

Role of Education 4.0 in preparing future fit talent for Industry 4.0

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I. INTRODUCTION

Globally, many countries are on the threshold of entering the Fourth Industrial Revolution, also referred to as Industry 4.0, in which technological advances enable significant changes in industry. The term was originally coined by Kagermann in 2011. Industry 4.0 apart from increase resource and time efficiency will also change the way people work. If Industry 4.0 sets the benchmark in production, it is not for only a select few people to have the expertise to work in such an environment, but a better understanding of the skills required to work and implement it are necessary to democratize the knowledge among the future workforce. The underlying idea in this work is for people to learn to work with, and complement, the new technology with the most important thing: the human skills that cannot be replaced.

In the changing era of technological advancement, every organisation is resorting to automation, wireless transactions, virtual transformation and fostering themselves to be called as a smart company. Starting from executing the idea and till the stage of receiving reviews about their product and services, organizations are enjoying the digital space. Every industrial revolution is changing the world around us.

In this context, there is limited understanding regarding the skills needed to work in Industry 4.0. Earlier research on professional skills related to Industry 4.0 has been more oriented towards personality profiles for recruitment purposes rather than skills that can be developed in education. This paper, on the other hand, focuses on the required skills that can be effectively developed by B-schools.

Higher education in the fourth industrial revolution is a complex, dialectical and exciting opportunity which can potentially transform society for the better. The main purpose of higher education across the world is to provide their students with the knowledge and skills required to function in this complex world of changing business dynamics. The fourth industrial revolution is powered by artificial

intelligence and it will transform the workplace from tasks based characteristics to the human centred characteristics. Because of the convergence of man and machine, it will reduce the subject distance between humanities and social science as well as science and technology. This will necessarily require much more interdisciplinary teaching, research and innovation. The future organisational capabilities need to be crafted for this new world. Without increasing our insight into the future, the talent we develop and attract will not meet the future organisational needs. We need to think of talent in the context of whether it is “future-fit”.

To take full advantage of the opportunity created by advanced technology we need a similar revolution in education – not just to meet the needs of industry, but also to ensure the best possible student experience, use of staff time and investment in infrastructure and facilities.

Research gap

Today, all graduates face a world transformed by technology, in which the Internet, cloud computing, and social media create different opportunities and challenges for formal education systems. These technologies powered by artificial intelligence, Cloud computing, big data, social media, data analytics are so much transforming and defining the workplace at present. This period requires certain skills that are not exactly the same as the skills that were required in the third industrial revolution where information technology was the key driver. These skills are critical thinking, problem solving, communication skills, people management, managing virtual teams, emotional intelligence, judgement, negotiation, cognitive flexibility, data science as well as knowledge of production and management.

To address this skill gap education 4.0 is the panacea. Since Education 4.0 denotes changes, relevant to Industry 4.0, the Industry can expect better-prepared workforce, students will have better employability and better preparation for future with

a higher return expectation on educational investment. To meet the industry requirements from this transition and for an organisations to succeed with the right talent and capabilities, the youth have to be prepared by higher quality education to make them most productive; hence, the system needs to be transformed. The pedagogical tools play a crucial role in addressing the learning needs and expectation of Generation Z which is inclined towards being entrepreneurial, financially focused, staying connected, prefer to work independently,

craves for human interaction and readily embraces change. To meet these expectations it becomes imperative for the B-schools to integrate the innovative pedagogical tools.

21st century skills:

The 21st century skills are a set of abilities that students need to develop in order to succeed in the era of industry 4.0. These skills have been categorised into 3 types, which are as follows:

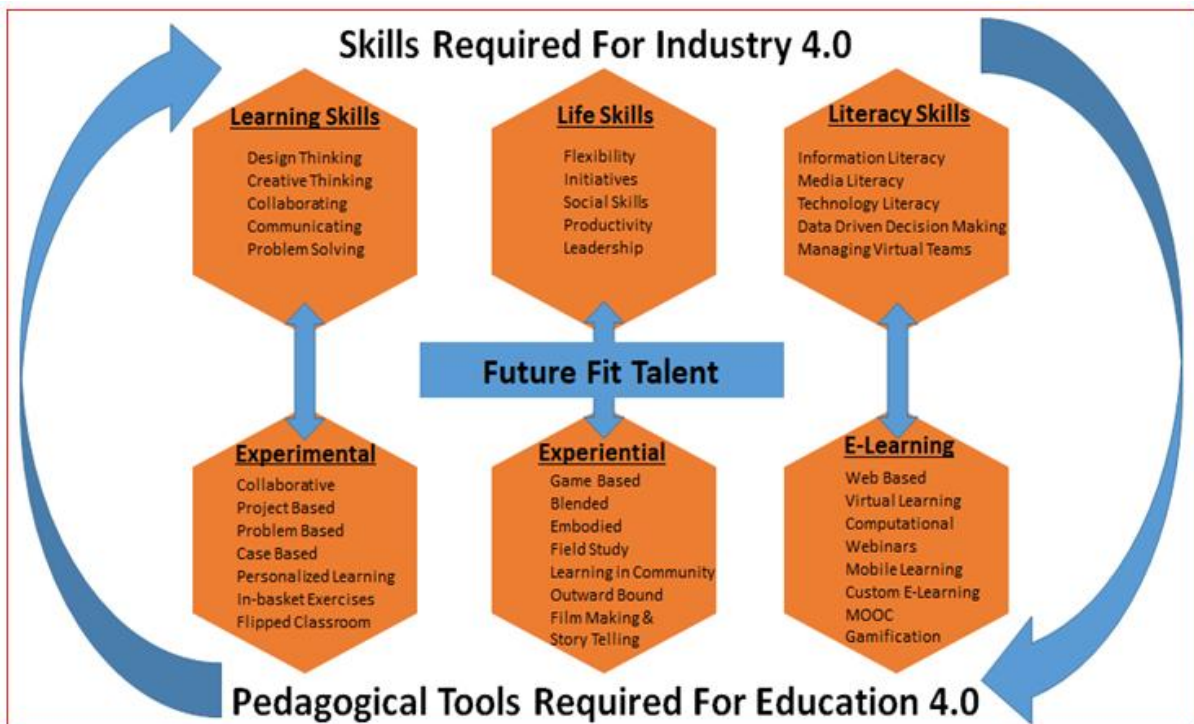
Learning skills	Literacy skills	Life skills
<ul style="list-style-type: none"> • Design thinking • Creative thinking • Collaborating • Communicating • Problem solving 	<ul style="list-style-type: none"> • Information literacy • Media literacy • Technology literacy • Data driven decision making • Managing virtual teams 	<ul style="list-style-type: none"> • Flexibility • Initiative • Social skills • Productivity • Leadership

Future of learning

Accelerating technology change is affecting every part of our society – from the way we communicate and collaborate, to the work we do,

the skills we need, and the way we learn those skills. Learning is the key – for employees adapting to new ways of working, and to educators preparing students for an uncertain future.

To facilitate these skills, the following framework explains the various pedagogical tools to be adopted by B-schools:



The framework explained:

1. Experimental method/Pedagogical tool to acquire learning skills

i. Collaborative Learning:

According to Gerlach, "Collaborative learning is based on the idea that learning is a naturally social act in which the participants talk among themselves (Gerlach, 1994). It is through the talk that learning occurs."

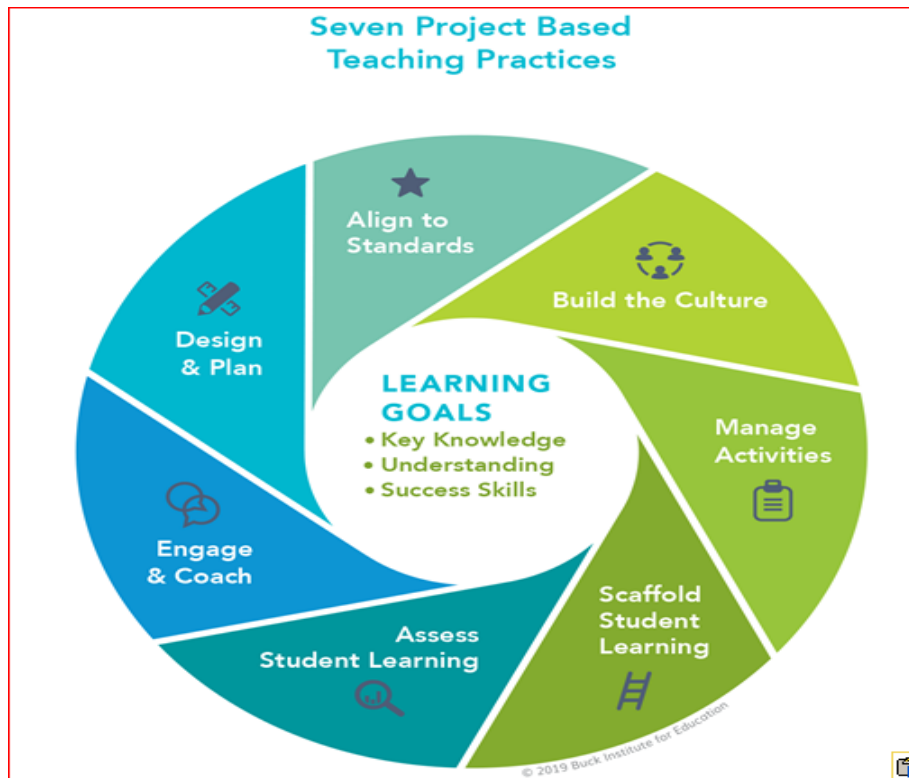
In the collaborative learning environment, the learners are challenged both socially and emotionally as they listen to different perspectives, and are required to articulate and defend their ideas. In so doing, the learners begin to create their own unique conceptual frameworks and not rely solely on an expert's or a text's framework. Thus, in a collaborative learning setting, learners have the opportunity to converse with peers, present and defend ideas, exchange diverse beliefs, question other conceptual frameworks, and be actively engaged.

Collaborative learning processes can be incorporated into a typical 60-minute class in a variety of ways. Some require a thorough preparation, such as a long-term project, while others require less preparation, such as posing a question during lecture and asking students to discuss their ideas with their neighbors. As Smith

and MacGregor state, "In collaborative classrooms, the lecturing/listening/note-taking process may not disappear entirely, but it lives alongside other processes that are based in students' discussion and active work with the course material"

ii. Project based learning

Project Based Learning (PBL) is a method in which students learn by actively engaging in real-world and personally meaningful projects. Students work on a project over an extended period of time – from a week up to a semester – that engages them in solving a real-world problem or answering a complex question. They demonstrate their knowledge and skills by creating a public product or presentation for a real audience. As a result, students develop deep content knowledge as well as critical thinking, collaboration, creativity, and communication skills. Project Based Learning unleashes a contagious, creative energy among students and teachers. In Project Based Learning, the project is the vehicle for teaching the important knowledge and skills student need to learn. To answer a Driving Question and create high-quality work, students need to do much more than remember information. They need to use higher-order thinking skills and learn to work as a team.



iii. Problem based learning:

Problem based learning (PBL) is an approach where students learn by solving challenging, open-ended problems. The problems are authentic tasks and are solved in socially and contextually based teams of students. The students rely on their current knowledge of the problem, identify “information they need to know to solve the problem, and the strategies they use to solve the problem” (Stanford University Newsletter on Teaching, 2001).

Students work in collaborative groups to identify what they need to learn in order to solve a problem. They engage in self-directed learning (SDL) and then apply their new knowledge to the

problem and reflect on what they learned and the effectiveness of the strategies employed. The teacher acts to facilitate the learning process rather than to provide knowledge. The goals of PBL include helping students develop 1) flexible knowledge, 2) effective problem-solving skills, 3) SDL skills, 4) effective collaboration skills, and 5) intrinsic motivation.

In problem-based learning, the problem is presented first after which students work in small teams to solve the problem. The following figure represents the problem-based learning process showing how each of the steps inter-connect and relate to one another and are iterative (steps can, and often should be, revisited).



iv. Case based learning:

Case-based learning (CBL) is an established approach used across disciplines where students apply their knowledge to real-world scenarios, promoting higher levels of cognition. In CBL classrooms, students typically work in groups on case studies, stories involving one or more characters and/or scenarios. The cases present a disciplinary problem or problems for which students devise solutions under the guidance of the instructor. CBL has a strong history of successful implementation in medical, law, and business schools (Herreid, 1994). This method involves guided inquiry and is grounded in constructivism whereby students form new meanings by

interacting with their knowledge and the environment (Lee, 2012).

Research has shown that case-based learning has been very successful at providing a context for abstract material. Cases also provide an ‘experience’ for students that can be transformed into learning through reflection or experimentation.

Case-based learning has been linked with the effective development of critical thinking, problem solving, clinical reasoning and analysis, which in turn are characteristics of a deep approach to learning. It also can be used to facilitate a model of self-directed and reflective learning that serves students very well in future courses and careers. (Dunne and Brooks, 2004).

v. Personalised learning:

Personalisation, which became one of the key concepts in current education, reacts to the fact that students come to school with different knowledge and skill bases as well as varying learning preferences, interests, and aptitudes. Personalised learning presupposes high quality teaching that is adaptive to the different ways students achieve their knowledge and skills. Therefore, the teaching courses, curricula, and school organisations have to be designed in a way to reach as many students as possible with diverse needs and experiences for as much of the time as possible. Personalised courses actively engage the learners by providing teaching strategies and materials that appeal to the learners' knowledge and preferences etc. An educational system that responds to individual needs by creating a personal learning path enables individual students to experience excellence in his or her learning. Among the various benefits of a personalised learning environment that are mentioned is the fact that the time taken to learn is reduced, and that the learner's retention is improved.

vi. In basket exercise:

An in-basket exercise assesses a student's ability to perform a manager's job from an administrative perspective. In the exercise, the student is confronted with issues and problems that have accumulated in the manager's "in-basket" after returning to work from an extended absence. A sample of in-basket items might include memos, correspondence, e-mails, directives, requests, reports, forms, messages, minutes, hand-written notes, etc., from management, supervisors, staff members, inmates, and other stakeholders. The student's task is to review the in-basket items and then take action on these varied issues and problems using action forms to record notes, comments, and responses. These actions are then assessed and rated based on job related competencies through a formal question and answer session by a group of trained raters. Standardized criteria and predefined rating scales are used to assess the student. This exercise is used to facilitate the students to understand the importance of prioritization.

The in-basket exercise is designed to test the student's adaptive thinking, problem analysis, judgment, administrative abilities, planning, organizing, delegating, and integrative skills while under pressure dealing with memos, e-mails, requests, messages, handwritten notes, etc.

vii. Flipped classroom:

Flipped learning is a pedagogical approach in which the conventional notion of classroom-based learning is inverted, so that students are introduced to the learning material before class, with classroom time then being used to reinforce understanding through discussion with peers and problem-solving activities facilitated by teachers.

By providing students with the material to gain a basic level of knowledge and understanding before class, classroom time can be used to deepen learning and develop higher-level cognitive skills. One of the core objectives of flipped learning is to move students away from passive learning and towards active learning where students engage in collaborative activity, peer learning and problem-based learning. Within this context, the role of the teacher shifts towards that of facilitator and coach by empowering students to take control of their own learning. The use of technology further enriches the flipped learning process and promotes skills that are essential for 21st-century learning.

2. Experiential method/Pedagogical tool for acquiring life skills

i. Game based learning:

Game-based learning uses games, whether virtual or physical, and game-like simulations/role playing to create learning experiences that can engage students and effectively teach classroom content. Game-based learning can take multiple forms depending on the needs of the classroom. These may include such formats as: board games, card games, word games, video games, simulations, role-playing games, puzzles etc.

Game based learning can be used to 1) reinforce concepts learned in class, 2) to create greater engagement with course material, and 3) to provide multiple methods of approaching course material. James Paul Gee has long been the standard bearer for identifying the usefulness of games for producing effective learning experiences (Gee, 2005).

ii. Blended learning:

Blended learning is a combination of offline (face-to-face, traditional learning) and online learning in a way that the one compliments the other. It provides individuals with the opportunity to enjoy the best of both worlds. For example, a student might attend classes in a real-world classroom setting and then supplement the lesson plan by completing online multimedia coursework. As such, the student would only have to physically attend class once a week and would be free to go at their own pace (and without

worrying about scheduling issues). Blended learning is often also referred to as “hybrid” learning, and can take on a variety of forms in online education environments.

In the process of implementing blended learning in classroom, the educator needs to know the approaches for blended learning so that selection can be made in order to suit the needs of learners and also the educators. According to Valiathan (2002), there are three approaches of blended learning which are skill-driven learning, attitude-driven learning and competency-driven learning.

iii. Embodied learning

Embodied Learning constitutes a contemporary pedagogical theory of learning, which emphasizes the use of the body in the educational practice and the student-teacher interaction both inside and outside the classroom and in digital environments as well. Using the body is essential in concept representation and communication while this is also confirmed by the emphasis other fields and cognitive objects place on the body as a learning tool, such as dance theatre, kinesiology, athletics even Mathematics and Physics. All these cognitive objects have student collaboration, movement and the process of cognitive development as a common denominator.

In Embodied Learning, new knowledge is affected by the conditions it is used and by the types of activities the student is expected to participate in. Consequently, the following parameters should be taken into consideration when designing an activity: a) cognitive involvement to the topic, cognitive processes, representation of a scientific notion b) body movements c) expression of the student’s feelings d) clarity of instructions e) holistic design of activities f) student cooperation g) ability of students to apply acquired knowledge to new environments

iv. Field study:

A field study is a general method for collecting data about users, user needs, and product requirements that involves observation and interviewing. Within a broad notion of “the field”, teachers using field- based methods work towards many different educational aims, some implicit and others explicit. Particular aims are examined, and some types of field activity are seen to be better for achieving certain aims than others. Facilitators should set clear learning objectives and carefully plan and select the experiences they intend students to have, taking into account educational aims, time

available, distance, student readiness, and availability of localities and resources. Thorough briefing and debriefing are important in maximising field learning.

v. Learning in Community

Community based learning, often referred by the acronym CBL, is learning that incorporates the community and immediate environment into the teaching approach. It can be done in many different ways, but the overall goal is to integrate community into academic learning.

The motivation for such an approach in education comes from the belief that all communities have innate values that can enrich learning experiences. Within the immediate environment, there are resources and assets that can be used to provide real-life, hands-on experience for students that cement learning objectives as real and important skills.

Community-based learning can be found at all levels of education. It is important to engage students early so that they can develop relationships that enhance their overall learning experiences, and it is important to engage students as they get older because it keeps them motivated when they can see a role for themselves in the greater social context. Because community-based learning can be done at any level, teachers can easily incorporate strategies into any curriculum.

vi. Outward bound learning

An Outward Bound Learning experience (OBL) is designed as an educational experience based on the principle that the individual develops self-confidence and leadership, concern for others and self-awareness when confronted with challenging experiences involving adventure, based in the outdoors. The OBL seeks to help participants experience that they possess the necessary internal resources to achieve whatever they truly desire; that despite differences in backgrounds, humans are more alike than different, and can live and work together; that it is a part of human nature to be helpful and to collaborate. Outward bound experiences leave a deep impact on participants as they begin to identify and work with their strengths; the influence of being in nature has been proven to add to the overall sense of fulfilment.

vii. Film making and story telling

The “Video Production” explores the creative and logistical challenges of producing and filming an ultra-low budget short film. Students can expect to complete a short movie, a commercial, a mini documentary, and/or a music

video, while learning basic lighting, editing, field sound recording, and postproduction techniques. Occasionally however, we identify a single project that not only encompasses the course objectives, but also offers a significant challenge for everyone involved.

Learning through storytelling refers to a process in which learning is structured around a narrative or story as a means of 'sense making'. It involves the use of personal story and anecdotes to engage learners and share knowledge. Stories are everywhere in human life and can be termed narrative, case study, life history, myth, anecdote, legend, scenario, illustration or example, storytelling and/or critical incident. 'Stories' can be 'told' in many ways – spoken, written, filmed, mimed, acted, presented as cartoons and/or as new media formats (Moon 2010).

3. E-learning method/Pedagogical tool for acquiring literacy skills

i. Web based learning:

Web based learning is often called online learning or elearning because it includes online course content. Discussion forums via email, videoconferencing, and live lectures (video streaming) are all possible through the web. Web based courses may also provide static pages such as printed course materials. One of the values of using the web to access course materials is that web pages may contain hyperlinks to other parts of the web, thus enabling access to a vast amount of web based information.

Web-based teaching materials are a subset of computer-based training (CBT) or electronic learning (eLearning) used to leverage the World Wide Web for the delivery to instructional materials. Several teachers and institutions provide access to Web-based teaching materials through links on Web pages.

Web teaching is all about making connections: connecting your students to one another and to resources around the world; combining different materials – music, motion, text, narration – into one presentation; collecting related information from multiple sources... enable students to make their own connections by offering materials for download and use in their scholarship or by having them construct web documents as part of their coursework. And this process of making meaningful connections is at the core of all learning.

ii. Virtual learning:

Virtual learning is a learning experience that is enhanced through utilizing computers and/or

the internet both outside and inside the facilities of the educational organization. The instruction most commonly takes place in an online environment. The teaching activities are carried out online whereby the teacher and learners are physically separated (in terms of place, time, or both). It can overcome many drawbacks of the physical environment such as time, facilities, location, etc. Online environments allow teachers to work with larger numbers of students and optimize their routine tasks. Virtual learning also brings new pedagogical techniques into the traditional forms of education and makes learning more personalized and convenient.

iii. Computational learning

The need to prepare students for the future of work is now imperative. To address essential 21st-century skills in our nation, educators are turning toward a new framework for problem-solving: computational thinking. Computational thinking enables us to solve any given challenge through an analytical and methodical approach. Put simply, computational thinking teaches students to process information like a computer would. It guides students through a series of steps, similar to an algorithm, to solve open-ended problems. While computation governs the world around us, computational thinking as a teaching and learning framework is a new concept for many educators.

iv. Webinars

Digital learning environments are increasingly popular in higher education and professional training. Teaching and learning via webinars, and web conferencing more broadly, represents one widely used approach. Webinars are defined as web-based seminars, in which participants and facilitators communicate live over the Internet across distant geographical locations using shared virtual platforms and interact ubiquitously and synchronously in real time via voice over IP technology and web camera equipment.

v. Mobile learning

Mobile device ownership has exploded with the majority of adults owning more than one mobile device. The largest demographic of mobile device users are 18–29 years old which is also the typical age of college attendees. This systematic review provides the scholarly community with a current synthesis of mobile learning research across 2010–2016 in higher education settings regarding the purposes, outcomes, methodologies,

subject matter domains, educational level, educational context, device types and geographical distribution of studies. Major findings include that the majority of the studies focused on the impact of mobile learning on student achievement. Language instruction was the most often researched subject matter domain. The findings reveal that 74% involved undergraduate students and 54% took place in a formal educational context. Higher education faculty are encouraged to consider the opportunity to expand their learning possibilities beyond the classroom with mobile learning.

vi. Custom e-learning

Custom eLearning means providing a customized solution for learner specific problems. Several business giants vouch for and invest in providing a custom eLearning experience for their clients and employees. The target audience of eLearning courses includes busy learners such as students or corporate employees. When developing an eLearning course, it is important to know the learners and their level of knowledge-grasping capacity. Engaging a learner and making a course interesting for them can be a challenging task. When we create a course, two major factors should be considered—good content and visual design—which, when combined give us the desired Learner Experience.

vii. MOOC

Massive Open Online Courses(MOOCs) have been at a furious pace. MOOCs are new type of e-learning class, which are consisted of short video lectures, computer-graded tests, and online discussion forums. MOOCs have been positioned as hybrids of previous attempts at online distance education opportunities, such as Open Course Wares (OCWs) and Open Educational Resources (OERs). However, in spite of widespread adoption, the instructional quality and business model of MOOCs are still under the question. Need of adequate instruction and business strategies for utilizing and operating MOOCs in higher education has been highly required.

The rise of MOOCs, and the general shift towards informal learning in digital spaces, has prompted HEIs to think about their long-term teaching and learning strategies. As a result of this increased digital awareness, organisations are beginning to implement digital strategies that include the development of digital literacies and bring your own device (BYOD) approaches (Universities UK 2013). MOOCs also provide HEIs with the opportunity to reach new audiences,

widen participation, raise their profile and expand digitally into new markets.

viii. Gamification

While gamification is gaining ground in business, marketing, corporate management, and wellness initiatives, its application in education is still an emerging trend. Gamification makes use of gaming mechanics, such as badges, points, levels or leader boards and applies these mechanics to the way a learning course is taught. This, in turn, improves the learner's motivation. Moreover, the design of game offers the learners the freedom to fail and to face and accomplish various challenges and goals respectively.

The gamification in education is also sometimes termed as game principles for education, gameful thinking, engagement design, or motivational design etc.

Gamification operates on the assumption that the engagement experienced by the gamer should be translated to the learning context. This would eventually influence the behaviour of student while facilitating learning at the same time. Since gamers wilfully spend hours on solving the gaming challenges, the developers are using the potential of video games to harness learners' motivation and to apply the techniques to learning environments.

II. CONCLUSION

Student-centered learning/ learning consequences will have lifelong erudition where educational institutions will develop robust integrated systems and infrastructure to facilitate learning by doing rather than by the conventional learning. New age of Industry 4.0 will bring in a considerable change in physical world as in the virtual facilitation enabled by digital connect shrinking the distances, removing differences, and conducting real time knowledge transfer and material transfer globally. Higher education must necessarily combine incisive knowledge of basic disciplines with the tacit knowledge that comes with practice. Many B-schools cater to this complexity by designing their curricula and teaching methods.

This paper focuses on the innovative pedagogical tools/techniques that could be integrated in imparting the B-school curriculum effectively. It emphasizes on building a conceptual model for preparing future fit talent for industry 4.0

The predominant requirements of Industry 4.0 are presented alongside the skills needed to meet them. Understanding the impact of

technology, locally and globally, needs to become a central consideration in the long-term decision-making process, especially when addressing issues of scarcity become a necessity for everyone.

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