

Review Paper

Digital Education: The Aspects and Growth in Socio-Economic Development—*Towards sophisticated Education 4.0 Practice*

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ABSTRACT

The concept and practice of Digital involvement is improved gradually in various sectors with the help of various digital and electronic tools as well as technologies. Importantly, most of these are widely using in teaching-learning process and today entire education system become more technology centric. There are many concerns about the Digital Education which include E-Learning, Online Education, Education Technology, Virtual Education, Blended Learning. However previously only ET i.e. Education Technology or E Learning was treated as practice of ICT in Education and gradually other areas have lead the development of the Digital Education not only a practicing concept but also a field of study. Newest nomenclature 'Digital Education' has become a subject in many international universities to offer the best in practice of planning, conducting education and also overall educational approaches so that sophisticated teaching-learning activities can be developed. Digital Education partially known as Educational technology needed in process of communication, and exchange of views using IT and Computing. The tremendous applications of IT in Education are results to advanced education and their practice in better pedagogy and curricula development and offering. Therefore future of education is purely based on advanced technology and automation and also concepts of the Creativity. The advanced concept of Education 4.0 also an important practice and this Chapter is concentrated on Digital Education and its various aspects with special reference to its practice in Education 4.0 practice and development.

HIGHLIGHTS

- ① Digital Education is combining different mode of education viz. Online Education, ICT in Education, Blended Education.
- ② Digital Education today not only a field of practice but also a field of study where educational programs are offered in this nomenclature & allied nomenclature.
- ③ Country to country perception and status for Digital Education is different but worldwide there are growing trends in digitalization.
- ④ Different emerging ICT is changing educational sector and as a result various concepts been emerged and among this Education 4.0 is important one.

Keywords: Educational Technology, Digital Education, E Learning, Higher Education, Education 4.0, ICT in Education

Digital Education is an interdisciplinary field comprises with IT and Computing with Education areas (Reeves, 2003; Dillenbourg, 2016). It involves various technological integration in developing lot of Digital tools and technologies particularly Information Technology components such as Software Technology, Communication Technology, Database Technology, Networking Technology, Multimedia Technology for the development and management of sophisticated Digital Education

System. Due to wider application of Digital Education it is also known as Digital Learning (Blikstein, 2013; Pau *et al.* 2012; Heller *et al.* 2008). In recent times not only the developed nations but also developing many nations have been integrated Digital Education practice in their

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pedagogy, instructional classes, assessment and examinations, operation including management and administration. Digital Education may be treated as following—

- ♦ Adaptive learning based classroom systems & technologies.
- ♦ Electronic textbooks and encyclopedias.
- ♦ Learning electronically or in online mode with live streaming.
- ♦ Availability and share of contents, objects and analytics.
- ♦ Open and free educational contents & resources.
- ♦ Recorded content (video) including streaming contents, Teaching and learning enabled with technology etc.

Due to the development of the Digital Education it is considered as broader than context *E-Learning* (some also denotes as Educational technology), and also treated as a branch of study. Digital Education is about the practicum of educational approaches and principles using ICT systems and not about only about implementing Online Education but also about the ICT in Traditional Teaching and Learning process. Further, the improvement of the learners, teachers and other kind of stakeholders are also important agenda of Digital Education, and it is applicable beyond academics viz. corporate houses, companies, in training centres (particularly for the On Job Training), Higher educational institutes and research centres etc. (Edwards, 2015; Elboubekri, 2017; Narciss, 2013). Thus, Digital Education is suitable in technology enable teaching-learning systems and enhancement of the continuing learning and education, skills development. Digital Education is perfect in developing blended learning promotion as well as development. As Digital Education is a broad one and may be consider as merger of some of the subjects such as Education Technology, E-Learning, Virtual Learning, Online Learning, Digital Teaching and Instruction, Digital Pedagogy, Blended Education and Learning etc. There are number of universities have started academic programs in Digital Education or allied nomenclature as mentioned above as a Major/ Minor/ Honor/ Concentration / Theme etc.

Objective of the Chapter

The present chapter is conceptual in nature with the concepts of management, educational science, Information technologies with following agendas (but not limited to)—

- ♦ To get an idea about the Digital Education including its general meaning, features and overview.
- ♦ To gather about the functions and background of Digital Education with reference to benefits as well as advantages of Digital Education and Learning.
- ♦ To find out the applications as well as integration of Digital Education and allied areas in education specific, and also in allied areas.
- ♦ To learn about the proposed the stakeholders of the Digital Education including changing and futuristic scenario.
- ♦ The work will also explore regarding different technologies and tools works for Digital Education and Learning practice.
- ♦ The work is intended to get the overall picture of advantages and benefits of Digital Education and allied fields in brief.
- ♦ To get an idea of Education 4.0 including its nature and significance and future potentialities in brief.
- ♦ To learn about the scenario and institutional goal and need from Education 4.0 in present and future context.

Methods Adopted

The current chapter entitled ‘Digital Education: The Aspects and Growth in Socio-Economic Development—*Towards sophisticated Education 4.0 Practice*’ theoretical and conceptual, and also it is interdisciplinary in nature. Chapter is combined with the Educational Science, Management and Information Science & Computing using multiple methods such as collecting resources from secondary sources, from the reviewed journals in the field and combined them into a meaningful sense to reach the aim and goal of the work.

Digital Education & Learning: Fundamentals

Digital Education is an emerging educational practice and concepts (also a system) using different sub-technologies of Information Technology. In Digital Education, instructional practice considered as worthy and here effective technological system considered as valuable. For healthy and sophisticated practices of Digital Education here integration of blended and virtual learning with traditional face to face learning. Combination of Online learning, electronic learning, E Content are treated as important in development of Digital Education, and thus such may be considered as a sub field of Digital Education (Gibson *et al.* 2015; Paul *et al.* 2012; Salmon, 2019). Some of the common technologies and strategies may useful effective Digital Education practices viz. Adaptive learning, Intelligent learning, Learning analytics, Learning objects, Learning Contents, Technology-enhanced learning system, M-Learning, Self-learning, E-learning-real, etc. It is worthy that various tools and strategies may be used for effective digital education practice and promotion.

Digital Education: Definitions and Meaning

Digital Education initially was a concept but now it has become a tool and a system of study and its changing rapidly and as a result its definition also changing rapidly. Digital Education is very tough to explain, though it may be considered as a kind of field, practice as well as technologies required in designing, utilizations, and development of entire education system. Moreover Digital Education is a technology supported teaching-learning mechanism using various components of Information Technology (Buchanan, 2011; Hiltz and Turoff, 2005; Paul *et al.* 2012). Therefore Digital Education not only helps and develops healthy educational management but also enhance the system of teaching and education including research and innovation system. Digital Education is the merger of theory as and practice regarding educational approaches and systems towards healthy teaching-learning activities. Digital Education is the advanced version in Educational technology involves in exchange of ideas using IT and Computing. Digital Education integrated with information technologies and in depth for the promotion of educational activities

of the student and teachers towards instruction, curriculum and complete educational management in contemporary context. Digital Education is an advanced tool for healthy educational management based information systems towards educational activities and further promotion and obviously complete educational administration. Digital Education is also fruitful in back-office management viz. budget and HR management, Learning Record Store, Official communication and network building, communication within and other institutions. Digital Education is considered as a strategy for complete educational and teaching-learning development (Halili, 2019; Hanna, 1998; Salmon, 2019). Ultimately it will be helpful in enhancing proper and efficient teaching-learning affairs as well.

Digital Education and Similar Aspects

Digital Education is a new nomenclature and conceptualized as a field of study. Digital Learning is another alternative one and following nomenclature are popular in this regard and valid –

- ♦ **Education Technology** (This is most synonyms with the Digital Education and widely used in academic fraternity).
- ♦ **Online Education** (It is direct uses in Computing and IT for healthy education and knowledge delivery mainly in live streaming. In Online Education cloud and virtual technologies considered as important for healthy performances).
- ♦ **Virtual Learning** (Virtual learning is the ICT depended education and it is also a remote learning using online and other IT mechanism).
- ♦ **E Learning** (E Learning is simply adopting Information Technology for further administrative activities).
- ♦ **Blended Learning** (The combination of Physical (On Campus), Distance, Self-studies and Private Learning) (Dunleavy *et al.* 2019; Keser and Semerci, 2019; Paul *et al.* 2012).

As Digital Education is the combination of all these mentioned areas which is rising, therefore it is gaining as a domain/ field of study instead of existing concept of tools/ technologies in educational means.

The Way of Promoting Digital Education

Digital Education supports teaching-learning systems and thus various methods of Digital Education can be used in traditional classrooms and systems. Digital Education is sustaining traditional On Campus Education including development of the Blended and Hybrid Education, Online Education and Learning, advancement in teaching and learning, individualized education, private and personal Learning, flipped and flexible Learning, gamification Process (Robin and McNeil, 2012; Xu, *et al.* 2019). Digital Education also supports in understanding and implementing of the Design including Universal Design for Learning, sophisticated User Experienced Systems and Designing, Content Management Systems, Enterprise Resource Planning etc. The technologies and tools are useful in proper mechanism and system development in teaching pedagogies and ultimately it promotes proper and healthy digital learning environment development including smarter learning systems. Many tools are being used in promotion of Smart Education such as RSS, YouTube & Similar Video Channels, Google Classroom, Zoom/ Microsoft/Cisco Meeting applications, Advanced Networking Systems, Skype, Cloud-based Word Processors and document management systems, Cloud File-sharing platforms including Evernote etc. (Halili, 2019; Huang *et al.* 2019). Therefore different sample tools are being used day by day for healthy creation of digital educations.

Digital Education & Benefits

Digital Education is about the formation of sophisticated and smart education systems development and it comes with various advantages and benefits viz.—

Time— Digital Education is offers less and reduced time as this type of system can be affordable anytime and anywhere opportunity. Therefore for the time Management and proper utilization of time Digital Education is important and fruitful.

Place— This type of smart system is also helpful in traditional classroom settings; and here for its real implementation various components of computing and information technologies considered as worthy

in healthy learning and education. In addition to these, Digital Education can also be offered in traditional educational systems.

Path— In Modern days academic community not only restricted in one pedagogy and here various things are being practiced, and among these few important are advanced IT, Computing systems to reach a specific path. Modern education systems seeks learning technologies for the promotion of real-time, healthy and newer educational pedagogy, and in this context use of Digital Education is worthy.

Face— Digital Education is supported by various IT Components viz. Database Technology, Web Technology, Multimedia Technology, Software Technology and other emerging technologies and systems—

- ♦ Cloud Computing and Virtualization;
- ♦ Big Data and Analytics;
- ♦ AI & Robotics;
- ♦ HCI and Usability Systems;
- ♦ Internet of Things (IoT);
- ♦ Cyber Physical Systems (CPS).

Thus Digital Education is helpful in changing traditional education system and also online and virtual education systems and different Higher Educational Institutions and academic bodies are engaging in imparting quality education and systems (Edwards, 2015; Hussin, 2018).

Digital Education & Stakeholders

Digital Education depended system is based on Content Management System or Learning Management System and therefore it supports in Online Mode; and also in Face to Face mode in uses of advanced projector based classes. Information and Content are treated as important towards effective traditional education and virtual education system development. Instruction is also considered as a valuable role in Digital Educational Systems (Heller *et al.* 2008; Miranda *et al.* 2021]. Here Fig. 1 Described various Stakeholders of Digital Education and also allied educational concepts and models.

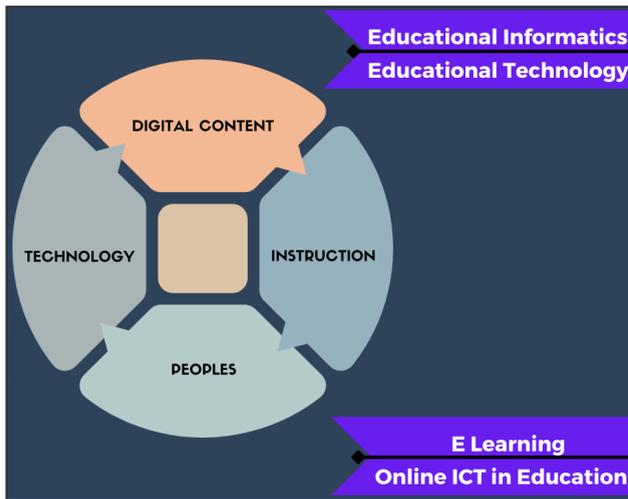


Fig. 1: Stakeholders of Digital Education and allied Nomenclatures

Technology and Systems

Digital Education is depends on various kind of technology in order to carry traditional and virtual teaching & learning process and here various IT components are being used viz. Networking Systems and Technology, Database Systems and Technology, Multimedia Systems and Technology, Web Systems and Technology. However apart from these some other tools and systems are also treated important for successful Digital Education system designing and development.

Information and Digital Content

Information and other contents (both manual and digital) considered as important in designing and development of Smart Education systems including Online and E Learning, Virtual Learning and other Digital Education platform (Hiltz & Turoff, 2005; Ozga, 2016). Without information and content, teaching-learning process is incomplete and the core is ‘information’ not matter what may be the form. Therefore information/ content is important in Digital Education development. In traditional class room systems and settings content is prime and teachers offer the same manually or in E format, and in Virtual or any E Platform content also valuable and comes in E Format.

Pedagogy and Instruction

Instruction is basically comes from the pedagogy and it is most valuable in spreading of knowledge.

The education and degrees are offered based on teaching & learning, educational delivery, educational assessment and evaluation. Digital Education and Learning therefore truly depends on proper designing and development of instruction and delivery.

Users and other Peoples

People are the important stakeholder in healthy designing, development of the Digital Education Systems. Teachers and faculty members are most vital in developing course contents, syllabus and curriculum, instruction and pedagogy designing. Students are another User of the Digital Education. Similarly apart from faculty members students also considered as valuable. The educational institutes are being run by the administrators therefore they can also be considered as important stakeholder in Digital Education and fall under the category of ‘Users and People’. Here Fig: 2 depicted the scenario in detailed.

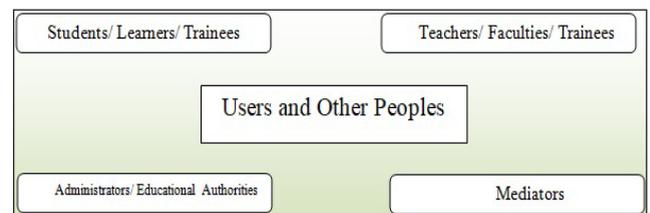


Fig. 2: Common users of Digital Learning

Emerging Information Technologies in Digital Education

Various technologies and systems are applied in promotion of educational systems and activities, educational administration, and therefore in Digital Education such technologies consider as important and worthy. In healthy Digital Education designing and development apart from Information Technology another important facet is being treated as Management Sciences Following Information Technology components are considered as important (also refer Fig. 3) (Hussin, 2018; Qureshi *et al.* 2021).

IT Component in Digital Education

In Information Technology various sub fields and components are treated worthy in Digital Education practice viz. Networking Technology, Database Technology, Multimedia Technology, Web Technology, Security Technology etc. And

apart from these all the emerging technologies and components are useful in Digital Education.

Cloud Computing & Virtualization

Cloud Computing is an important developing Information Technology infrastructure which combines with the hardware, software, applications and systems, various platforms. Cloud Computing is also helpful in remote platform management using Internet and allied technologies. Cloud Computing also supports in traditional physical classroom settings for easy and effective management. Similarly in online learning and virtual education system Cloud Computing is most effective (Knox, 2016; Ozga, 2016). In the process of admission, teaching-learning, examination and assessment also Cloud and virtualization supported tools considered worthy and powerful.

Big Data and Analytics

Big Data Analytics is a technique and process of *Big Data and Large amount of Data Management*. It is also the *Analytics* for proper and effective data management especially complex data. Education is about the educational activities in digital educational operation and there data analytics is required in different operation. As far as teaching-learning is concerned both physical and virtual classroom settings uses lot of data and here Big Data and Analytics considered as worthy (Keser & Semerci, 2019; Paul, et al. 2014). In Educational Management including application and admission management, data related to Examination and Evaluation etc. Big Data and Analytics considered as worthy and important.

Usability Systems & HCI

In the context of 'Usability Systems and Engineering' the User Experience Designing considered as important and worthy. And in addition to the UX or UXD, various allied aspects viz. Human Computer Interaction, Human Centered Computing, Man Machine Interaction are important. Educational Technology is dedicated in creation, development of the contents which are required for the students, researchers, and multimedia presentation. However for the research related events such as seminar, conferences, workshop, creation of the online contents, preparation of the students documentation

and electronic brochure etc., usability and systems of HCI principles considered as worthy and important.

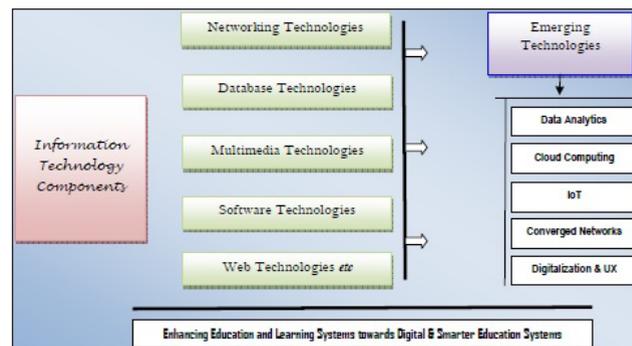


Fig. 3: Various IT components are emerging in Digital Education system

Advanced Networks & Convergence

Advanced Network is important in framing of Digital Education system both enhancing traditional or physical mode of education, and also in the real-time/ or streaming. Apart from general networking systems multimedia based content delivery needs support of Advanced and Converged Network for the healthy and smart educational delivery and teaching-learning.

Internet of Things (IoT)

Advanced Internet of Things (IoT) is required in promoting and modernizing entire education systems including content designing sharing, device management and the same is worthy in traditional educational mode and in online means.

Education 4.0: Basics and Digital Education

Education 4.0 is based on the forth industrial revolution and it is dedicated in advancing education systems and educational pedagogy delivery models using advanced technologies and also automation. Education 4.0 is highly concentrated with creativity and it emphasized the basic requirement for the IT and computing towards a change of paradigm of education with futuristic concepts. In Education 4.0 concept students should be available with proper skill sets and they must adhere technology skills and they should concentrate on leadership not direction and vocational education should be enriched with Education 4.0 context. Education 4.0 today comes to this stage after three previous phases and today works for more flexible and personalized

learning (refer Fig: 4 for more details). According to the educationalist and policy makers Education 4.0 requires following for its complete attention (Elboubekri, 2017; Qureshi *et al.* 2021).

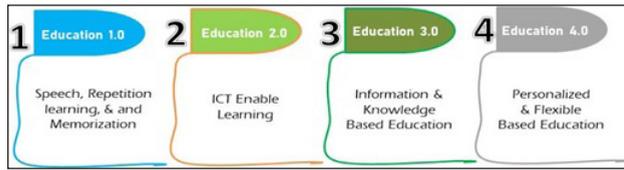


Fig. 4: Education 4.0 and its previous phases

- ♦ In Education 4.0, it should be demand-led education than that of instead of supply-led education
- ♦ Competency and skill based education is prime in Education 4.0 where knowledge-based education considered later stage.
- ♦ Education 4.0 requires and enhances proper disruptive technologies & skill-sets to reach the goal sets.
- ♦ Education 4.0 believes in Lifelong learning rather front-loaded learning
- ♦ Modular Degree may be considered as vital in Education 4.0 context rather one-shot going.

Basic trends of Education 4.0 is considered as worthy and here some of the important aspects and matters are mentioned below (also refer Fig. 5).

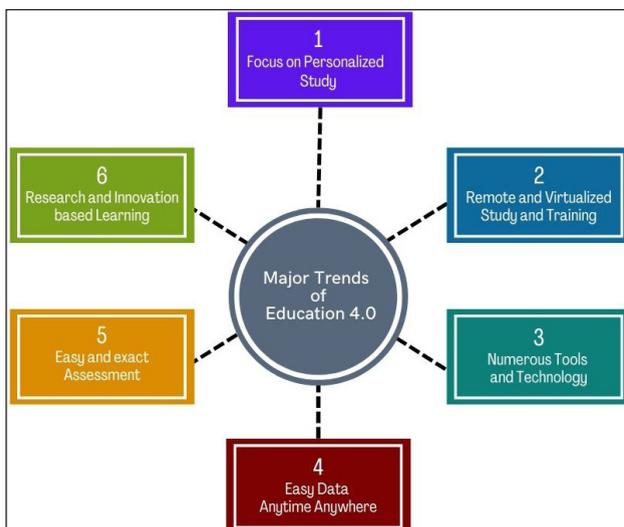


Fig. 5: Depicts some of the major trends in Education 4.0

Diversity, Time and Place

In Education 4.0 different opportunities are exists and among these proper e-Learning tools are

recommended including remote operations, self paced learning. Education 4.0 model is important to enhance inside and outside the classroom and here practical subject may be offered using latest technologies even remotely.

Personalized Learning and Education

Today education system is student friendly and here Education 4.0 is considered as most vital concept and practice which is supported and encourages by technology enable systems. Therefore it supports personalized learning and education. It enhances the individual learning process perfectly. Cloud Computing, Big Data and Internet of Things (IoT) is helping in Digital Education systems impactful and worthy.

Free Learning Experiences

In Education 4.0 the concept of free learning experience considered most vital for complete and sustainable learning. Education 4.0 basically promotes the uses of different devices, different programs and techniques as per the users and learners need. Here blended, and flipped learning considered as worthy and important (Hanna, 1998; Heller *et al.* 2008).

Digital Education and Project Based Systems

Modern educational systems have been changed drastically and students are getting involved in project based learning. Modern educationalist and policy makers are also in favor of starting flexible and industry integrated learning where project work is being considered as important and beneficial. In regard to prepare a good project work use of Digital technologies are worthy and in this context use of the Digital Education is the need of hour.

Field Experience, Education 4.0 and Digital Education

Skill is important for the real life education and therefore educational institutions are putting effort in offering skill into the educational programs in context of skill important is field work and face-to-face interaction. Education 4.0 puts importance in field experience and for practical and emerging exposure Digital Education no doubt worthy and important. Internship, mentorship, skilling in different settings and capacity is important.

Efficient Exam, and Evaluation Process with Student Centric Approaches

Education 4.0 helps in easy and advanced examination systems and procedure and therefore Digital Education is being considered as important to enhancing the system. Since Education 4.0 promotes efficient examination and evaluation process it confirms student centric approach. Since Education 4.0 believes in quality content and durability therefore it also helps in student centric approach and education system development (Robin & McNeil, 2012; Wahabi *et al.* 2019).

Sophisticated Mentoring Systems & Remote Learning

Sophisticated monitoring is very important in today’s education system. Flexibility is also crucial and worthy. In context of sophisticated monitoring Education 4.0 is important approach and for its realistic and futuristic goal Digital Education is important. With Education 4.0 remote learning become easy due to support of emerging technologies fall under Digital Education. The Blended learning extension becomes easy and advanced with Education 4.0 approach powered by Digital Education.

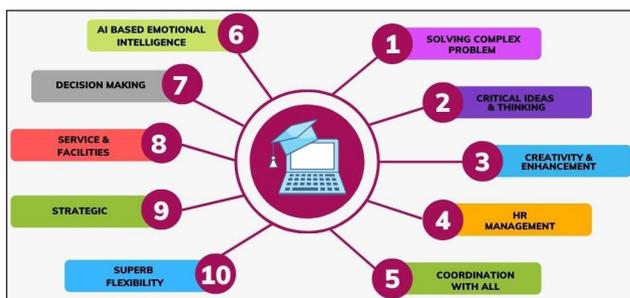


Fig. 6: Depicts Advantages from Education 4.0 to various beneficiaries

The surplus of educational and skill development tools

Education 4.0 is prefer in flexible learning and therefore it also support additional skills and knowledge, and in this context Digital Education and its impact is valuable. Students now have option of having multiple courses, training and skill sets using IT and Computing and it further supports in Collaborative tools helps in flipped learning, blended learning, and online learning and so on.

Data at the fingertips

Data is most important in any organization and institutions and educational institutions are not exception. Students data, educational contents, financial data, research related data become easily manageable using Digital Education principles. The statistical analysis helps in better data governance and the impact is increasing in this process.

Implementing Education 4.0 in HEIs with Digital Education Context

The philosophy of Education 4.0 is changing rapidly and also being adopted in different institutions and organizations in international and ranked institutions. Education 4.0 also believes in Education Technology utilizations in order to offer and enhance Education 4.0 in real sense. Today is the need of the hour that organization should put importance in delivery of content timely and accurately and here automation and technologies considered as valuable, and therefore people are using Education 4.0 as mentioned in Fig: 6. Today students and learners need to adopt latest skill in different educational formats, and therefore higher educational institutions are in process of implementing Education 4.0. Therefore, *revising and remodeling of curriculum* should be considered as important with focus of new age and futuristic subjects. Since most of the organizations are in skill shortage therefore skill based curriculum is considered as prime factor for overall and complete development. Up-skilling and making curriculum at par scenario and interdisciplinary format is also essential course of action. *Digital and Technology Skill*, is another important requirement in advancing and realizing Education 4.0 and thus training to the students and at the same time to the faculty and staffs considered as worthy. Apart from technology related skills it is worthy to focus on *Soft skills* that are important for holistic development of the students and researchers. In the soft skill segment additional importance must be carried for complete development (Hussin, 2018; Ozga, 2016). *Moving to Online Tools*, is another important criteria for advancing educational practices into the reality and with solid foundation. Virtual Learning may be incorporate in traditional teaching learning mode whenever required. With the support of online means ‘learning and teaching’ become easy

and online chat facilities is also allowed us for promoting sustainable education system.

Therefore, Digital Education should be considered as valuable for the development of the education system in advancing traditional education delivery system and also online education delivery system. Hence apart from basic Information Technology uses to advanced and latest emerging information technology utilizations viz. Cloud Computing, Big Data Technologies, Internet of Things, Human Computer Interaction, Usability Engineering, User Experience Designing, Cyber Physical Systems the implementation of 'Education 4.0' must be treated as need of the moment.

Conclusion with Future Potential

The developments of the technologies and computing have been changes the entire system of society and different sectors are getting benefits from the technologies. The Education 1.0 transformed memoristic education where contents of traditional format play an important role with greater focus on deliver of knowledge. However the evolution of the Computer Systems has gifted Education 2.0 which offers technological involvement into the educational process and delivery. The advent of Information Technology comes with Networking Technologies (and also Web and Database Technologies) and also offers education technology and as a result Education 3.0 has been evolved. Later, more advanced and intelligent IT and Computing systems promotes Education 4.0 which believes and dedicated on more personalized education with healthy flexibility. The world is transforming rapidly and learning activities are also getting changed during the past course of time. The educational models have become changes with the development of the education and at the same time changes made in Information Technology and Computing. Skill is treated as vital for complete and overall development in education and learning. Education 4.0 can be reached with proper Digital Education utilizations including new age educational platforms viz. E Learning, Educational Informatics, Online Education etc. and side by side it is also promoting traditional education by introducing latest technologies into the education system.

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