Sometimes, adopting technology for the right thing in a right way becomes a challenging job. Digital proficiency becomes a big question mark there.[12] The

learners need to have the skills and abilities to adapt in the social change from agricultural society to the smart industrial society.[13]

- **Economic Challenge-**Digitization definitely makes our work easier. At the same time, it also demands for skilled professionals to work on it. The economic challenge arrives in terms of requirement of new skills, trained professionals. On the other hand automation replaces human workforce in person.[9]CPS Cyber Physical Systems enables optimisation of product development and collects all information required for production based on Internet of Things (IoT).[14]
- **Psychological Challenge-**The VARK model(Visual, Auditory, Respiratory, Kinesthetic) explores evaluates the effectiveness of new teaching strategies to embrace changes and reduce a potential threat of technological unemployment.[15]
- **Environmental Challenge-**Education 4.0 need to address some environmental challenges such as global climate change, ecosystem degradation and the depletion of natural resources[9]. Socio-ecology skills need to be developed among educationists to protect the planet.

5 RESEARCH GAP

The researcher finds the following gaps.

RG1: How does the learner communicate effectively in a cross functional virtual platform for effective understanding?

RG2: What are the strategies to follow to produce skilled professional to cope up with automation in Industry 4.0?

RG3: Automation replaces human workforce in place. So, how to deal with unemployment in future?

RG4: Technologies depletes natural resources. How to deploy the technology by protecting environment and providing sustainable growth towards innovation and creativity in Industry 4.0?

6 CONCLUSION

Education 4.0 design approach will definitely meet the requirements of Industry 4.0. Educationists and Academicians at various levels reframed and redesigned the education management process to achieve the greater height of Industry 4.0. In order for it to attain these goals, higher education must possess some fundamental attributes such as faculty and students engagement with local communities and with real world problems ensuring collaborative, inclusive, and cross-disciplinary ways. Instead of solely rote learning, colleges and

universities must encourage active learners to develop the abilities of independent, logical, and scientific thinking, creativity and problem solving, and decision making. It must engage young people in national issues to generate human capacity to build new knowledge and foster innovation. The structure, curriculum, and processes of higher education must all work together coherently towards attaining all of these characteristics in order to deliver these goals. The paper highlighted various opportunities as well as challenges in the journey of education 4.0. With the deep understanding of technology integration, new horizons can be explored to address various issues pertaining to education 4.0. Technology integration definitely made the work process easier but at the same time digital proficiency and digital literacy left a thought in mind of every individual involved in the process.

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