

Creating Education 4.0: A Summative Perspective

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ABSTRACT With the advent of the new millennium, technology began bringing about changes in the education process. The use of basic technology by learners and faculty gave rise to Education 2.0 followed by Education 3.0. Changes in the traditional education pattern have encouraged the need to develop a more personalised way to learn that would focus on learner autonomy, freedom and flexibility. This is the new phase of education known as Education 4.0. The present research study strives to examine the next big revolution in education, that is, Education 4.0. Through this study, the researchers have attempted to propose a conceptual framework that would provide a clear representation of vital factors for Education 4.0. The researchers have focused on the architecture of Education 4.0 by discussing its key characteristics required to sustain in Education 4.0, and the trends that define it. The model derived provides interesting insights that academicians and policymakers could use while re-looking at traditional learning setups.

INTRODUCTION

The education ecosystem highly influences the future of current and succeeding generations. The education ecosystem holds a centre stage in fortifying and strengthening the competencies required by the generation in the forthcoming years (Rosenheck et al. 2017). Also, the education ecosystem needed to prepare a future workforce that is drastically different from the past and present educational ecosystems. For instance, Education 1.0 focused more on classroom lectures, repetitive delivery of information to support rote learning, and memorisation of delivered information by the learners. Education 2.0 evolved with Web 2.0 and therefore was characterised by internet-enabled teaching and learning. In Education 3.0, knowledge-based education held the centre stage. However, Education 4.0 is an approach that has emerged as a need for education models and systems to align and synchronise themselves with the emerging

fourth industrial revolution or Industry 4.0. According to Salmon (2019), “The key concepts of Education 4.0 and the differences in impact from Education 3.0 are the massive ubiquitous connectivity and the symbiosis between humans and machines and consequently our inability to understand or predict what this might mean in the long term”.

Industry 4.0 is described by the integration and intensive usage of modern technologies. Jayaraman et al. (2020) were of the view that “Industry 4.0 or Smart Manufacturing is the fourth industrial revolution. It is a new paradigm and convergence of cutting-edge ICT and manufacturing technologies. It provides ground for making effective and optimised decisions through swifter and more accurate decision-making processes”. Therefore, to produce a future-ready workforce, education institutions need to align their teaching-learning processes with the technological advancement of Industry 4.0. It is also interesting to note that most of the current jobs and the skillsets required to perform these jobs may become obsolete and redundant soon. Moreover, several examples already exist of firms indulging in restructuring themselves and redefining the workforce with future-driven skill sets. Though, studies in the recent past have explored various facets of the impact of Industry 4.0 on the job market, skill re-

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quirements, lifelong learning in the digital era, and so on (Ehlers and Kellermann 2019), no background/primer regarding planning, teaching, delivering, and implementing Education 4.0 is available thus leaving one with many unanswered questions (Bonfield et al. 2020).

Objectives of the Study

In the backdrop of the above explanation, the present research study strives to examine the next big revolution in education, that is, Education 4.0. The research study also aims at proposing a conceptual framework and thus tries to contribute to the body of knowledge. The paper's main objective is to propose a model that provides a clear representation of factors that are vital for Education 4.0. The proposed model may be used as a blueprint for academicians and policymakers to look at Education 4.0 and device strategies that enable its smooth implementation.

With this in view, the paper is structured as follows. The first section is an introduction that provides a brief background of the study. The introduction section is followed by the literature review section, which covers an insight into the key topics for the present study. The section also includes the rationale of the study. The following section is dedicated to the model development that highlights the various aspects of Education 4.0. The paper ends with the conclusion of the present study followed by the future directions and limitations of the present study.

Theoretical Background

Industry 4.0 and Education 4.0: The Link

Industry 4.0 is described by the intensive usage of modern technologies and is a conglomerate of numerous technologies. It encompasses megatrends such as Big Data, the Internet of Things (IoT), Artificial Intelligence (AI), enhanced automation in various manufacturing processes (Liao et al. 2017), augmented and virtual reality, and cyber-physical systems. Researchers in the past have defined Industry 4.0 from varied perspectives. Gilchrist (2016) defines Industry 4.0 as “essentially a revised approach to manufacturing that makes use of the latest technological inventions and innovations, particularly in merging operational and

information and communication technology”. The fourth industrial revolution or Industry 4.0 has ushered changes in various aspects of one's lives. Digital and innovative technologies are thriving and have created a contemporary ecosystem with substantial changes in the social, cultural, economic, and environmental aspects of human life.

Education and related fields are no exception and have been affected by these changes (Kin and Kareem 2019). Also, to stay relevant and effective, the education ecosystem needs to be changed, which is inevitable. Moreover, today's learners are the workforce of tomorrow and should be equipped to face the working environment that is continuously changing, globalised, virtualised, automated, highly connected, and flexible (Wallner et al. 2016). Xing (2019) believed that investments in higher education are synonymous with investments in the future and thus act as a “gateway to valued careers for its graduates”. Therefore, higher education institutions should rethink their role, broaden their vision, and experiment with new teaching-learning models to embrace change. A concept that has evolved in response to the changed workforce requirement of the fourth industrial revolution or Industry 4.0 is termed Education 4.0. Education 4.0 is not a very well-defined term, and as a concept it is still evolving. The present study uses a generic definition of Education 4.0, as “Education 4.0 encompasses the different ways and approaches that Higher Education institutions can, and are, aligning their services and curricula to prepare future graduates for work” (Hussin 2018).

Characteristics Defining Education 4.0

Education 1.0 was characterised by traditional classroom setups with the teacher at the core, and memorisation was a common trait of this phase of education. The introduction and growth of computers and the Internet impacted Education 2.0. Education 3.0 focused on the learners as the core aspect of the classroom, pedagogy, and classroom practices around learner requirements. Education 4.0's next stage in education is a hybrid model that empowers students and faculty to innovate, think practically, and challenge traditional boundaries (Harkins 2008). The following section discusses the paradigm shift that defines the critical features of Education 4.0.

Flexibility in Learning

Digitalisation in education has enabled the use of technology to deliver classes effectively. As the world heads towards Education 4.0, technology plays a vital role in aiding flexibility in-class delivery. Technology has enabled the ability to connect to learners across the globe. Physical presence is no longer a mandate to pursue a course. By harnessing digital technology, content delivery can be done flexibly (Orr et al. 2019). The end learner has the flexibility to learn sitting at home at flexible time zones (Rye 2007). In the Education 4.0 context, students would have the flexibility to decide what they want to study, the university they wish to pursue, and the time duration they wish to invest in the course. In this setup, students would have relatively great freedom to decide what they want to study, and they may opt to study from home (Rønning and Grepperud 2006). Flexible learning provides liberty to students to determine how, what, when, and where they want to learn. It represents the ability to customise the learner's pace, place, and learning mode. The diffusion of ICT applications and services has supported flexibility in academic delivery. It fosters the implementation of a dynamic and flexible classroom setup (Valenduc and Vendramin 2017).

Learner Autonomy and Freedom of Choice

Education 3.0 laid emphasis on classrooms that were focused and driven by learners, and a lot of emphases were laid on learner needs, and learner engagement levels. Due to technological disruptions, the learners had access to a wider range of courses as time progressed. Education 4.0 requires higher education institutes to permit autonomy and choice to learners who are key stakeholders. The hybrid education model provides learners with a wide range of courses to choose from. It needs learners to be self-disciplined and self-driven. Today, learners need freedom of choice and autonomy to decide their time schedules (Agustina and Fajar 2018). There should be an emphasis on providing learner autonomy, and adequate sensitivity to explore one's learning abilities should be provided to learners. The systems and processes developed to this effect focus on flexibility, self-initiative, and self-direction (Bajrami 2015). Learner autonomy has also redefined faculty roles. Faculty now have the

role of facilitators and counsellors. They have to inform the learners about available options, scope and also make learners capable of selecting the best option suitable to them. A learner autonomous classroom emphasises collaboration between the learners and facilitator or teachers to have constructive interaction and learn from each other (Camilleri 1999).

Pedagogical Transformations

There is a need to redefine traditional pedagogies used in the classroom and introduce new pedagogical approaches to improve the quality of learning in Education 4.0. The use of active pedagogy with a focus on student-centred, teacher-led methods is important to improve student engagement. A faculty may have to deal with students from diverse backgrounds. The pedagogy should be designed in such a way that it would appeal to a diverse set of students (Taguchi 2009). Techniques such as project-based learning flipped classrooms, Massive Open Online Courses, and game-based pedagogies will significantly impact the implementation of Education 4.0 (Larmer and Mergendoller 2010). Faculty will have to start incorporating pedagogies that allow students to reflect, brainstorm, and develop deeper insights (Kokotsaki et al. 2016). Innovations in technology and various transformations in pedagogy have resulted in a need to improve the learning process. The learning process should be aligned with the needs of learners. This is vital for educational organisations to move towards Education 4.0 (Gueye and Exposito 2020).

Technology

Technological advancements and innovations have changed the way people connect, interact and work. These advancements have also impacted the education sector. As per Buasuwan (2018), technology has a positive impact on education, and it is essential to understand how to leverage technology to enhance quality and standards of education. Trends include encouraging digital learning through the digital participation of teachers and learners. Universities and institutions have also started investing in information and communication technology to enhance digital learning (Raudeliunien et al. 2018). Practices that use

technology to improve the teaching and learning processes are core aspects of Education 4.0 (Kayimbasioglu et al. 2016). The use of advanced technology in aiding teaching, such as augmented reality, virtual reality, massive online open courses, flipped classrooms, will enhance the learner's experiences, and they would be able to learn better (Halili 2019). Today's learners are a generation that has grown up with access to numerous devices and technology. They are comfortable with different modes of technology, and hence, using technology in classrooms would increase their motivation to learn and engage in the classroom and out of the school (Kunzler et al. 2009).

Infrastructure

Good management practices are important to impart good education (Fattah 2015). One of the practices is an investment in infrastructure that facilitates the teaching-learning process. Education 4.0 has provoked policymakers and educators to re-look at the traditional classroom and institute set up. Good management of facilities that encourage the infusion of technology in learning, provide flexibility and autonomy to learners has become necessary (Usman 2013). Good infrastructure acts as a bridge between teacher-learner relationship building. Good infrastructure aids the process of continuous improvement through continuous feedback, knowledge storage, and transfer (Chong and Wan 2018). Access to good infrastructure also helps to enhance teacher performance (Singh et al. 2014). Research by Musa (2016) showed that inadequate and out-dated infrastructure could act as a roadblock to quality learning.

Knowledge Management Practice

According to Davenport et al. (1998), knowledge management is key to facilitating the creation of knowledge repositories. These repositories help to capture and store knowledge and experiences that are beneficial to teachers. A robust knowledge management system would enable teachers to improve their knowledge base by providing access to the latest knowledge. A knowledge repository is a digital archive that represents an intellectual product. This is created by faculty, research staff, and students based on their knowledge and experiences. It may include teaching material, syllabi,

session and evaluation plans, case examples, etc. (Sarker et al. 2010). Knowledge management practices are crucial to implementing Education 4.0, as it helps in the documentation and sharing of content (Rowley 2000). Education 4.0 brings forward opportunities for an integrated educational environment that encourages lifelong learning. A good knowledge management process will encourage creativity and lifelong learning among students helping them to succeed in a knowledge-based economy (Stukalina 2008).

Culture

A culture that promotes top management support to implement practices conducive to the new mode of learning is a must for Education 4.0. The culture of institutions should encourage technology-enabled learning. Smidts et al. (2001) found that a culture that bridges the gap between management, faculty, and students through clear and rapid communication is essential to smoothly transit from the traditional classroom set up to a smarter campus (Mavodza and Ngulube 2013). Similarly, research on employee involvement indicates that adopting such practices increases organisational performance (Riordan et al. 2005). Top management communication can be defined as the degree of clarity and completeness in the messages sent by top management to employees (Smidts et al. 2001). The culture of higher education institutes should blend policies and practices that encourage the implementation of Education 4.0. There should be mechanisms to address concerns from the faculty and student side and provide adequate support and training to align with the changing needs put forward by Education 4.0.

Table 1 summarises the key characteristics of Education 4.0 and the key contributors as reflected by the past literature.

As shown in Figure 1 and proposed by the authors, Education 4.0 is characterised by robust infrastructure through investment in technology. Conventional teaching methods laid a lot of emphasis on content that the faculty had to deliver. With advancements in the education sector, curricula have started emphasising the capabilities to process how the information will be used rather than with what the information is (Oliver 2002). Traditional classroom spaces need to be redesigned to adapt to the concept of digital learning

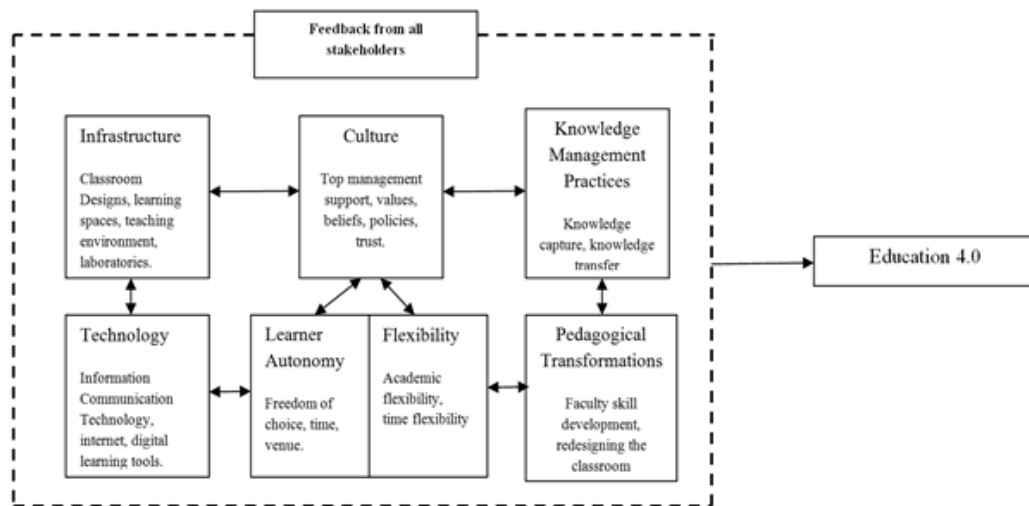
Table 1: Characteristics of Education 4.0

S. No.	Characteristics of Education 4.0	Key contributors
1	Flexibility in learning	Orr et al 2019, Rye 2007, Rønning and Grepperud 2006, Valenduc and Vendramin 2017
2	Learner Autonomy	Agustina and Fajar 2018, Bajrami 2015, Camilleri 1999
3	Pedagogical transformations	Taguchi 2009, Larmer and Mergendoller 2010, Kokostaki et al. 2016, Gueye and Exposito 2020
4	Technology	Buasuwani 2018, Raudeliunien et al. 2018, Kayibasioglu et al. 2016, Halili 2019, Kunzler et al. 2011
5	Infrastructure	Fattah 2000, Usman 2013, Chong and Wan 2018, Kumar & Singh 2014, Musa 2016
6	Knowledge Management Practices	Davenport et al. 1998, Sarker et al. 2010, Rowle and Stukalina 2008
7	Culture	Smidts et al 2001, Mavodza and Ngulube 2013

Source: Authors

spaces. The teaching environment that supports this mode of lecture delivery has to be inculcated. Embracing digital technology is a key feature of Education 4.0. Integrating ICT and digital technologies in the teaching-learning process enhances the quality of the teaching-learning process (Bono et al. 2009) and boost digital literacy among facilitators and learners. Cevik-Onar et al. (2018) have classified the digital technologies related to Education 4.0 into three key groups. The first group encompasses virtual labs and augmented reality, while the second group involves gamification in education. The last group has learn-

ing analytics at its focal point. To promote this, there should be the support of top management. The culture of higher education should be able to promote learner autonomy and flexibility to learners. The incorporation of digital technologies results in flexibility in the teaching-learning process. The learners can learn from anywhere, anytime, and in most cases at their own pace (Hussin 2018). In other words, information is omnipresent, and the process of teaching and learning has become dynamic (Halili 2019). Knowledge management practices play an essential role in this regard, and higher educational institutes need to invest in

**Fig. 1. Characteristics of Education 4.0**

Source: Authors

knowledge management. The current economy is also known as the knowledge economy. This economy needs organisations to invest in infrastructure that would aid in capturing, storing, and transferring knowledge. This is vital to stay competitive (Ferreira et al. 2016). Innovation in pedagogy is the need of the hour. Pedagogy should create a symbiosis between technology and human teaching and extract the best out of both (Salmon 2019). Collaborative learning should be reflected in pedagogy. Also, the evaluation or assessment should be relevant and reflect the objectives and goals of Education 4.0.

The 6 C's: Skills Required for Education 4.0

The Changing Role of Educators

With time the role of educators has undergone considerable transformations. The role keeps evolving with trends in the classroom. The characteristics of Education 4.0 have started discussions around the changing role of educators that are important to successfully transition into Education 4.0. Knowledge outburst and rapid development of technology have become key challenges for educators, they have to now train students for jobs that are unpredicted in the future (Guglielmino 2013). Students have access to the same information as educators, and it is important for educators to now look at the job of helping students analyse this information rather than providing information (Padmavathy 2017). Educators need to continuously upgrade their skills and innovate in pedagogy and continuously develop curriculum to keep it relevant. Domain knowledge for educators is insufficient if it is not backed with technical skills. Innovative teaching methods, a sense of initiative, cultural awareness, creativity and critical thinking are competencies that would be needed by educators in the changing education scenario.

Skills Required For Education 4.0

Technological transformations have resulted in a wide array of opportunities in various fields, and the education sector is no exception to these changes. Education 4.0 represents innovations that have transformed the traditional education setup and a step towards the hybrid learning and teaching model. To be ready to benefit from this para-

digm shift, there is a need to re-look and redefine the skill set required by all stakeholders, emphasising learners and faculty (McComas 2014). The next section attempts to shed some light on the skills needed to embrace Education 4.0.

Creativity (C1)

A skill that a faculty should possess is creativity. A faculty should be creative to redefine processes. They should have the ability to combine existing knowledge in a new way that is useful and acceptable to learners. Faculty should be creative to redesign pedagogical aspects relevant in all modes of teaching (Afida et al. 2013). Effective teachers are a must for the successful implementation of an educational system (Borkar 2013). Creative faculty challenge their students to work to their full potential and achieve high targets. They emphasise open communication and can stimulate classroom discussions (Paolini 2015). Such faculty develop a climate that respects creative thinkers, and where new ideas are encouraged. Discussions, idea generation, creative problem solving are encouraged in highly creative classrooms (Leung et al. 2008). Successful Education 4.0 needs the faculty to construct lectures that would appeal to diverse learners creatively. They should be able to give students opportunities to think across disciplines. Evaluation is another crucial aspect of learning. Faculty should design creative evaluations that would effectively capture learners' engagement and key learnings (Bereiter and Scardamalia 2006).

Critical Thinking (C2)

Critical thinking is a skill that requires one's presence of mind to analyse knowledge before its application (Tsui 2003). It is the skill to identify patterns, correlate relationships, make inferences and accordingly make conclusions (Furedy and Furedy 1985). Education 4.0 demands critical thinking skills from all stakeholders. For a long time, educators have been aware of the importance of critical thinking to prepare students for future job positions. A look at Bloom's taxonomy shows that vital thinking occupies a high position in the pyramid and is developed by the analysis, synthesis, and evaluation of knowledge that has been gained (Kennedy et al. 1991, Martín-Gutiérrez 1991). It is

important to consider this skill while looking at the overall framework for Education 4.0, as it enables students to effectively deal with scientific, practical, and social problems. To promote this, there has to be focused attention towards the application of content delivered (Shakirova 2007). The previous developments in the education sector did not pay too much heed to the development of critical thinking skills (Broadbear 2003). However, there have been discussions on various forums highlighting the need to train and develop faculty on critical thinking to disseminate the same among their students. To successfully transition towards Education 4.0, skill-based instructions are a must and formal training needs have to be identified and delivered in this regard (Scriven and Paul 2007).

Compassion (C3)

Compassion is an important skill, especially between students and faculty in a classroom. It is the positive feeling towards each other. Faculty engagement levels inside and outside the classroom are important for student development (Astin 1990). The role of faculty has evolved into that of a mentor. With the transition to Education 4.0, the faculty role as a mentor has gained significant importance. Compassion satisfaction represents the satisfaction derived from being committed to the job and doing the job well. Faculty compassion impacts student identity development, confidence, and academic achievement. It improves the levels of interaction and improves faculty-student relations. This would aid in inculcating a sense of belonging and improve communication and effectiveness in the class (Parnes et al. 2020). As the roles of faculty and students as a learner would be redefined in Education 4.0, compassion is a must for the smooth transition. Compassionate individuals would have positive interactions, which aid in establishing closer relationships with others (Neff 2003). Compassion would aid in the development of cognitive skills, analytical skills, and self-study skills (Avparoglu and Güles 2019).

Collaboration (C4)

Collaboration skills are vital for a team to coordinate and communicate well. As per Webb (2013), collaboration acts as a catalyst to facilitate the exchange of ideas and enhance learning in a group. Collaboration helps integrate technology with learners, faculty, and higher education institutes,

and good collaboration skills are necessary for smooth exchange of information for Education 4.0 (Austin and Harkins 2008). It is also imperative to consider peer or faculty-to-faculty collaboration that aids in increasing awareness of students' knowledge (Daiute and Dalton 1993). Efforts towards collaboration result from in-group cohesion that would build trust among faculty and learners. Members feel more connected to a highly cohesive group and contribute and help in mutual development. In the virtual setup, collaboration has gained importance to ensure that the learners stay connected and learn from each other to avoid feelings of isolation and frustration.

Change Management (C5)

Technological changes in the education sector have resulted in new delivery methods. Change is an inevitable process, and many times, change results in removing people from their comfort zones (Sidikova 2011). The change could be planned or a result of sudden changes that have taken place, which is beyond the organisation's control (Kitur 2015). Faculty have to get acquainted with these changes, embrace these changes, and adapt and modify their teaching methods accordingly. Education 4.0 encourages technology use and tools that enhance class engagement and effectiveness. It promotes practical learning that would help the student achieve excellent results. Higher education institutes must recognise the changing demands and train faculty to be equipped with the necessary skills and expertise to adapt to these changes. Faculty have a pivotal role in the higher education space. It has become essential to strengthen the change management skills of faculty to reduce levels of discomfort and achieve the desired outcome levels (Dawson et al. 2010). Organisations must support their employees to deal with the changes in the organisation effectively (Green 2007).

Confidence (C6)

Self-confidence forms a student's belief that they can accomplish a required task (Brown and Douglas 2001). It is important to highlight two concepts, that is, self-efficacy and self-esteem, to understand self-confidence. Bandura et al. (1999) discussed self-efficacy as one's belief that one can complete a task that has been assigned. It is the belief in one's capacity to handle the task. Self-effi-

cacy is a strong predictor of how effectively and efficiently one would complete their task. Self-esteem, on the other hand, represents the extent to which a person likes. It is the tendency to have high regard for one's abilities (Heslin and Klehe 2006). Faculty confidence impacts levels of student confidence. Schunk and Pajares (2002) proposed that self-efficacy is an important predictor of achievement, which helps to boost one's confidence level.

The above-mentioned Cs are summarised in Table 2.

Trends in Education 4.0

The Flipped Classroom

Traditional classroom setups treated students as passive learners. The flipped classroom model is a recent development in pedagogy that has re-

sulted in interactive and collaborative classroom sessions (Toto and Nguyen 2009). Education 4.0 considers the flipped classroom a developed pedagogy to engage with the learners. In the flipped classroom method, reading material is posted well in advance before the scheduled session to learners. Learners are expected to go through the content and contribute their perspectives in the classroom sessions. Thus, it can be termed as role reversal, where the faculty assumes the role of a facilitator (Bergmann and Sams 2012). A vital aspect of this method is the focus on group learning rather than individual learning. The role of the faculty is to plan, upload related content and create an interactive environment that would promote discussions. It is the responsibility of the faculty to encourage active participation and maintain students' engagement levels. This can be achieved by posting relevant content, exciting material and

Table 2: 6C's Skills required for Education 4.0

<i>Nomenclature</i>	<i>Skills</i>	<i>Key characteristics</i>
C1	Creativity	• Ability to redefine processes • Ability to redesign pedagogical aspects • Challenge students to work • Appeal to diverse learners • Design creative evaluation techniques
C2	Critical Thinking	• Ability to analyse knowledge before its application • Skill to identify patterns • Critical thinking is developed by the analysis, synthesis, and evaluation of knowledge • Enables students to deal with scientific, practical, and social problems effectively
C3	Compassion	• Represents the positive feeling between faculty and student • Synonymous to the role of a mentor • Faculty compassion impacts student identity development, confidence, and academic achievement
C4	Collaboration	• It helps to establish closer relationships with students • Essential for a team to coordinate and communicate well • Is a catalyst to facilitate the exchange of ideas and enhance learning in a group • Helps in integrating technology, learners, faculty, and higher education institutes • Helps to achieve group cohesion • Helps in building trust
C5	Change Management	• Technological disruptions have resulted in new ways of delivering lectures • The change could be planned or a result of sudden changes that have taken place • To facilitate change management faculty, need to be trained
C6	Confidence	• Comprises of self-efficacy and self-esteem • It is the tendency to have high regard for one's abilities • It is an important predictor of achievement, which helps to boost one's confidence level

Source: Authors

creating good asynchronous content (Herreid and Schiller 2013; Bergmann and Sams 2012). The role of students is to effectively use classroom time for discussions and develop problem-solving acumen (Youngkin 2014). Thus, the flipped classroom model makes students accountable for their learning.

Massive Open Online Courses (MOOCs)

Advancements in technology have resulted in minimising physical and socioeconomic boundaries. It has opened up an array of learning opportunities for keen learners (Xing and Marwala 2017), highlighted the need to progress towards the blended mode of learning, and massive open online courses (MOOCs) to successfully implement Education 4.0. MOOCs are self-paced, self-instruction courses that empower students to decide what they want to study, choose from a wide range of universities, and also pursue the lessons at their own pace. They comprise short videos, proctored tests, and discussion forums. The adoption of MOOCs has increased rapidly during recent years (Watson et al. 2016). One of the biggest advantages of MOOCs is students have access to courses across the globe. In Education 4.0, MOOCs offer a wide range of learning opportunities to faculty and learners (Pappano 2012). They would help support the hybrid model of education. Institutes would have the option of completing some credits via MOOC or even assigning a weightage of marks depending on the MOOC evaluation. Institutes need to explore such options.

Project, Peer, and Phenomenon Based Learning

Education 4.0 would focus on practical aspects of learning. Hence, another important practice in Education 4.0 would be project-based learning. Under these concepts, learners would be encouraged to collaborate and work in groups. The group would be assigned a short project for which the members would have to apply the knowledge and skills that they have gained (Hussin et al. 2018). The project-based learning model would demand more time, planning, and resources than the traditional methods of teaching, as the focus is more on learning rather than teaching (Mergendoller and Thomas 2001). The project would have to be designed so that it is authentic, challenging, engages the learners, and should also have formal and in-

formal assessments linked to it (Lee and Wong 2014). It should be spread over a short period and provide opportunities for discussions, presentations, and performance. It should be carefully designed to permit knowledge acquisition, self-directed learning strategies, and team participation (Moore et al. 2005). Peer learning is another important pillar of Education 4.0. Learners learn best from their peers, as they actively engage in the learning process. In peer learning, the role of the teacher is more of a facilitator (Hussin et al. 2018). Cooperative learning, collaborative learning, experiential learning, peer mentoring, the buddy system, etc., are all forms of peer learning (Topping 2005). Peer learning as a concept involves learners from similar academic backgrounds supporting each other to acquire knowledge (Topping 2005). Phenomenon-based Learning (PhBL) was developed in Finland in the 1980s. It is a curricular technique that recognises student-centred methods to enhance learner intellect. This approach relies on originality and authenticity to be successful. It combines techniques that promote game-based learning, critical thinking, and creativity to enhance students' growth in skill learning. PhBL studies real-world scenarios in a holistic manner for which a student's active role is a must. It actively makes students work on collaborative activities to problem-solve (Zhukov 2016). An inquiry-based approach is extensively used in phenomenon-based learning (Hattie 2012).

Blended Learning

Another trend to consider in Education 4.0 is the blended learning model, which combines traditional face-to-face learning with the emerging e-learning (Vallée et al. 2020). This concept has been gaining significant importance and higher education institutions have started offering some part of their curriculum in the blended mode. This has also been referred to as the new normal in the higher education scenario (Norberg et al. 2011). There are various models to adopt blended learning. Watson in 2008 proposed that blended learning could have a complete online curriculum with distance learning. It could also be an online curriculum with some sessions in the classroom or computer lab. It could also be the vice-versa with traditional classroom learning with a few online sessions. Graham in 2006 emphasised that the blend should be taking into

consideration the merits and demerits of face-to-face and online learning. There should be a blend that culminates the positives of both approaches. Blended learning would provide higher education institutes the flexibility to explore both forms of learning and use it to their advantage to make learning more accessible, flexible and feasible to all.

Conceptual Framework: A Summative Perspective

Figure 2 represents the proposed model for Education 4.0. Infrastructure is crucial to the successful implementation of Education 4.0. A traditional classroom setup comprises a blackboard, tables, and chairs. It is important to re-look at the traditional classroom setup to encourage collaborative learning. It is crucial to set up smart classrooms that are Wi-Fi enabled and have a smart board installed. The current and future generations of students would be well versed with the digital environment, and hence in Education 4.0, learning patterns will have to be re-looked at to design suitable teaching techniques (Huang et al. 2019). Re-

formers view digitisation as a source of hope. A technology-enabled ecosystem should have both the techno-centric and human-centric proponents, as a synergy of interaction between technology, faculty, and students is a must in a technology-enabled ecosystem (Baena et al. 2017). There have been numerous technological advancements over the past two decades. These advancements have incredibly altered the education landscape. These advancements have opened up doors to explore in Education 4.0 by expanding access, facilitating communication between different stakeholders, and improving the quality of education by mitigating boundaries. The changes are so rapid that organisations have to design FAST (Frequently discussed, Ambitious, Specific and Transparent) organisational goals to keep pace with the changing environment. These goals should enable faculty members to get access and training to cope with the changes in the external environment.

To succeed, it is essential to identify the skill set required by faculty and students who are the critical stakeholders in Education 4.0. The role of the faculty would be more of a facilitator. To do

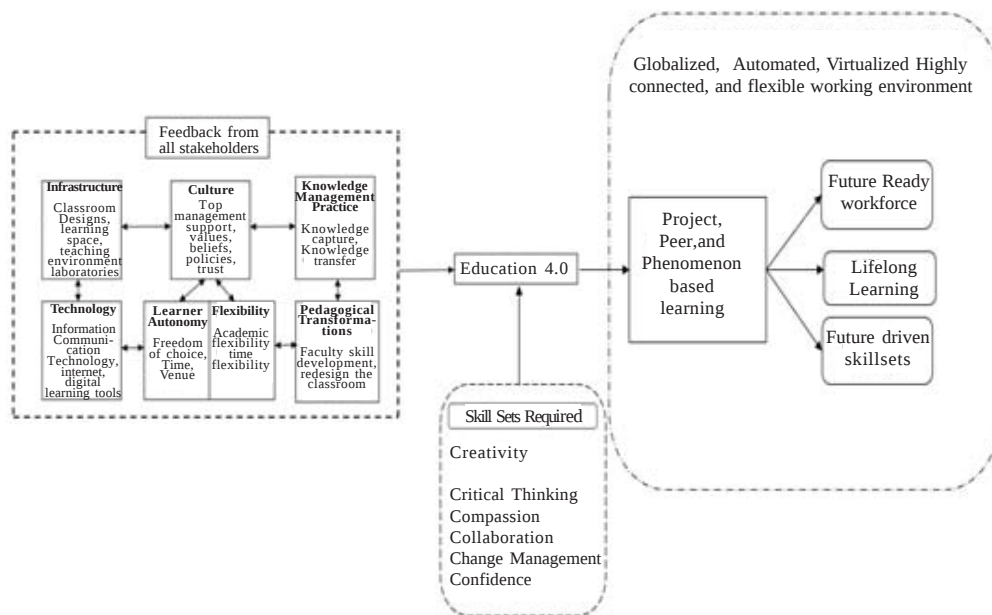


Fig. 2. The proposed conceptual framework
Source: Authors

justice to this role, skills such as creating creative modules, effective communication, compassion for students, etc., are required. The sessions would be designed to promote self-learning, collaborative learning and cooperative learning (Topping 2005). Hence it is necessary to have collaboration skills. Figure 2 depicts the skill required by students and faculty in Education 4.0. Higher education institutes need to identify these skills and get the student and faculty ready to embrace Education 4.0 (Mergendoller and Thomas 2001). This will lead to project, peer, and phenomenon-based learning.

This project, peer, and phenomenon-based learning will not only ensure a workforce that is future-ready but will bestow learners with lifelong learning and future-driven skillsets. Also, the future working environment will be highly globalised, virtualised, automated, connected, and flexible. In other words, Education 4.0 is a proactive approach to this futuristic virtual working environment.

METHODOLOGY

The research philosophy followed by the authors was to understand the changing trends in the education sector and the emergence of Education 4.0. The authors followed qualitative research to support this research philosophy. The authors systematically studied the evolving patterns in the education sector by referring to papers published in journals of repute from sources such as J Stor, Ebsco Host, Scopus indexed journals and papers published in the web of science. The authors identified the key contributors in the area of Education 4.0 and studied their work to understand the existing gap in literature. This formed the basis of the extant literature review that helped in understanding the characteristics of Education 4.0. The literature review also helped to form the basis of the proposed model.

RESULTS AND DISCUSSION

The emergence of Industry 4.0 has significantly impacted and improvised practices in the education sector (Alakrash and Razak 2020). Higher education institutions hold a key position in shaping the future of any nation. A robust higher education system not only contributes to the nation's ability in providing a skilled workforce to the global marketplace but also acts as a vital nodal

point for creating a robust ecosystem that allows and supports students to convert their novel ideas into successful and sustainable business models (Trivedi 2016). Technologies relevant to Industry 4.0 technologies have found an application in Education 4.0 (De Oliveira et al. 2022). Thus, there lies a solid need to introduce innovation in the teaching-learning process and "rethink academic education to meet these future challenges" (Wallner et al. 2016). The influence of digital technologies has brought about changes across the education sector and has urged the need to redefine skills and employment. These technologies have prompted institutions to think of innovative techniques of teaching and learning (Qureshi et al. 2021). It is also imperative to note that the concept of Education 4.0 is still evolving and has received attention from media, technology providers, governing bodies, and others recently (Salmon 2019).

The education sector needs to recognise the rapid changes in the environment and provide an ecosystem that drives the future of any nation, and it needs to change with the changing global environment (Das et al. 2020). With the world moving towards Industry 4.0, Education 4.0 relevant strategies need to be part of higher education institute processes and organisational structure. Higher education institutes need to recognize that Education 4.0 has blossomed as a vital aspect that cannot be ignored in the fast-growing education system and practices across the globe. (Srivani et al. 2022).

Also, higher education institutions have a pivotal role to play in the implementation of Education 4.0. According to Salmon (2019), there has to be a focus on three approaches, that is, actionable interventions, accessibility, and careful assessment. Since Education 4.0 may offer a blended approach of virtual set up and physical classroom and roles of faculty and learners will get redefined, there is a need to have valuable interventions to facilitate the process. It could be in continuous feedback, peer review, mentoring systems, etc. Higher education institutes need to be proactive and invest in strategies that promote actionable interventions. Globalisation and advancements in technology have made it possible to set up virtual learning environments. However, the system would be a failure if it lacked accessibility. Higher education institutions need to ensure accessibility and flexibility for all learners. This would require good infrastructure support. Many aspects of Education 4.0 would need active participation and self-

learning on the part of learners. Effective assessment methods would have to be designed to capture student learning and engagement levels significantly. Faculty would have to be trained on effective assessment mechanisms.

Higher education has been identified as vital, strategic, and a priority for the future of the nations (Martinaitis 2014). Technological advancements have had an impact on all sectors, and the education sector is no exception. It is necessary to boost the current education system by implementing technology to support teaching and learning activities. The current generation of students is tech-savvy, the future generations would also be well versed with technology, and educators need to realise this and readily embrace technological integrations in their classroom (Khanghah and Halili 2015). These institutions would have to re-look at the curricular aspects and redesign courses as per global standards. Education 4.0 empowers students to delineate their approach and pace of learning (Bartolomé et al. 2018). There should be mechanisms to identify learner needs and empower them to select courses that they would like to study. Also, a vital element of the entire process is the empowerment and enhancement of the skillsets of the faculty and facilitators. The faculty should be trained to use various web-based tools. This will not only empower faculty with technical skills but also will enhance their coordinating and collaborative skills. Institutes of higher education can take multiple steps to strengthen faculty skillsets and make them ready to deliver and contribute to Education 4.0. Therefore, the researchers strongly recommend that higher education institutions perceive Education 4.0 as an approach that aligns and synchronises the education models to answer to the new challenges faced due to constant changes in the ecosystem. This is also in line with Salmon's (2019) suggestion for higher education institutions. Salmon (2019) recommended using FAST, that is, "Frequently discussed Ambitious, Specific and Transparent" goals instead of "SMART (Specific, Measurable, Achievable, Realistic, and Timely)" goals to disrupt the traditional models of education and to achieve a constructive transformation for the long run.

CONCLUSION

The researchers have attempted to propose a conceptual framework that would provide a clear representation of vital factors for Education 4.0.

The researchers have focused on the architecture of Education 4.0 by discussing its key characteristics, changing skillset required to sustain in Education 4.0, and the trends that define Education 4.0. The model derived provides interesting insights that academicians and policymakers could use while re-looking at traditional learning setups and re-designing them to meet the changing demands of education 4.0. The researchers have also highlighted the skills that would be needed to be successful in Education 4.0, and policymakers should formulate policies to identify training needs and provide the necessary support to faculty and learners. This would enable faculty to explore the latest technology and implement them in their classes. Higher education institutions, faculty, and learners should embrace this new wave of reforms in the education sector, that is, Education 4.0. This will benefit students by providing them autonomy, flexibility, accessibility, and choice and faculty through skill enhancement and flexibility in designing their courses. The existing literature on Education 4.0 is fragmented and does not give a clear view. The changing scenario and Education 4.0 also invoke a lot of questions and uncertainties. Is one looking at a paradigm shift where the web is the source of curriculum, knowledge, and students have the multifaceted role of learner, content developer, and sharer? Is one looking at the role of teachers in class to only being a facilitator? The aim of the paper is not to pass any judgment but to set the stage for constructive debate and discussion to define the future. The literature review gives a definitive yes to smarter classrooms and intricate role of technology and innovation in evolving pedagogies. However, there needs to be an in-depth discussion on the extent of technology to be used. The learner should always be at the centre of all pedagogical intervention and the new technical tools should be used in a positive and constructive manner for application of curriculum design and creating a learning environment.

RECOMMENDATIONS AND SCOPE FOR FURTHER RESEARCH

The proposed model is based on the researchers' understanding of the available literature. Through the model it is recommended that policymakers in higher educational institutions start making policies that promote the compulsory

use of technology in teaching-learning-related activities. Policymakers should focus on the skills identified in the study for the smooth transition towards Education 4.0. It is vital to incorporate the concept of smart learning environments. The study can be carried forward through phenomenal interpretation to get a deeper insight into perceptions and readiness of higher education institutions for Education 4.0. The proposed model can be further validated through structured questionnaires and statistical analysis.

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