VIRTUAL LIFELONG LEARNING

EDUCATING SOCIETY WITH MODERN COMMUNICATION TECHNOLOGIES

Editors:
Neha
Pooja Gupta
Ihtiram Raza Khan
Gülsün Kurubacak

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Edited by

Neha
Department of Computer Science and Engineering
Jamia Hamdard, New Delhi, India

Pooja Gupta
Department of Computer Science and Engineering
Jamia Hamdard, New Delhi, India

Ihtiram Raza Khan
Department of Computer Science and Engineering
Jamia Hamdard, New Delhi, India

&

Gülsün Kurubacak
Faculty of Open Education
Department of Distance Education
Anadolu University, Eskisehir, Turkey

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PREFACE

The concept of virtual/online learning is the next paradigm of education. During the hard times of COVID-19, the whole world was locked in their homes with no option to go to school, colleges, or offices. This led to the rise of virtual learning platforms. Virtual learning signifies the use of digital platforms where in the students are taught by the teacher in a virtual class with the help of live audio and video streaming. The classes are conducted in a real-time (synchronous) environment.

Virtual learning is being chosen over instruction in traditional classrooms by most people. There are several reasons for the same, such as flexibility in virtual learning through which full-time workers who cannot attend the classroom may continue to pursue their education and is also a good option for people who enjoy self-learning. Virtual learning has an option for attending scheduled classes or one can learn at his own pace. With the latter option, one can enjoy the benefits of guided lessons along with autonomy with intensity and overall cadence. It also allows one to explore a skill or subject without any commitment to an in-person class. Short introductory courses or long in-depth masterclasses can be found on multiple subjects and skills.

Virtual learning being online is often convenient, flexible and affordable and has the option to either enroll fully online or choose to enroll for online classes as well as in-person classes. As the students do not require to commute for the class and paper waste is less, virtual learning forms an environment-friendly learning option. However, self-discipline is required for virtual learning. The environment can have an impact on the mindset. The classroom environment trains the brain to be in learning mode. Virtual learning helps to avoid distractions and focus on studies. Having a dedicated place or rotation of places for learning may help.

This book focuses on the virtual learning paradigm keeping in mind the technologies like machine learning, virtual reality, augmented reality, mixed reality, blockchain, data analytics, e-learning and education 4.0.

Neha
Department of Computer Science and Engineering
Jamia Hamdard, New Delhi, India

Pooja Gupta
Department of Computer Science and Engineering
Jamia Hamdard, New Delhi, India

Ihtiram Raza Khan
Department of Computer Science and Engineering
Jamia Hamdard, New Delhi, India

&

Gülsün Kurubacak
Faculty of Open Education
Department of Distance Education
Anadolu University, Eskisehir, Turkey

List of Contributors

Ankush Patel	Department of Computer Science and Engineering, Geetanjali Institute of Technical Studies, Udaipur, India
Archana Gupta	Kamala Nehru College, University of Delhi, New Delhi, India
Aji Prasetya Wibawa	State University of Malang, Malang, Indonesia
Anil K. S. Chauhan	Uttaranchal Institute of Management, Uttaranchal University, Dehradun, India
Bhavya Alankar	Department of Computer Science and Engineering, School of Engineering Sciences & Technology, Jamia Hamdard, New Delhi, India
B. Jesvin Bency	Department of Microbiology, Muslim Arts College, Thiruvithancode, India
B. Jesvin Veancy	Easwari Engineering College, Chennai, India
Deepak Chhabra	University Institute of Engineering and Technology, Maharshi Dayanand University, Rohtak, Haryana, India
Dedi Kuswandi	State University of Malang, Malang, Indonesia
Dinesh	Shri Vishwakarma Skill University, Haryana, India
Deepak Kumar	Manav Rachna International Institute of Research and Studies, Faculty of Engineering and Technology, Department of Mathematics, Faridabad, Haryana, India
Dinesh Yadav	Shri Vishwakarma Skill University, Palwal, Haryana, India
Ekta	Shri Vishwakarma Skill University, Palwal, Haryana, India
Freeda Maria Swarna M.	Dharthi NGO, Bangalore, India
Ihtiram Raza Khan	Department of Computer Science and Engineering, School of Engineering Sciences & Technology, Jamia Hamdard, New Delhi, India
Ishteyaaq Ahmad	Uttaranchal School of Computing Sciences, Uttaranchal University, Dehradun, India
Krishnakant Singh	Department of Civil Engineering, Chandigarh University, Mohali, Punjab, India
K. Chandrasekaran	Department of Computer Science and Engineering, National Institute of Technology, Karnataka, Mangalore, India
Mehtab Alam	Department of Computer Science and Engineering, School of Engineering Sciences & Technology, Jamia Hamdard, New Delhi, India
Mitanshi Rastogi	Vivekananda Institute of Professional Studies, Delhi, India
Mayank Patel	Department of Computer Science and Engineering, Geetanjali Institute of Technical Studies, Udaipur, India
Monika Bhatt	Department of Computer Science and Engineering, Geetanjali Institute of Technical Studies, Udaipur, India
Neha Goel	Vivekananda Institute of Professional Studies, Delhi, India
Neha	Department of Computer Science and Engineering, Jamia Hamdard, New Delhi, India

CHAPTER 1

E-learning and Teaching in the New Millennium

B. Jesvin Veancy[1,*] and **B. Jesvin Bency**[2]

[1] *Easwari Engineering College, Chennai, India*

[2] *Department of Microbiology, Muslim Arts College, Thiruvithancode, India*

Abstract: Teaching is becoming one of the most challenging professions in society as the world is changing at an exponential speed, especially during the pandemic. In the current economic scenario characterised by changes in industry advancements in the fields of artificial intelligence, intelligent robots, the Internet of Things, augmented reality, virtual reality, autonomous driving vehicles, big data and neuro-technological brain enhancements, traditional classroom coaching cannot always meet the requirements of lifelong learning. Learning has been shifted in higher education institutions (HEI) and working professionals like corporate trainers, professors and consultants need to integrate eco-friendly education. They must understand how they can correlate and put their knowledge in varied contexts according to the requirements of the industry. Traditional, blended, and virtual e-learning using modern communication technologies has an influence on the teaching-learning process in the new era which offers tremendous opportunities and reduces the cost of living. The future generation is expected to be highly trained in emerging communication technologies by learning how to use these technologies in a pedagogical context and need to appreciate the values associated with remote educational strategies. The fundamental challenge encountered by teachers is to understand the concepts of Education 4.0 and educational institutes must adapt to the demands and challenges of Industry 4.0. There is a necessity for rethinking teaching and redesigning learning to be relevant to post-pandemic learning needs and practices.

Keywords: Blended E-learning, Education 4.0, Industry 4.0, Traditional E-learning, Virtual E-learning.

1. INTRODUCTION

With today's advancement in the communication industry, educational institutions responded to the pandemic with a curriculum that has transitioned from face-to-face learning to connected mode. It is expected to influence how students adapt and the way in which learning can be converted into practice. Hence it becomes mandatory to reshape the teaching process with the impact of students and

* **Corresponding author B. Jesvin Veancy:** Easwari Engineering College, Chennai, India;
E-mail: veancy@yahoo.co.in

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teachers reworking on the learning pedagogies. E-learning is a currently emerging revolution that has replaced old classroom teaching with lifelong or remote learning. Both teachers and students access audio-visual aids on the internet that are organized by various universities worldwide and experts which include certificate programs and training. E-education can be synchronous which includes two-way communication with the participation of all learners and trainers at different places or asynchronous e-learning where real-time learning does not exist and there is on-demand delivery. The benefits include time and location flexibility with cost and time-saving (Zhang & Nunamaker, 2003). This led to a paradigm shift in higher education institutes with a transition among students and teachers from a passive mode to an independent learning environment. Thus, the design for e-teaching learning should be based on the constructivist theory where learning is based on the ability to analyse, synthesize, and evaluate information (Allah & Ghulam, 2010). The conversion from objectivism to constructivism is multidimensional and provides personal tools and social networks to engage the students by using interdisciplinary collaboration (Chirag *et al.*, 2011). By formulating Information and Communication Technology (ICT) policies with the evolution of living laboratories and modernization centres, the indigenous research gap between theory and practice was reduced. Using ICTs in higher education is a multifaceted task in development and implementation (Qureshi *et al.*, 2009). HEIs have crossed three phases of evolution like education with the use of ICTs, multimodal, and virtual. ICTs became essential tools for trainers, scholars and managers to satisfy the purpose of life-long erudition anytime, anywhere, and for anyone (Khan *et al.*, 2011). Higher education strengthened the research quality, quality of teaching and learning, and student employment by following transformational and charismatic leadership styles (Halili, 2019). The use of innovative teaching approaches with greater stratagems strengthens the power of resolving rare complications, motivates the student's intellectual activity, and encourages thorough training by integrating skill with hands-on activity. An efficient educator improves moralistic services by encouraging novel methods in the student community (Mynbayeva, 2019). To enrich the development, push-pull technology is applied as a driving force for the fourth industrial revolution (Ghobakhloo, 2020). The key elements to evaluate Industry 4.0 for organizations depend on the digitization of supply restraint, the interrelations that exist, and how future investigation should progress (Sony & Naik, 2019). The main requirements for colleges expected in Industry 4.0 include monetary planning, trained staff, an advanced manufacturing firm with advanced organization, and insightful workshops. The present industrial 4.0 change is focusedon attaining digitalization by creating a virtual world by combining digital, physical, and biological systems (Mian *et al.*, 2020). Education 4.0 was recently introduced with an extensive appreciation of Industry 4.0 in the education

division which motivates faculty development programs, seminars, and workshops that edify budding engineers with recently advanced skills of Industry 4.0. A road map is considered with three pillars that describe the enhancements to be made in the online mode in course expansion, conduction of laboratory, and club activities (Coşkun *et al.*, 2019). A lot of challenges and opportunities for higher education institutions across the world due to the COVID outbreak were faced which contributed to online learning and teaching outcomes' understanding (Mseleku, 2020). The majority of the schools and universities had barriers and difficulties like access to computing facilities at home, confidence for learners, and attitude towards computers with ICT usage (Assareh & Bidokht, 2011). Professors have to equip themselves to be good motivators by encouraging the students and providing them with the materials they need like video tutorials and Power Point presentations and knowledge to use hardware and software technologies to yield real-life output during the pandemic crisis (Cortez, 2020). Blending learning creates an appropriate balance by combining web-based courses, and electronic performance support systems, which collectively add to a meaningful learning skill (Singh, 2021). The job market has been shifted in response to new technologies like AI, highlighting the skills required for future jobs. The end result is achieved by enabling new learning experiences to enhance teaching and learning by reducing administrative overload, academics to support research, and the ability to discover new insights (Bonfield *et al.*, 2020). When teachers face administrative transformation related to a public health emergency, transparent internal communication can help inspire problem-focused control handling, reduce ambiguity, and substitute employee organization relationships. Such core practices with reduced managing tactics implementation effectively build strong relationships between organizations and employees (Li *et al.*, 2021).

2. IMPACT OF THE PANDEMIC ON TEACHING-LEARNING PROCESS

The pandemic outbreak severely affected almost all sectors every industry and personnel life, in all countries. The pandemic affected schools, colleges, universities, and offices all over the world and made every human being make the decision to shut their doors. It affected every individual from a kid too old to be aloof. Since this universal and abrupt shift in students to distance learning proved troublesome for teachers, students, and parents, transitioning online in such a short duration became very tricky, and the whole world was kind of turned upside down. The shift to online education made teachers rethink lesson plans to fit into a very different format and many were not computer-savvy. The lessons were reframed and redesigned which encouraged co-learning. Teachers fortified students to be more self-reliant in learning which may be alleged differently and appealing than conventional classroom teaching. Virtual learning has a mandatory transformation by both students and teachers to become accustomed to the new

CHAPTER 2

UGC-HRDC: Virtual Learning, Challenges, Opportunities, and Vision for the Future

Shaheed Khan[1,*], **Panch Ramalingam**[2] and **Freeda Maria Swarna M.**[3]

[1] *Research and Training, Dharthi Learning Centre, Pondicherry, India*

[2] *UGC-HRDC, Pondicherry University, Pondicherry, India*

[3] *Dharthi NGO, Bangalore, India*

Abstract: The Staff development, designing and training, learning and development (L&D) are very essential in the domain of Higher Education (HE) in India. The changing of the present day, too, have added a multitude of issues to the Higher Education Institutions (HEI). At a point in time, the Academic Staff Colleges (ASC) made the efforts to train the teachers joining the HEI, through orientation programs and engage the in-service teachers through refresher courses, which made all efforts to build the capabilities of the teaching community. The explosion in HE with the coming in of Private Universities, deemed to be Universities, Autonomous Institutions, and increase in Central Universities, ensured that the L&D for HE teachers became essential. The ASCs were established by the University Grants Commission (UGC) in 1987 and did yeomen service to the Nation and the HE teaching community after they came into existence following the recommendations of the then New Education Policy of 1986 till 2015, when they were rechristened as UGC-Human Resources Development Centers (UGC-HRDC) and continued to cater to the needs of the faculty and the administrators of HEI across the country. By 2020, the UGC-HRDCs started to roll out the Faculty Induction Programmes (FIP) in ten structural modules to help the faculty members to the newer nuances of the fast-changing dynamics of HE. The present study is a real-time assessment of the way UGC-HRDCs have taken to virtual training and adopted to the Hybrid-mode of learning for the benefit of the teaching communities and administrators. 2023 has been a watershed year for Higher Education, Teacher capacity building, with the UGC-HRDC being rechristened as UGC-MMTTC, with an intent to usher in synergy and integration between programs as envisaged by the Ministry of Education, Government of India.

Keywords: Faculty induction programme (FIP), Higher education, Higher education institutions (HEI), Staff development.

[*] **Corresponding author Shaheed Khan:** Research and Training, Dharthi Learning Centre, Pondicherry, India; E-mail: shaheeddharthi@gmail.com

1. INTRODUCTION

Covid-19, created multitude of issues across the global, it gave opportunities to learn, to usher in change, to adopt techniques and technology, to move forward teachers, though, invisible like the front-line workers, nurses, doctors, policemen, firemen, the military, journeyed on. They brought in a change; kept the children in one place and engaged them, through the online classes, the discussions, the interactions. At the Higher Education Institutions (HEI) level too, faculty members of all hues, Arts, Science, Commerce and Management, Mathematics, Tourism and Hospitality, Advertising, Dance and Drama, the languages; at times, they went beyond what normally was expected of them. Speaking about the HEI, who would try to teach the teachers in the updated frameworks, the methodology, the pedagogy, the art, and the science of classroom teaching; the University Grants Commission (UGC) had created the Academic Staff Colleges (ASC) in 1986-87 following the then New Policy on Education (NPE) of 1986 a total of sixty-six (Quadri, 2017) ASCs were set up with a prime intent of (UGC, 2007):

i. Designing Orientation Programmes (OP) for news inducted teachers of HEI and the ones already in-service,

ii. Organizing OPs and Refresher Courses (RC) for serving teachers,

iii. To encourage teachers to participate in seminars, symposia, and workshops.

1.1. The Academic Staff Colleges move to become UGC-HRDC

The ASCs had come up during 1986-87 for the professional development of teachers in higher education, conducting orientation programmes for newly-appointed teachers and refresher courses for serving teachers (Amaujala, 2013).

The objectives (UGC, 2007) of the Academic Staff College (ASC) were at the point of establishment to enable newly appointed Lecturers to:

i. An understanding of the significance of education in general, and higher education, in the global and Indian contexts;

ii. To understand the linkages between education and economic and socio-economic and cultural development, with reference to the Indian polity where democracy, secularism and social equity are the basic tenets of society;

iii. To acquire and improve art of teaching at the college/university level to achieve goals of higher education;

iv. To keep abreast of the latest developments in their specific subjects;

v. To ensure and understand the organization and management of a college/university and to perceive the role of teachers in the total system;

vi. To utilize opportunities as provided for development of personality, initiative, and creativity; and promote computer literacy as well use of ICT in teaching and learning process.

2. UGC-HRDC, THE MOMENTUM

In a multitude of ways, the ASC did not live up to their expectations of training the new inductees and providing advance training in the relevant subject of the Senior faculty members. ASCs to ensure for the teaching fraternity had organized short-term programmes for Administrators of HEIs. But an evaluation study by National Accreditation and Assessment Council (NAAC) (NAAC, 2012) rated most of the ASCs (53 out of 66) functioning below expected performance level and seven ASCs as 'non-performers', forty-five were 'under-performers' and the rest had been performing reasonably well. True for the kind of investment, the ASCs were expected to churn out better or was it that the old rust had to be cleaned. Well once the return on investment (RoI) gets questioned, then it is a matter of time that the organization will get a fresh paint and new Key Result Areas (KRA) to work with. Panda (2017) after much of research and studies maintained that the existing model of professional development through ASCs has lived its life, and that revisions with alternative formulations need to be considered. Though there was lot of resentment towards the NAAC (2012) report, the ASCs too were surprised, Krishnamoorthy (2012) reported that, "Bharathidasan University had expressed surprise over the 'quite low' score awarded by NAAC to its ASC." There was lot of heartburn among the Universities and the ASCs. However, the then Director of NAAC, H.A. Ranganath had mentioned, "the review of ASCs is not to give them a bad remark, instead the exercise has been done to strengthen them as they have a very important and pertinent role to play in the 12th plan." He further mentions, "adding the review will help policy makers in moving forward by identifying the challenges, gaps, which NAAC has come to know the strength and weaknesses, the constraints (Infrastructure and human capital) of the ASC, which will lead to quality enhancement of faculty and all stakeholders of higher education" (Jain, 2012). These developments were critical to the functioning and the existing of ASCs, because Governments of the day had to spend tax-payers money and look at the output that was happening. How would they have to ensure that the ASCs are contributing to society.

The reform was the launch of Pandit Madan Mohan Malaviya National Mission for Teachers and Teaching (PMMMNMTT) (GoI, 2015), which directly

CHAPTER 3

The Attitude of Experts in Higher Education Towards New NEP-2020

Anil K. S. Chauhan[1] and **Ishteyaaq Ahmad**[2,*]

[1] *Uttaranchal Institute of Management, Uttaranchal University, Dehradun, India*

[2] *Uttaranchal School of Computing Sciences, Uttaranchal University, Dehradun, India*

Abstract: India's educational system is poised at a fascinating turning moment, in preparation for the new National Education Policy (NEP) 2020. The NEP 2020's underlying vision is to prepare a highly educated and literate generation to appropriately assume social, economic, and political duties. The Indian Government has proclaimed that the NEP 2020 is a tool to fight poverty and satisfy the demands of the 21st century. NEP-2020 is a comprehensive framework emphasizing education from the primary level to higher education in the nation and will replace the National Policy on Education 1986. Though the Government sought inputs and suggestions from citizens, educationists, and other stakeholders on a draft of NEP, some of the stakeholders have levelled several criticisms against NEP 2020 and shown reluctance in its implementation. The present investigation aimed at assessing NEP 2020 based on the attitudes of educationists towards it and seeking valuable suggestions from them for the successful implementation of the new NEP to accomplish its objectives in a very efficient and effective way. Fishbein's multi-attribute model is used in this research to measure the attitudes of educationists in India in quantitative terms. Statistical analysis is performed on the average attitude score to judge the degree of favourableness of attitudes. Seven features that an education policy must possess are derived from the review of the inputs and suggestions given by various experts to the committee constituted by the then Ministry of Human Resource Development in June 2017 and used as attributes to apply Fishbein's model.

Keywords: Attitude, Belief, Evaluation, HEIs, NEP, NEP- Attribute linkage.

1. INTRODUCTION

In July 2020, the Union government adopted the New Education Policy (NEP), which would take the place of the National Policy on Education from 1986. The country's primary education to higher education is the focus of the new policy, which is an all-inclusive framework (Khusnnam P.N., 2022). The Indian

* **Corresponding author Ishteyaaq Ahmad:** Uttaranchal School of Computing Sciences, Uttaranchal University, Dehradun, India; E-mail: ishteyaaq@gmail.com

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Education Ministry claims that NEP will change the country's educational system— however, only if it is applied at all levels. The goal of NEP is to make education more inclusive, equitable, and accessible. The very comprehensive NEP 2020's implementation is the key challenge. To implement the changes at each level, the curriculum, pedagogy, and content must be thoroughly restructured following the NCF (National Curriculum Framework), and the content rubrics must be reviewed to modify the textbooks (Bharathi S *et al*, 2021). However, some state governments are giving negative reviews of NEP and demonstrating resistance to its implementation. The NEP's success depends on a consistent, open, and resource-equitable implementation at all levels. Only with complete coordination and collaboration between the Central Ministry of Education and HEIs can this enormous undertaking be completed. An effort has been undertaken through this inquiry to evaluate the NEP for higher education based on the perspectives of educationists in India (Ahmad, I et.al., 2017; Bairwa, S. L., 2022). The attitudes of educators will be crucial in fostering adaptation among HEIs, regulatory bodies, and governmental agencies as well as building credibility through open acts and the involvement of all stakeholders.

Seven features *viz*. Focus on interactive, exploratory, collaborative, and experiential teaching and learning approach, Focus on application-based learning, Focus on research-based internship, Focus on the student-centric model to decide the subjects of study, Focus on 360-degree assessment model, Focus on holistic & multidisciplinary education, and Focus on critical thinking, discussion, and analysis among students are derived from the review of the inputs and suggestions given by various experts to the committee constituted by the then Ministry of Human Resource Development under Chairman Dr. K. Kasturirangan in June 2017 and used as attributes of an effective NEP in general to apply Fishbein's model.

According to Fishbein's Multi-attributes Attitude Model, an individual build his/her attitude about a programme based on how he/she feels about each attribute in general and his/her beliefs about the relationship between the programme and each attribute in particular. Beliefs regarding the relationship between a program's attributes and its numerous qualities are formed by assessing the data gathered through communications about those programmes that come from other sources. The facts, individual experience in the field for which the programme is developed, and opinions held about these attributes all contribute to the construction of feelings (Important or Unimportant) for each attribute. As seen in Fig. (**1**), an individual's attitude toward a programme is thus influenced by his or her perceptions of its numerous characteristics. With the use of this model, we may calculate a person's general attitude as a number.

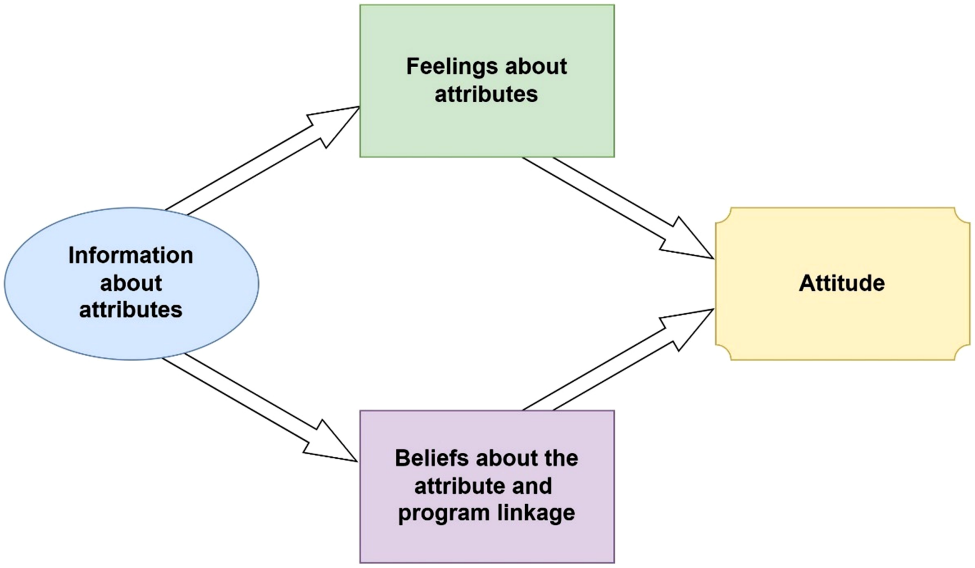

Fig. (1). Fishbein's multi-attribute attitude model.

Fishbein's multi-attribute attitude model is shown mathematically as follows:

$$Ap=i=1nEiBi$$

Where,

Ap is an individual's overall attitude score toward the program.

Bi represents the intensity of his conviction that attribute **i** is connected to the program.

Ei is the result of his assessment of the significance of attribute i.

n denotes the whole assortment of attributes or characteristics.

A five-point semantic differential scale with bipolar adjectives at the opposite extremes, respectively very important to very unimportant, is used to calculate E_i for every i^{th} attribute. Similarly, a five-point semantic differential scale with bipolar adjectives at the opposite extremes, namely very likely to very unlikely, is used to calculate B_i for the belief regarding the linkage of every characteristic.

CHAPTER 4

A National Skill Qualification Framework in India

Dinesh Yadav[1], Ekta[1], Sajan Kumar Wahi[1], Sunil Kumar Sharma[1,*] and Neha[2]

[1] *Shri Vishwakarma Skill University, Palwal, Haryana, India*

[2] *Department of Computer Science and Engineering, Jamia Hamdard, New Delhi, India*

Abstract: This chapter addresses the need for skill development with a specific focus on the National Skill Qualification Framework (NSQF). The attempt is made to streamline the core of NSQF itself for improved understanding of the concept by simplifying the application of the NSQF in organizing the educational learning outcomes in a series of levels that can be mapped with competencies for the agility of the learner in both education system and employment sector. The core objective, the significance of the NSQF in the education system, its functionality, and international experience with qualification frameworks are the main topics discussed in this chapter.

Keywords: Levels of Learning, NSQF, Skills, Vocational training, Vocational education.

1. INTRODUCTION

The Department of Economic Affairs, Ministry of Finance, Government of India *via* The Gazette of India No. 10 of Friday, December 27th, 2013 notified the details of The National Skill Qualification Framework hereafter referred to as NSQF. This chapter is an interpretation of the same notification. In this chapter, interpretations are presented concerning what is NSQF, the objectives of NSQF, the background of NSQF, the need for NSQF, international experiences, and the working of NSQF along with its framework.

1.1. The National Skills Qualification Framework: NSQF

The NSQF is a framework used for arranging educational qualifications in a sequence of levels that are specific to knowledge, skills, and aptitude. This framework ensures that these levels are in line with the competencies that a learner is supposed to acquire, regardless of the type of learning be it formal, non-formal, or informal type of learning. The NSQF not only establishes a progression

[*] **Corresponding author Sunil Kumar Sharma:** Shri Vishwakarma Skill University, Palwal, Haryana, India; E-mail: sunil.sharma@svsu.ac.in

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of levels but also allows learners to move upward and laterally within the educational system, as there are opportunities to move within vocational education and training as well as between vocational education, vocational training, general education, and technical education.

Another major function of the NSQF is to link the levels of learning with corresponding higher levels of learning in the same describing and differentiating two different levels of learning. This clarification of different levels provides a list of options that formed a strong base for skill development in the country. Mehrotra, S. K., (2020) these options include the choice for the learner to decide and possess desired levels of skill along with the movement to the job market based on a specific skill level and the option to return to the education system at the next level of learning based on his current skillset and move to the next level.

2. OBJECTIVES OF THE NSQF

In India, core curriculum, vocational, and training have traditionally operated as distinct verticals, with little collaboration between the two. As a result, candidates have been apprehensive to choose either. This creates the need to understand the objectives of NSQF, to clarify the NSQF further these are listed below.

i. To offer a place where the various Indian educational and training systems can coexist.

ii. To define a set of standards for each level based on results that are acknowledged across the country.

iii. To provide a framework for the design and preservation of progression pathways that also provide gateways to qualifications.

iv. To make it simple and efficient for people to transition between diverse fields of education and training as well as between those professions and the labor market.

v. Provides people with the choice to advance in education and training.

vi. To be acknowledged for their preceding education and experiences.

vii. Provides people with the opportunity to advance in their education and training and receive credit for their prior knowledge and experiences.

viii. Supports and improves the mobility of individuals on a national and worldwide level.

ix. To promote significant importance and comparability of Indian credentials/qualifications.

Planning Commission (2013) while these provide further support in better understanding the NSQF, it is always helpful to understand the process behind the incorporation of the NSQF which is described under the title background of the NSQF.

3. BACKGROUND OF THE NSQF

Through the National Skill Development Policy of 2009, India acknowledged the necessity for the implementation of a National Qualification system. The policy stated the framing of a framework that would support reforms in skill development and facilitate standardization, acceptable and international comparable qualifications. Since there was no Centre level authority for it, individual ministries started working towards it. Two frameworks in Fig. (**1**) were framed by the Ministry of Labour and Employment and the Ministry of Human Resource Development. These frameworks are National Vocational Qualifications Framework and National Vocational Educational Qualification Framework.

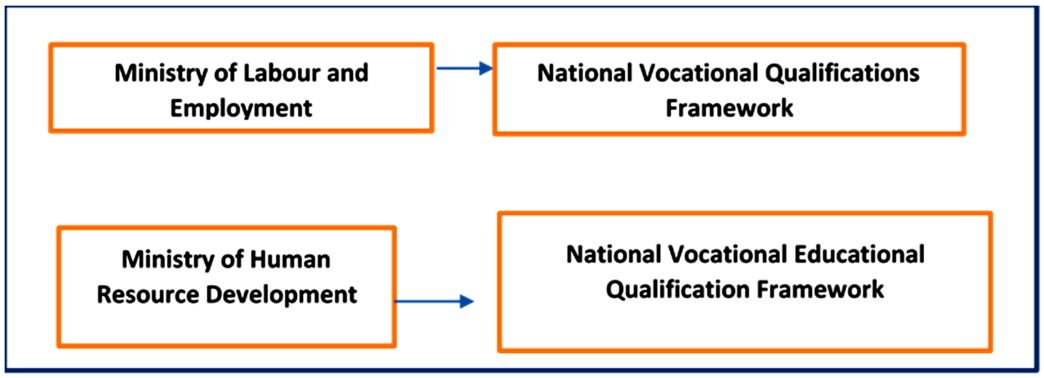

Fig. (1). Frameworks for vocational education qualification.

This formed the basis of the development of the NSQF which was developed by an inter-ministerial committee, formed by the cabinet secretariat India's NSQF was announced on December 27, 2013. The National Skills Qualifications Committee (NSQC), which is composed of all significant stakeholders, is responsible for implementing the NSQF, which is based at the National Skill Development Agency (NSDA). As per NEP 2020, each discipline, career, and profession will have its section of the National Skills Qualifications Framework. Additionally, the International Standard Classification of Occupations published by the International Labour Organization will be aligned with Indian norms. The

CHAPTER 5

Open Journal Systems as an Instructional Media for Developing Thesis Proposals During the Covid-19 Pandemic

Roni Herdianto[1,*], Punaji Setyosari[1], Dedi Kuswandi[1] and **Aji Prasetya Wibawa[1]**

[1] *State University of Malang, Malang, Indonesia*

Abstract: The development of new courses, the preparedness of instructors, and the Covid 19 pandemic have each contributed to the emergence of difficulties at universities. This research examines the possibility for Open Journal Systems (OJS), which was hitherto merely a manager of periodic electronic scientific publications, to become a new learning platform for thesis proposal development courses (TPD) during the Covid-19 pandemic. This is based on two factors: (1) the features of the OJS editorial review process that are used in the consultation process between supervisors and students; and (2) the recording function of OJS that will store assistance data along with the results of the review that are organized in a review article session that is divided into multiple sections in OJS. Students are required to be able to generate a thesis proposal and comprehend the scientific publication process, which is a requirement for graduating from their program of study.

Keywords: Covid-19 pandemic, Instructional media, Open journal systems, Thesis proposals.

1. INTRODUCTION

To prevent the development of the COVID-19 pandemic, interaction between instructors and students during the learning process is conducted online. In the past three years, numerous specialists have conducted a number of studies on the learning methodologies employed by colleges throughout the pandemic. Several studies discuss collaboration and technology in distance learning (Vale *et al*., 2021), online game-based learning (Chang *et al*., 2022), self-regulated online inquiry-based learning (Kor *et al*., 2022), online clinical education (McKay *et al*., 2022), online learning based on TAM and TPB (McKay *et al*., 2022), and online learning based on TAM and TPB (Yao *et al*., 2022).

[*] **Corresponding author Roni Herdianto:** State University of Malang, Malang, Indonesia;
E-mail: roni.herdianto@um.ac.id

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In establishing learning strategies, it is crucial to consider the choice of media to facilitate teaching and learning interactions between instructors and students. The usage of e-books (Afnita *et al*., 2021), social media (Jogezai *et al*., 2021), video-based learning (Suryandari & Singgih, 2021), video sharing platforms (Irwandy *et al*., 2021), and multimedia-based sociology education are areas of study connected to the use of learning media during the pandemic (Putrajaya *et al*., 2022).

As a result of the use of learning media during the pandemic, issues arise regarding the preparation and delivery of lectures and student involvement (O'Sullivan *et al*., 2021), the division of challenges based on individuals, institutions, and technology (Faza *et al*., 2021), the learning environment, the quality of the learning experience, and the mental health of students (Faza *et al*., 2021), and the learning environment, the quality of the learning experience, and the mental health of students (Barrot *et al*., 2021). This topic is also encountered and becomes a challenge for teachers in the thesis proposal development (TPD) course of the electrical engineering graduate program at the State Universitas Negeri Malang (Wibawa *et al*., 2018).

The TPD course is a new course (Dasna *et al*., 2020) and typically results in new issues. The first issue is the preparedness of the instructor. Although writing a thesis proposal is customary for professors, transferring knowledge to graduate students can be challenging. This course may be challenging for students with limited writing expertise (Kuswandi *et al*., 2023; Jeyaraj *et al*., 2022; Kuswandi *et al*., 2021; Paré, 2019). Another issue is the unavailability of media and instructional materials for TPD courses at Universitas Negeri Malang.

Based on the preliminary research that has been done, some of the findings in TPD learning include the following:

i. Problems with student digital literacy such as choosing inappropriate keywords, knowledge of scientific reference databases such as Google Scholar, Science Direct, Dimensions, DOAJ *etc*., using search engines for the benefit of finding scientific references, and understanding publication ethics and plagiarism.

ii. Writing skills such as poor writing structure, weak research problems, misquoting sources (there are references in the proposal content but not found in the bibliography and *vice versa*), inappropriate pictures/tables or not included in the proposal writing.

iii. Search for scientific reference sources, for example lack of knowledge about research tools and utilization of Open Educational Resources.

iv. Organizing content such as storing guidance data and sharing teaching materials in a systematic way.

v. Communication-collaboration lack of intense communication, low transfer of knowledge, less intense mentoring, not well-structured mentoring system.

Several earlier research have examined learning strategies, media, and challenges for new courses; however, there are still few studies that discuss learning media to aid lecturers' preparedness for the systematic transmission of knowledge in TPD courses. This study seeks to determine whether Open Journal Systems (OJS), which was hitherto solely a manager of electronic periodical publishing, has the potential to become a new platform for TPD courses (Herdianto *et al*., 2022). This is based on two factors: the similarity between the OJS editorial review process and the mentoring and consulting process between lecturers and students; and the accessibility of the OJS (Przybylo, 2018; Shuttleworth *et al*., 2019). The second is that the recording function of OJS will keep the guidance data alongside the review findings that are packed in the session for reviewing an article.

2. METHOD

The research was conducted at the Postgraduate of Electrical Engineering, State Universitas Negeri Malang for one semester. This activity involved one class of the Postgraduate of Electrical Engineering in the TPD course as many as 15 students. Each student was guided by lecturers and researchers while interacting with the system to write a thesis proposal in the format of a scientific article. Fig. (**1**) and Table **1** are the stages of learning carried out during 16 weeks of teaching.

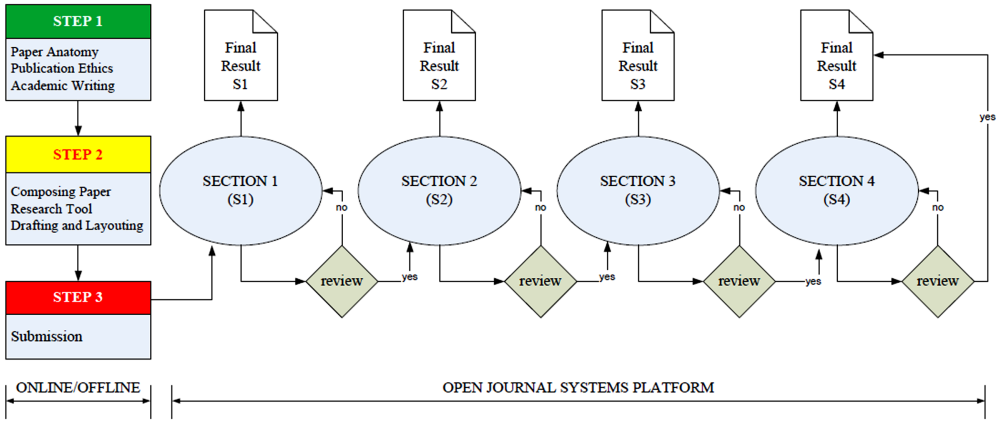

Fig. (1). The stages of the TPD course learning process using OJS.

CHAPTER 6

Bridging the Gender Gap with Virtual Learning

Krishnakant Singh[3,*], Pooja Gupta[1], Archana Gupta[2] and **Neha[1]**

[1] *Department of Computer Science and Engineering, Jamia Hamdard, New Delhi, India*

[2] *Kamala Nehru College, University of Delhi, New Delhi, India*

[3] *Department of Civil Engineering, Chandigarh University, Mohali, Punjab, India*

Abstract: Interaction between people has become a lot simpler in modern times because of the ever- widening interface between humans and technology, which itself is an outcome of the "Digital Revolution". In the contemporary scenario, access to digital information has become a basic requirement for navigating through everyday life, whether in education, security, business, or other sectors. However, even with such a broad reach, there are certain sections of the society that remain untouched by the advances in technology.

The COVID-19 pandemic and the consequent closure of educational institutions around the world left us all stranded in our homes forcing us to rely solely on a virtual environment for education, information access, and even for everyday interactions (Barrot *et al*., 2021). In this context, the already persistent issue of "digital gender bias and discrimination" re-emerged and got magnified, especially in poor and underdeveloped regions. Numerous studies and reports have highlighted how women were not treated equally and were not fully included in this new revolution, which allowed inequalities to linger on, and in some circumstances, even worsen.

This chapter presents a study that explores how virtual learning environments and education can enhance female entrepreneurship, leadership, and empowerment in today's world. The advent of digitalization, particularly in the context of the COVID-19 epidemic, has had a significant impact on how information can be accessed, processed, and transformed into knowledge-transforming these variables into critical components of economic creation and political power. In a rapidly digitizing world, it is crucial to develop multiple educational streams for varied talents, but it is even more important to ensure that women emerge as significant stakeholders in this new digital setup. Keeping this in mind, the chapter outlines the challenges that women have experienced and continue to confront in the digital world, as well as the recommendations for making the e-environment more egalitarian and progressive.

Keywords: Cyberspace, Digitalization, Digital gender divide, Equality, Virtual-learning.

[*] **Corresponding author Krishnakant Singh:** Department of Civil Engineering, Chandigarh University, Mohali, Punjab, India; E-mail: plkk3000@gmail.com

1. INTRODUCTION

Education is the fundamental pillar of a progressive society. Education creates opportunities, and is often the key to social mobility. However, gender disparities in accessibility and achievement in education are a major threat to this progress. Technology can play a crucial role in addressing this issue by enhancing education access and making it more inclusive. In this regard, virtual learning is a good example.

1.1. Why Virtual Learning

Virtual learning refers to an enhanced learning experience with the usage of computers and internet within the premises of educational institutions, and even outside. In contrast to traditional classrooms, virtual learning enables students to understand things holistically, and even gives them a window to study at their own momentum and as per their convenience which might be helpful in reducing student attrition rates as well. As Popat *et al*. discuss, the increasing demand of virtual learning because of its multiple benefits is the reason why many educational institutions are shifting towards a blended learning mode that is online, as well as offline mode (Popat *et al.*, 2007).

Virtual learning can also be very beneficial for those who are unable to attend classes physically, be it because of work, or other social and financial constraints. Digital Distance Learning would enhance the participation of the underprivileged sections who could not afford travelling long distances or altogether migrating to different cities for education. It can greatly impact women who are usually forced to quit education because of the unavailability of resources at the local level, or the homemakers who cannot manage regular education along with their responsibilities. In fact, it can also bring about a revolutionary change in the field of special education, thereby emerging as a crucial tool for the social inclusion of the disabled persons (Weller *et al*., 2007).

1.2. Virtual Learning and the Pandemic

The quick response to Covid in most countries was a lockdown, and among all, educational organizations were the first to be closed (Barrot *et al*., 2021). As a result of this pandemic, approximately 10 million girls may have been at the risk of dropping out of school. In the long term, this disparity has the potential to widen the employability gap. In that background, virtual distance learning emerged as the most suitable alternative as it saved the whole education system from reeling towards an abrupt collapse (Mathrani *et al.*, 2022). Fig. (**1**) discusses the primary and secondary factors associated with digital learning.

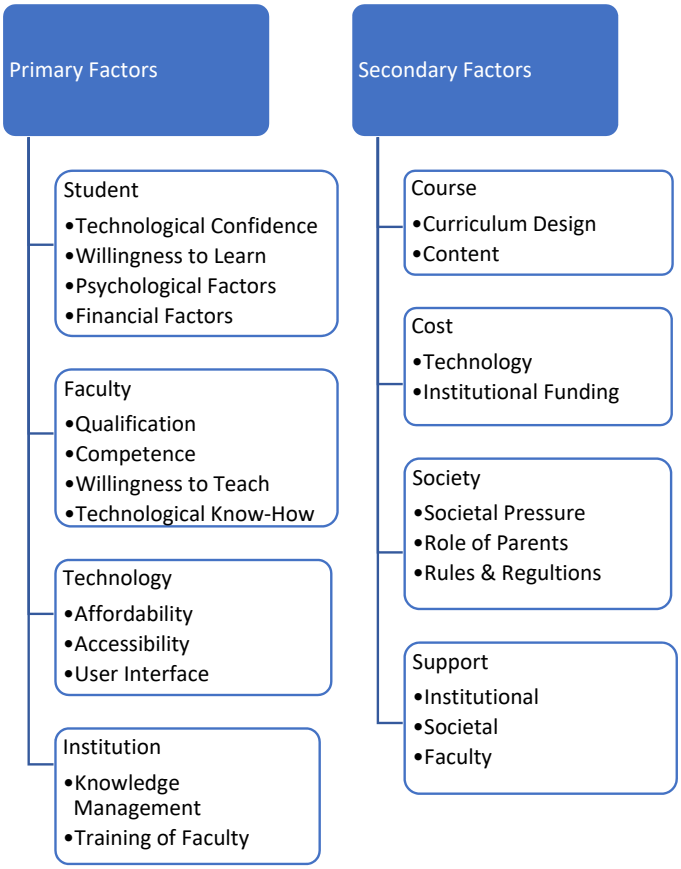

Fig. (1). Factors of digital learning.

Instead of levelling the playing field, the shift to virtual learning exacerbated the gap between the rural and urban populations, and further deepened the gender-divide. Today, India's economy is the world's third-largest, trailing only the United States and China. However, the income of households is not distributed uniformly, and this has an indirect effect on educational choices (Mishra *et al*., 2020). The digital chasm between rural and urban households is very wide because of the varying income levels, and the economic disparities will only get multiplied with time thereby further marginalising the marginalised. This could be inferred from a report from UNESCO which highlighted that around 320 million students were affected in this pandemic, and out of that, 158 million were female students (Jain, 2020).

CHAPTER 7

Demystifying the Benefits and Challenges of Virtual Learning for Differently Abled Students

Rohit Bansal[1], **Tamanna Bansal**[2] and **Nishita Pruthi**[3,*]

[1] *Department of Management Studies, Vaish College of Engineering, Rohtak, India*

[2] *Department of Management, MDU-CPAS, Maharshi Dayanand University, Rohtak, Haryana, India*

[3] *Institute of Management Studies and Research, Maharshi Dayanand University, Rohtak, India*

Abstract: Virtual technology has revolutionized the global universe into a new dimensional structure, as well as the age-old impediments of time and distance have almost vanished. Nowadays, technology plays a significant role in education as a powerful tool for accelerating the modernization of education, particularly for differently-abled students. Technology offers many new ways to reduce accessibility barriers and provide opportunities for differently-abled people to exchange information and knowledge for effective virtual learning. ICT tools and applications are paving the way for differently-abled people to access and participate in educational materials and resources in various formats. For this, there are various kinds of tools available according to the type of disability because disability can be in any form like dyslexia, Attention deficit hyperactivity disorder (ADHD), dysgraphia, physical disability, *etc*. But still, challenges are faced by disabled students during virtual learning. So, the present study proposed to study the benefits and challenges of virtual learning for disabled students. Further, the study also investigates the different tools available for different-abled students. The research is conceptual in nature and uses secondary sources for data collection which include journals, reports, newspapers, websites, books, and thesis. Current research has academic as well as practical implications as it is an addition to existing literature and helps different stakeholders like teachers, differently-abled students, and parents to participate more effectively in the virtual learning environment for disabled students.

Keywords: Disabled students, Differently-abled learners, Online learning, Virtual learning, Virtual learning tools.

1. INTRODUCTION

As per Oxford Dictionary, disability can be defined as “an impairment which can be Intellectual, limitations, cognitive, improvement, sensory, exercise or the mix-

* **Corresponding author Nishita Pruthi:** Institute of Management Studies and Research, Maharshi Dayanand University, Rohtak, India; E-mail: pruthinishita@gmail.com

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ture of all these". World Health Organization (WHO) defines Disability as a catch-all phrase that refers to disabilities, activity constraints, and participation limitations. A physical impairment is a problem with how the body works or is constructed; an activity restriction is a problem that a person has carrying out a task or action; and a participation restriction is an issue that a person has participating in everyday activities. Thus, disability is a complicated phenomenon that arises from the interaction between a person's physical characteristics and those of the society in which he or she lives. In India, 2.68 crore people were counted as "disabled" in the 2011 Census, which represented 2.21% of the country's 121 crore population. 56% of people with disabilities were men, and 44% were women.

An individual may have a disability in seeing, hearing, speech, and movement, or may have mental retardation and mental illness. Classification of persons with different abilities as per the census 2011 is given in Fig. (**1**).

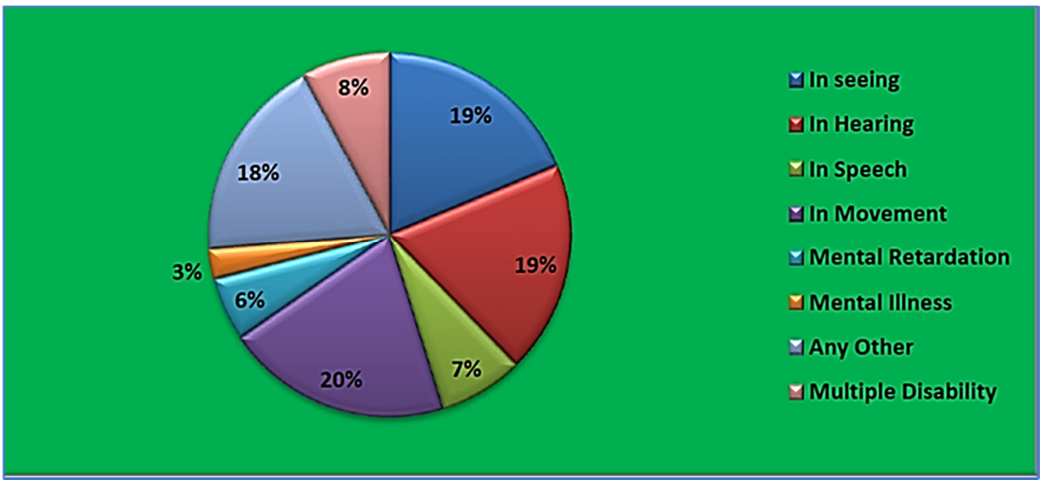

Fig. (1). Classification of persons with different abilities (Mishra, 2019).

Graph in Fig. (**1**) reported that 20% of people have a disability in movement followed by 19% in seeing or hearing while 8% of individuals have multiple disabilities. As reported by the Ministry of Statistics and Programme Implementation in 2019, among persons with disabilities of age 15 years and above, 19.3% had the highest educational level as secondary and above. As per the report by UNESCO, One-fourth of disabled children between the ages of 5 and 19 and three-fourths of those under the age of 5 do not attend any type of educational institution.

Distance learning has been used for a long period of time to keep in contact with students and share resources globally. Online learning is the most recent in a long series of social technologies that have been developed to enhance distance learning through numerous augmentations, substitutions, or fusions of innovative learning techniques and technologies.

Online learning has grown significantly as a result of the academic and technological convergence that has allowed students to acquire new skills. Ever since COVID-19 global epidemic, online education has taken centre stage in people's lives. The epidemic has forced businesses, academic institutions, and other organizations to operate remotely, which has increased the demand for online education. The benefits and drawbacks of virtual learning are still debatable. This topic becomes even more debatable in the case of students with disability.

Thus, this chapter aims at discussing the following objectives:

i. To study the benefits of virtual learning for differently abled students.

ii. To study the challenges of virtual learning for differently abled students.

iii. To investigate the different tools available for differently abled students.

2. RELATED STUDIES

Supratiwi *et al*, 2021 describe the difficulties that special education teachers encountered when delivering distance learning to children with exceptional needs during the COVID-19 pandemic. Ali, 2021 highlighted primary implementation challenges, the professor's opinion of e-learning for SWDs, and the actions that can be made to enhance the application of online learning in universities' special needs departments. Zongozzi, 2020 examined the obstacles impeding accessible, high-quality higher education for students with disabilities in Open Distance and e-Learning (ODeL) institutes in South Africa. Smith, 2020 collected data from school psychologists, speech therapists, occupational therapists, and special education teachers to assess the opportunities and challenges of virtual learning. Ferrell *et al*, 2020 analysed the benefits and drawbacks of emergency remote learning using lessons learned from COVID-19. Several technological, pedagogical, and social challenges were identified. Policar *et al*, 2017 discussed the benefits of adopting online learning for disabled students and concluded that "accessibility" is the top most benefit that attracts students with disability towards online learning. Paramasivam *et al*, 2022 stressed the mental and emotional challenges faced by differently-abled students during online classes.

CHAPTER 8

Recent Trends in Virtual Teaching

Neha Goel[1] and **Mitanshi Rastogi**[1,*]

[1] *Vivekananda Institute of Professional Studies, Delhi, India*

Abstract: The sudden outbreak of Coronavirus has impacted almost everyone. The education sector has seen a major transformation. The pandemic introduced the world to the concept of Virtual Education. As per the survey conducted by UNESCO, in 2020 around 1.07 billion students were affected due to this corona outbreak which affected approx. 61% of the student population globally. From traditional brick-and-mortar schools, students started shifting to this new mode of learning. Video conferencing, social media, *etc*. became new venues for the creation of knowledge. Not only students but even skilled professionals started this online platform to upgrade themselves. The pandemic has completely replaced traditional teaching pedagogies with trends like participative learning, experiential learning, and problem-solving methodology. This blend of device-based and verbal learning will help in developing the cognitive ability of the students to a remarkable level. Forbes estimates that the size of the global e-learning market would rise from $165.36 billion in 2014 to $325 billion in 2025. To keep ourselves abreast with this world of online education, a few trends need to be highlighted. Trends like Artificial Intelligence, Microlearning, Gamification, Blockchain, Mixed reality, and Personalized Learning will influence how students learn now and, in the future. Also, it raises the completion rates of courses, streamlines the process of learning, improves productivity, and boosts the satisfaction of the user. This chapter will be focusing on these trends and how these trends are impacting the entire community of online learners with reference to real-life examples. By making use of these innovative trends' user experience can be enriched and immersive environments can be created.

Keywords: Artificial Intelligence, Blockchain, Gamification, Mixed Reality, Personalized Learning.

1. INTRODUCTION

The education sector has seen a paradigm shift after the sudden outbreak of the pandemic Coronavirus. In the earlier scenario, the concept of education was confined to the typical brick-and-mortar classrooms. However virtual teaching has introduced people to the concept of anytime anywhere teaching. Virtual teaching

* **Corresponding author Mitanshi Rastogi:** Vivekananda Institute of Professional Studies, Delhi, India; E-mail: mitanshi.rustagi@vips.edu

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allows the reproduction of the organization's resources in different physical spaces. The impact of Covid changed the education landscape completely. Virtual education became the need of the hour. This transition from Offline to Online was not easy. It was challenging for both teachers as well as students. India experienced almost 250 million students affected because of the lockdown imposed due to COVID-19 (Ramaswamy, 2021). A sudden rise in the dropout of students and learning loss was seen among the students. Prior to Covid people hardly used studied online. But COVID acted as a catalyst in this digital adoption (Li & Lalani, 2020). Not only in India but across the globe people started this teaching-learning process online. But before going deep we must first familiarize ourselves with what exactly we mean by virtual teaching. The term virtual teaching signifies a learning environment that is created online rather than offline. Everything else remains the same, the teacher, the student, interaction amongst the participants, communication, collaboration, and other activities. The only difference is that it is conducted Online. With the concept of online or virtual teaching, several myths are seen like it is not as effective as traditional classroom teaching, lack of human interaction, and many more. However, this is not true. If we talk about no physical interaction, we might be correct, but lack of interaction is not correct. Online or virtual teaching gives student's enormous opportunities wherein the students can get engaged in comparison to time-strapped classes (Bhardwaj, 2021).

Virtual learning frequently refers to online settings but encompasses a much wider range of activities. We shall go through its definition, trends, impacts, advantages, and limitations in this chapter. We've also compiled a list of the most popular virtual learning formats for you that covers the various facets of the teaching and learning process. To successfully engage students, virtual teaching focuses on four key segments, with the theme of online and digital learning permeating the entire program:

i. How can I create a plan for online active learning?

ii. What online resources can I utilize to include students during live sessions and beyond?

iii. What digital tools can I utilize for feedback and assessment to encourage meaningful learning?

iv. How can I include all students in my lessons?

Virtual learning allows the user to enhance their learning experience with the help of technology. It makes use of technology and the internet for delivering content. Here the teacher and learner are physically separated. The learning can take place

synchronously (side-by-side or live lectures) or asynchronously (in the form of recorded lectures). Virtual learning is said to be based on modern educational theories like Behaviourism, Cognitivism, and Social Constructivism.

i. Behaviourism: The study of behaviourism looks at how learners behave. It emphasizes how students react to various stimuli. When the stimuli are repeated, the teacher can monitor, manage, and change each student's unique behaviour. Learners follow instructions and are only prepared to automatically carry out duties and repeat fundamental facts. The mind or cognitive processes are not examined by behaviourism. Guided video tutorials, game-dependent exercises, regular and productive assessments, quizzes, and other methods can be used to implement virtual learning behaviourism.

ii. Cognitivism: The focus of cognitivism is on how the mind and cognitive processes contribute to learning. It outlines the stages of cognitive growth that serve as the basis for learning as well as how the brain works. Studies on cognitivism aid teachers in better comprehending how students learn and how to improve their teaching methods. Cognitive theory can be used in virtual learning through adaptable and personalized learning systems, AI, learning analytics, *etc*.

iii. Social Constructivism: Teaching and learning are explained as complex interactive social phenomena that take place between teachers and students. Learning activities focus on experience sharing, teamwork, and collaborative learning. Peer-group exercises, buzz sessions, problem-oriented learning, and group debates are all excellent venues for applying social constructivism.

The most common form of Virtual Teaching examples includes MOOCs, boot camps, and Online courses.

Massive Open Online Courses (MOOCs) are online courses in which anybody can sign up and take part. They are designed for open access and widespread participation by all students online. Students receive the study materials in digitized form and videos since it is an online course. Assignments and weekly study materials are made available to students who have registered for the courses. MOOCs facilitate students for self-learning. Nptel, Coursera, Udemy, NIELIT, and edx are a few examples of platforms available.

Another type of course that can be taught online using virtual classrooms is boot camps. In-person or online boot camps are available for web designing, graphic designing, data mining, and among many other topics, and they give students specialized instruction and training in the field they want to enter or grow in. Consider Thinkful, General Assembly, and Galvanize as suppliers of boot camps.

CHAPTER 9

Blockchain Technology in Education

Shobha Tyagi[1,§,*], **Shobha Tyagi**[1,§] and **Deepak Kumar**[2]

[1] *Manav Rachna International Institute of Research and Studies, Faculty of Engineering and Technology, Department of Computer Science and Engineering, Faridabad, Haryana, India*

[2] *Manav Rachna International Institute of Research and Studies, Faculty of Engineering and Technology, Department of Mathematics, Faridabad, Haryana, India*

Abstract: As a decentralised platform, blockchain may be used by educational organisations to exchange details about online courses and programmes, as well as by students to rate what is offered online. This will aid in the discovery of accredited programmes that will help other students enhance their education. The management of academic records as well as how students and teachers collaborate have the potential to be significantly changed by blockchain. Blockchain's distributed ledger technology can significantly improve the transparency and accountability of the education sector. Numerous aspects of education could be impacted by blockchain, including keeping student information, awarding certifications and diplomas, storing papers, and developing curriculum and courses. Smart contracts can be used to create exam papers, and blockchain-enabled technology can be applied to evaluation as well. In the Gartner study, approximately 50% of respondents from the higher education sector expressed a lack of interest in using blockchain. This opposition may be mostly attributed to the challenges of technological integration, such as worries about security, scalability, adoption rate, and cost. In this chapter, the function of blockchain in the educational space is examined, along with all of its applications and difficulties.

Keywords: Blockchain technology, Distributed ledger technology, Higher education, Online learning, Smart contract.

1. INTRODUCTION

Bitcoin and other digital currencies are most usually associated with blockchain. Since data input on a blockchain is stored in chronologically linked blocks, it is rather easy to determine the data's provenance and verify its accuracy. The working of cryptocurrency blockchain is depicted in Fig. (**1**). These qualities, along with the technology's decentralised nature, have led to its adoption by a

[*] **Corresponding author Shobha Tyagi:** Manav Rachna International Institute of Research and Studies, Faculty of Engineering and Technology, Department of Computer Science and Engineering, Faridabad, Haryana, India;
E-mail: shobhatyagi.fet@mriu.edu.in
[§] These are two different authors having similar names

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number of industries, most notably the financial one. The International Data Corporation projects that by 2023, global spending on blockchain technology will have increased from more than $4 billion to more than $14 billion.

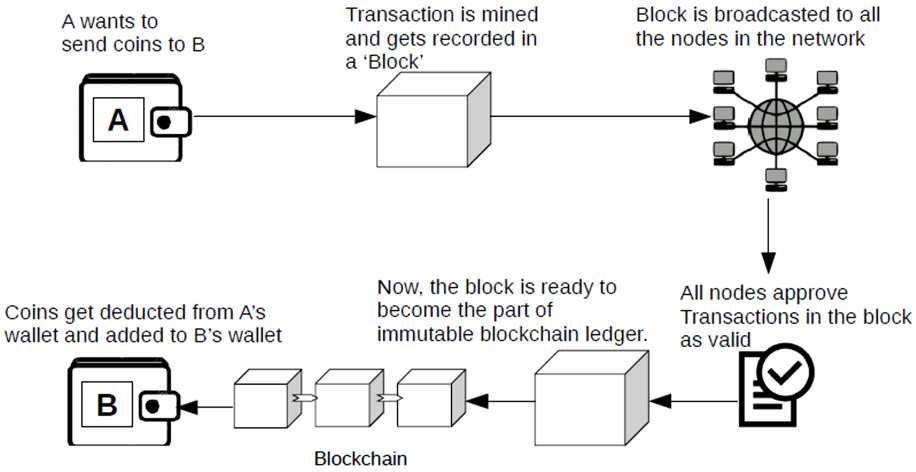

Fig. (1). Working of cryptocurrency blockchain.

Blockchain technology has four characteristics from a technological standpoint: decentralization, traceability, immutability, and monetary qualities. Decentralization describes the distributed system-based procedures for data verification, storage, upkeep, and transfer on blockchains. In this structure, rather than relying on centralized organisations, the trust between distributed nodes is established by mathematical techniques. Working of cryptocurrency blockchain is depicted in Fig. (**1**). As a result of the cryptographic hash function, a block is linked to two neighbouring blocks and on a blockchain, all transactions are organised chronologically. As a result, every transaction can be tracked by looking at the block data connected by hash keys.

In other words, any blockchain network has some kind of cryptocurrency attribute. Blockchain technology and cryptocurrencies go hand in hand. Because point-to-point transactions, in which there is no involvement of a third party, are at the core of blockchain technology, there is no need for third parties to be involved in any transactions. The blockchain-based digital currency is fixed circulation. Since Bitcoin's currency base is expressly set at 21 million caps, its creation is limited by a predetermined formula and produced through a specific mining technique. So, neither inflation nor a collapse nor anything else will be a concern. Governmental, educational, and financial functions can take on the properties of money when merged in Blockchain 2.0 and 3.0 applications (Tschorsch and Scheuermann, 2016).

The four technological aspects of the blockchain outlined above have various benefits, which are listed below:

i. *Reliability:* All transaction records are held on open, distributed ledgers hosted by thousands of nodes rather than closed, centralised ledgers controlled by a small number of accredited organisations since a blockchain network is decentralised. The operation of the network as a whole is unaffected by the collapse of a single node. As a result, the high dependability of blockchain-based systems is ensured and a single point failure is no more a problem.

ii. *Trust*: Additionally, trust is decentralised through the blockchain network. The blockchain network with decentralised ledgers substitutes the centralized trust that may be taken for granted, like central governments issuing money and commercial institutions. These ledgers are dispersed throughout a network of tamper-proof nodes (Underwood, 2016).

iii. *Security*: The one-way hash function is a mathematical technique used by the blockchain network to transform a text input with a variable length into a binary sequence with a predetermined length. There is no obvious connection between the input and the output. Because the input cannot be determined from the output alone, the process is difficult to reverse (Yli-Huumo *et al*., 2016). Additionally, the freshly created block strictly follows time in a linear fashion.

iv. *Efficiency:* Pre-determined techniques are automatically applied to all data. Therefore, blockchain technology has the potential to both significantly reduce labour costs and boost productivity. Blockchain 1.0's digital currency uses distributed ledger technology to automate settlement in large part. Blockchain technology may speed up some financial transactions by removing middlemen and streamlining the reconciliation process (Wang *et al*., 2016).

Education has been impacted by blockchain in a number of different fields. During the epidemic, the education industry quickly reacted to digitalisation. With its strong attributes like transparency, immutability, accessibility, and accountability, blockchain technology has the potential to further revolutionise this industry. By expediting the verification process and using blockchain to issue degrees, higher education institutions can conserve time and resources. Due to the greater security that comes with keeping information on a blockchain as shown in Fig. (**2**), it would be harder for candidates to falsify their academic credentials, providing confidence that new recruits have the skills necessary to succeed in the workplace.

CHAPTER 10

Applications, Challenges, and Possibilities of Blockchain in Education

Ihtiram Raza Khan[1,*], Tabish Mufti[1], Saman Aisha[1] and **Mehtab Alam[1]**

[1] *Department of Computer Science and Engineering, School of Engineering Sciences & Technology, Jamia Hamdard, New Delhi, India*

Abstract: Blockchain is a groundbreaking innovation and has been incorporated into education lately. Blockchain has acquired significant consideration from analysts and specialists. This is primarily because of its exceptional elements including decentralization, security, unwavering quality, and data preservation. Despite this growing interest, some significant information was available regarding the use of blockchain innovation in education as well as a growing awareness of the current status of information. It revolves around three principal topics: The potential of blockchain innovation to deliver constructive changes to education, as well as the challenges it poses, has been demonstrated with several informative learning applications. It additionally offers an understanding of other instructive regions that could profit from blockchain innovation.

Blockchain is the innovation that can prompt critical changes in our learning climate and will incredibly affect the years to follow. Blockchain technology is designed to provide a decentralized and secure way to record and verify transactions or data across a network of computers. Its key features include Decentralization, Immutability, Transparency, Security, and Trustworthiness. Thus, this review endeavors to examine and investigate favorable as well as challenging factors used in Blockchain Technology for current or future utilization. Accordingly, countless distributed examinations were thoroughly investigated and dissected depending on their commitments to the Blockchain's assemblage of information.

Keywords: Blockchain, Decentralized, Education, Application, Security.

1. INTRODUCTION

Today, in an ever-increasing and expanding world, technology is advancing at a rapid speed. Cryptographic networks have been around for quite some time. The nascent technology blockchain is being extensively explored. A blockchain

* **Corresponding author Ihtiram Raza Khan:** Department of Computer Science and Engineering, School of Engineering Sciences & Technology, Jamia Hamdard, New Delhi, India; E-mail: erkhan2007@gmail.com

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facilitates recording transactions in a business network and tracking assets through an immutable, shared ledger (Nofer *et al* 2017). Every 10 minutes, a new block of blockchain is solved.

Blockchain was initially employed as a shared ledger to record Bitcoin cryptocurrency transactions (Alam and Khan, 2021). Its primary goal was to eliminate the need for intermediaries and enable users to conduct transactions directly. To achieve this, blockchain was structured as a decentralized network of peer nodes. Each node within the network (Suyambu, Anand, and Janakirani, 2020).

i. Maintains a duplicate of the exchanged record.
ii. Records an entry in its ledger upon receiving consensus from other nodes in the network.
iii. Shares any transaction made by its user with other nodes in the network.
iv. Regularly verify that the ledger it possesses matches those across the network.

Blockchain's novel capacities including changelessness, straightforwardness, and reliability were viewed as valuable in digital currencies as well as in numerous different fields. Following its release, blockchain-based applications were developed in a wide range of fields. Version 1.0, 2.0, and 3.0 of blockchain-based applications can be categorized into three groups. Blockchain 1.0 was utilized for cryptographic forms of money. Its prime aim was to work with basic money exchanges. Along these lines, Blockchain 2.0 was presented for properties and shrewd agreements. Before enrolling them in the blockchain, these agreements make explicit conditions and models necessary. Enrolment takes place without the involvement of a third party. In Blockchain 3.0, numerous applications were created in different areas like government, training, well-being, and science.

There are different types of Blockchains based on their usage and specific credits (Aras and Kulkarni 2017):

i. Public blockchains
ii. Private blockchains
iii. Consortium blockchains

Public blockchains are generally decentralized and permit anybody to join the network and participate in overseeing it. Private blockchains just welcome individuals from a solitary association who can join the network and oversee them. consortium Blockchain also referred to as “Bound together Blockchain,” includes both public and private Blockchains. Invited people from various affiliations are allowed to join this Blockchain. These blockchains are portrayed exhaustively later in this paper. Blockchain's significance across various domains

stems from its key attributes: decentralization, transparency, robust control framework, immutability, auditability, resilience against failures, and security. When building a blockchain, organizations must first define the specific problem they aim to solve. Subsequently, they need to determine the transactions or interactions the blockchain will record and carefully manage access rights to ensure appropriate parties have access to relevant data.

Dealing with the student's records such as gathering, managing and distributing them is the most tedious issue in the educational sector.Education faces significant challenges concerning cheating, alterations, and managing financial transactions between students and staff. The multitude of research areas aimed at supporting students has notably expanded in recent years, with numerous papers outlining their relevance within the educational system, as illustrated in Fig. (**1**).

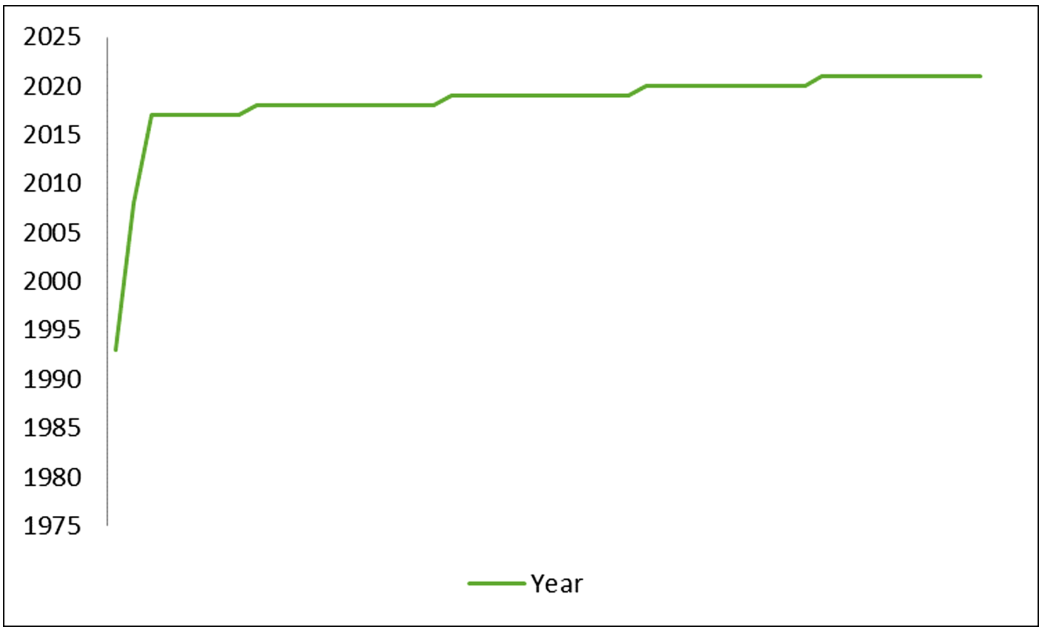

Fig. (1). Number of research papers on "Blockchain in Education" over the years.

1.1. Attributes of Blockchain

Blockchain has the accompanying key attributes:

i. Decentralization: It tends to be divided into three categories: structural, political, and legitimate decentralization (Dwivedi *et al* 2019).
ii. Transparency: Transactions are visible to all participants in the network, enhancing trust and accountability.
iii. Immutability: Data, once recorded, cannot be altered or deleted, ensuring a

CHAPTER 11

AR/VR Virtualisation of In-Class Academic Activities

Mayank Patel[1,*], **Monika Bhatt**[1] and **Ankush Patel**[1]

[1] *Department of Computer Science and Engineering, Geetanjali Institute of Technical Studies, Udaipur, India*

Abstract: The Fourth Industrial Revolution, 4IR, or Industry 4.0, conceptualizes rapid changes in technology, industries, and social patterns and processes in the 21st century due to increasing interconnectedness and smart automation. This phase of industrial change is a fusion of technologies such as artificial intelligence, gene editing, virtual reality, and advanced robotics that are blurring the lines between the physical, digital, and biological worlds. In the future, the most in-demand skills will not only be related to technology but there will be a huge demand for creativity, emotional intelligence, critical thinking, and interpersonal skills. Traditional formal education systems can no longer respond to the most important expectations of smart cities and related societies. Students can no longer be prepared for the future with linear knowledge-based education, much less to compete with robots. Virtual reality has been around for over half a century. We further present and compare a large number of recent virtual reality technologies and discuss their potential to overcome several challenges identified in our analyses, including cost, user experience, and interactivity. If we implement virtualization in classroom activities, then it enhances the learning ability of students. The human brain, as we now know, retains information more effectively when it sees, hears, and visualizes it in its entirety as opposed to just reading it. So, by implementing V.R. in the education sector, we will try to provide visualized practical learning simultaneously with theoretical knowledge. Students are more engaged in their studies when they visualize the academic material, and this will benefit society by producing valuable human resources.

Keywords: Augmented reality, Artificial intelligence, Analysis of variance, Virtualisation.

1. INTRODUCTION

Industry 4.0 transforms the concept of production tactics, and advances and releases its products (Anderson 2002).

* **Corresponding author Mayank Patel:** Department of Computer Science and Engineering, Geetanjali Institute of Technical Studies, Udaipur, India; E-mail: mayank999_udaipur@yahoo.com

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Manufacturers are working on new technologies consisting of cloud computing and analytics, Internet of Things (IoT) and AI and machine learning to become familiar with their manufacturing operations and workings (Barbe *et al*., 1998).

These advanced factories are embedded with sensors, embedded software programs and robotics that collect and use data for better work and enable higher selection as shown in Fig. (**1**) (Bellamy and Warren 2011). Even more value is created when insights from manufacturing operations are combined with operational records from ERP, supply chain, and other enterprise systems. These virtual technologies lead to advanced automation and predictive maintenance, self-optimizing method enhancements, and especially unique phase of quality work and client integration that was not earlier possible (Benton *et al*., 2013). The development of high-tech factories gives a prime chance to the manufacturing enterprise to enter into the Industry 4.0 revolution. Looking into the huge records gathered from plant-level sensors provides actual on-time visibility of production units and can offer tools to implement predictive protection if you have the desire to decrease system downtime. The use of IoT gadgets in advanced factories provides better productivity and better convenience (Bloom *et al*., 1956).

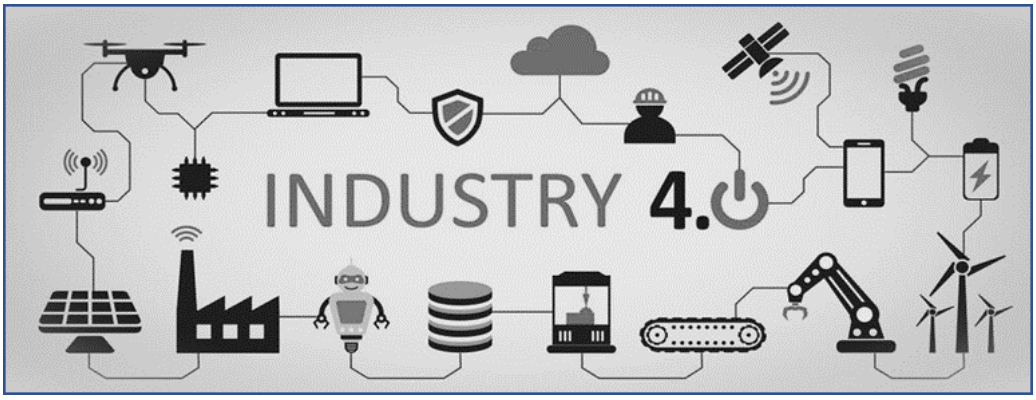

Fig. (1). Industry 4.0 technologies.

With a small amount of funds, quality handling staff can install a cloud-related phone and honestly check manufacturing procedures from anywhere. By making use of device recognition algorithms, manufacturers can find errors immediately, instead of at later levels, while restoration of paintings is extremely expensive. The working and core values of Industry 4.0 can be implemented throughout all types of industry groups and discrete and procedural manufacturing, as well as oil and gas and other industry segments. Augmented reality, virtual reality, and artificial intelligence are also part of Industry 4.0 (Menaria, Nagar, and Patel 2020). These technologies play a huge role in many industries. Some of these

technologies make many tasks possible for humans that were not normally possible, like predicting the risk of doing any adventurous task without performing it in real life.

1.1. Introduction to Artificial Intelligence

Artificial intelligence is the simulation of human intelligence techniques and the usage of machines, in particular laptop systems. AI programs consist of professional systems, Natural Language Processing, speech recognition, predictive systems, *etc*. (Cook and Woods 1996).

Artificial Intelligence systems operate on a large scale by analysing large amounts of classified educational data. Analysing patterns and correlations in those data helps us anticipate future states (Gaytan and McEwen 2007). In this way, a photo recognition system can learn to identify and describe objects in images, and a chatbot that is fed examples of textual chat content material to create meaningful exchanges with people (Goetz *et al* 2006).

AI programming specializes in three cognitive skills: learning, reasoning, and self-correction.

AI is applicable in many fields, we'll easily see it in our day-to-day life. A few fields are:

i. AI in healthcare
ii. AI in business
iii. AI in education
iv. AI in finance
v. AI in law
vi. AI in manufacturing
vii. AI in banking *etc*.

1.2. Introduction to AR-VR

1.2.1. Virtual Reality

Virtual reality refers to a computer-generated environment that mimics a three-dimensional world and allows users to explore and engage with it in a manner that is similar to reality as perceived by their senses. To interact with this environment, users may also need to wear goggles, haptics gloves, headphones, or helmets. Users are more likely to accept a virtual reality (VR) environment as real where they can immerse themselves (Izard *et al*., 1974; & Kay 2011). The video game industry has been a major sponsor of this technology. The area has a substantial number of users who are inclined to invest capital to improve the experiences.

CHAPTER 12

Integration of Information and Communication Technologies in Mechanical Engineering

Dinesh[1], Neha[2], Deepak Chhabra[3], R.K. Garg[4], Rajkumar Yadav[5] and **Sunil Kumar Sharma[1,*]**

[1] *Shri Vishwakarma Skill University, Haryana, India*

[2] *Department of Computer Science & Engineering, Jamia Hamdard, New Delhi, India*

[3] *University Institute of Engineering and Technology, Maharshi Dayanand University, Rohtak, Haryana, India*

[4] *DCRUST, Murthal, Haryana, India*

[5] *Indra Gandhi University, Meerpur, Haryana, India*

Abstract: This chapter addresses how information and communication technologies (ICT) can be used in industrial engineering and manufacturing, as well as how Web and Agent Technologies can be used to maintain and monitor the status of mechanical and electrical systems. Condition monitoring in the manufacturing sector demands great competence and full potential. This prompted the adoption of distributed and artificial intelligence technologies for condition monitoring in the industrial sector. ICT integration with the mechanical industry has been more efficient as decision support tools subsequently. This chapter outlines the integration, maintenance, diagnostic, and prognosis uses of ICT technologies in manufacturing and other industries.

Keywords: Artificial intelligence, ICT, Monitoring, Maintenance engineering, Mechanical industry.

1. INTRODUCTION

Information and communication technology (ICT) is the field that employs electronic devices to communicate, process, store, generate, display, or exchange data. It has been in use for a long time. ICT is an extended form of information technology. It is a broad area that focuses on the integration of telecommunication with necessary software and optic systems which enable the user to control, store, and transfer the data. ICT receives and processes the signals electronically and

[*] **Corresponding author Sunil Kumar Sharma:** Shri Vishwakarma Skill University, Haryana, India; E-mail: sunil.sharma@svsu.ac.in

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communicates to the user accordingly. Since "the concepts, methods, and applications involved in ICT are constantly developing on an almost frequent basis", there is no precise definition of ICT.

1.1. Origin and Development of ICT

The collection and usage of information for a specific purpose are as old as human society and civilization. In primitive society, the primitive way of collecting and recording information was to collect it orally store it in the memory, and then transmit it orally to the user. The development of paper and ink is considered a breakthrough in ICT. ICT was developed after the advancement in various technologies and in telecommunication technology.

1.2. Flow Process of ICT

1.2.1 Formulating Information System: An important objective of information and communication technology is to formulate the information system for scientific collection, storage, and dissemination of information so that users can have easy access to scientific facts.

1.2.2 Interpretation of Information: To help the persons in proper understanding and interpretation of the information in its true and original form is another important objective.

1.2.3 Information Processing: To assist the users in the information processing manually or with the help of computers.

1.2.4 Using Information: To help the users make effective use of information for bringing desirable changes in their behaviour and developing their decision-making problem.

1.3. Objectives of ICT

i. To develop a moral and ethical approach using technology.
ii. To encourage students to use electronic research techniques.
iii. To make the students use technology to investigate and solve problem-solving problems.
iv. To encourage the students to critically assess information that occurs through technology.
v. To make the students and teachers alike consumers of mass media and electronic information.
vi. To encourage students and teachers alike to access, use, and communicate information through sophisticated technologies.
vii. To inculcate the habit of seeking alternative viewpoints.

2. ICT AND MECHANICAL

In the present scenario, research on elegant manufacturing utilizing ICT has improved extensively and interest has been given to sensors, artificial intelligence, and industrial data analytics as core technologies. Artificial intelligence is a major technical element in smart manufacturing processes and methods. Engineering design is a specific field with extra and relevant features of ICT. ICT helps design highly complex mechanical and physical systems like power trains, vibration tools, aircraft products, nuclear industry tools, kinematic chains, and monitoring instruments. With the help of ICT software, new products can be tested without the fabrication of expensive prototypes and the use of visualization technology. CAD is a famous tool for designing products. With the help of CAD, any curves and figures in 2D and 3D can be designed. ICT acts as a virtual enterprise and a multi-agent networking system in manufacturing engineering.

In the training of engineering design, growth plays an important role in the needs of the manufacturing sector and the speedy advancement of ICT in this sector. Now market demands an engineer, who has expertise in the technical field along with enough knowledge of software like MATLAB, CAM, ANSYS, and CAD, and their functioning with limitations. The development of the industrial products of the mechanical engineering branch heavily depends on ICT to get the maximum profit from this technology.

Nowadays, life is fabricated by the emergent growth and progression of technologies. Live Technology is touching every aspect of human life.

ICT is a huge term that includes communication devices cellular phones, wireless, TV, LED, PC, software, hardware, geostationary satellites, and assorted inspections, and repairs. Audio, and video conferencing from distant people within seconds is also possible with the help of ICT. ICT is widely applied in several industries like manufacturing, aerospace, education system, *etc*. Some studies have discussed the benefit of utilizing ICT in education, for instance, Wims, P., & Lawler, M. (2007) found that exposure to computers in schools influenced the career options of previous students Winslett, G. (2014) stated the role of ICT in the education system, social system, and management system. With the help of videos and audio lectures, a revolution came in the education system. Jaffer, S., Ng'ambi, D., & Czerniewicz, L. (2007) also suggested that ICT can take on several roles in giving instruction. To introduce the role of ICT in the whole progress of education, internet availability is one primary aspect. In case of mechanical or manufacturing sectors, web and agent information and communication technologies played an active role in the maintenance of the system and its monitoring. In production sectors, experts do not permit condition

CHAPTER 13

Machine Learning and Data Analytics in m-Health from the Perspectives of Public Health System

Vaibhav Pratap Singh[1], Siddhartha Sankar Biswas[1,*], Bhavya Alankar[1], Safdar Tanweer[1], Prashant Vats[2] and **Sayar Singh Shekhawat[2]**

[1] *Department of Computer Science and Engineering, School of Engineering Sciences & Technology, Jamia Hamdard, New Delhi, India*

[2] *Department of Computer Science and Engineering, School of Engineering Sciences & Technology, Manipal University Jaipur, Jaipur, India*

Abstract: Digital health-based medical technology (m-health) uses mobile phones and other patient monitoring equipment to keep tabs on a patient's health. It is largely acknowledged as an important modern-era technological accomplishment. Traditionally, big data analytics and intelligent machines have been used in m-health to provide far more productive medical coverage. Current therapeutic research utilises a variety of data types, including electronic health records (EHRs), diagnostic images, and professional language that appear to be disparate, unclear, and disorganised. In addition, it makes a substantial contribution to the emergence of a large number of unstructured and jumbled data sources as a result of mobile platforms and healthcare infrastructure. The use of machine intelligence and big data analytics to enhance the m-health infrastructure is thoroughly examined in this chapter. Additionally, various machine learning big data approaches and platforms are studied to the data source, methodology used, and application area. The overall findings of this study will undoubtedly affect the creation of techniques for processing m-health data more easily utilising a resource that incorporates big data and AI.

Keywords: Agent-Based technologies, m-Healthcare, Big data analytics, Deep learning, IoT.

1. INTRODUCTION

A mobile health app known as “mobile health” makes use of smartphone technology for monitoring of patients’ gadgets, digital personal assistants (PDAs), and various other portable devices, for health services and social welfare. Thus, it is vital to use SMS, without a doubt the most important aspect of mobile phones,

* **Corresponding author Siddhartha Sankar Biswas:** Department of Computer Science and Engineering, School of Engineering Sciences & Technology, Jamia Hamdard, New Delhi, India; E-mail: ssbiswas@jamiahamdard.ac.in

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along with voice communication. There are already roughly 550 active m-health projects, and there are already close to 45,000 applications for smartphones that are connected to medicine available globally (Sousa *et el.*, 2015 & Kahn and Alotaibi, 2020).

The amount of glucose in the blood (Darrell, 2013 & Kahn and Alotaibi, 2020), heart rate (Jenny *et al*., 2016), pulse (Kahn and Alotaibi, 2020), patterns of sleep (Kahn and Alotaibi, 2020 & Darrell, 2013), heart rate variability (Kahn and Alotaibi, 2020 & Darrell, 2013), and the activity of the brain (Kahn and Alotaibi, 2020 & Huckins, 2019) may all be measured using mobile medical instruments. Additionally, it makes use of ever-more complex processes and systems, including GPRS, third- and fourth-generation mobile networks, GPS navigation systems using satellites, and Bluetooth-based devices. Clinical images (McAfee, 2012) (Lynch, 2008) (Jacobs, 2009) (Ritter *et al*, 2011), medical records from doctors, prescription medications and assessments, computed tomography (CT) images, MRI images, test results, pharmacy documentation, insurer's EPR information, and other data about administration and leadership are all examples of big data in the medical industry. An increasing number of individuals in the global healthcare industry are supporting this. However, there is a lack of knowledge of the suitable foundation that focuses on the computational approaches necessary for this approach to be effective.

Analysis of large (Wu *et al*, 2014); (Belle, 2015) amounts of data from many different places is referred to as big data analytics. This type of information can be obtained in a wide variety of forms and arrangements. The data may be analysed using a variety of statistical techniques, including retrieval of information and computational intelligence. Using big data analytics' approaches, it is feasible to spot anomalies that are produced when merging a large amount of data across different places (Sun and Scanlon, 2019). The concepts of big data and mobile healthcare have been closely related.

Regarding big data analytics and cellular primary health care, there are still questions that remain unresolved. A number of suggestions (Kahn and Alotaibi, 2020); (Huang *et al*, 2015); (Cyganek *et al*, 2016); (Asi *et al*, 2015); (Raghupathi and Raghupathi, 2014) and assessments (Cyganek *et al*, 2016); (Asi *et al*, 2015); (Raghupathi and Raghupathi, 2014); (Greef *et al*, 2014); (Chen, Jiang and Xie, 2019) have been made regarding the application of machine learning as well as big data analytics in the field of medicine. The ability to analyse medical proof has expanded because of the effective usage of smartphones and tablets in healthcare monitoring applications (Dogan *et al*, 2017); (Sakr and Elgammal, 2016). To evaluate the patient's connections between encounters and the development of their illness, ecological risk evaluation (EMA) or encountering

method of sampling (ESM) was used (Berrouiguet *et al*, 2017). Because every single one of these apps will function instantaneously, the efficiency of current tactics, which primarily concentrate on providing educational material and surveys that users conduct themselves, is diminished (Asselbergs *et al*, 2016). Thanks to recent technological advancements, cell phones may now collect data passively, that is, with no users' participation in any way.

The location and information-sharing behaviours described in the proposed model, which are typical of current smartphones, might be used to collect patient responses with the use of m-health-based technology. It was also possible to remotely manage several medical conditions, both physical and psychological, using this mobile health-based software (Kahn and Alotaibi, 2020); (Reinertsen and Clifford, 2018).

The authors (Nazabal *et al*., 2016) produced a smartphone app that reliably identifies activity using an accelerometer sensor to determine the user's level of activity while recording. From the perspective of mobile health, the following threats are presently being considered:

i. A better comprehension of the organised and unorganised data streams produced by different transportation and informational resources.
ii. The users of 5G health apps intelligently implemented and transformed enormous amounts of health information. Contrasting the most predicted intellect, planned change in behaviour, or persuasive approaches is important to inspire more people to improve their health and well-being.
iii. The next generation of portable imaging equipment will generate and transmit enormous volumes of computed tomography as well as other important clinical information, thus it is imperative to develop long-lasting, accurate, and dependable techniques for information analysis.

2. LITERATURE STUDY

Several publications on m-health, big data analytics, and the integration of machine learning in the healthcare sector have already been vetted or issued as proposals (Kahn and Alotaibi, 2020). This page gives information on the characteristics and implementations, the domain and healthcare scenario of interest, the time frame, and the number of articles looked at.

Using the following information is what this study is trying to address:

i. What is mobile health, and which detectors and applications are presently available?
ii. What benefits and uses may machine learning have for health app developers?

CHAPTER 14

Impact Analysis of Online Education Development and Implementation using Machine Learning Model

Usha Divakarla[1,*] and **K. Chandrasekaran**[2]

[1] *Department of Information Science and Engineering, Nitte (Deemed-to-be-University), Karkala, Udupi, India*

[2] *Department of Computer Science and Engineering, National Institute of Technology, Karnataka, Mangalore, India*

Abstract: Online education is becoming increasingly necessary and in high demand as a result of the current circumstances and the enormous expansion in internet users. Various studies have been done in this area to enhance the positive benefits of offering educational courses online. One of the most crucial concerns for learning contexts like schools and universities, especially during current epidemic period, is the prediction and analysis of students' performance since it aids in the development of practical mechanisms that enhance academic achievement and prevent dropout. Most educational institutions now place a high priority on forecasting and analysing student performance. That is necessary to assist at-risk students, ensure their retention, provide top-notch learning tools and opportunities, and enhance the university's ranking and reputation. This project aims to collect information related to online education and use Machine Learning to predict students' performance.

Keywords: Classification algorithms, Decision tree, Machine learning, Naive bayes, Prediction, Random forest, Support vector machine algorithm, WEKA tool.

1. INTRODUCTION

The internet and technology advancement have revolutionized people's lives on many different levels, especially in the sphere of education. One of the learning avenues that enables people all around the world to receive education for free or at a reduced cost is the internet. Because of the rising amount of data that is being made available, smart data analysis will probably become more widespread as a

[*] **Corresponding author Usha Divakarla:** Department of Information Science and Engineering, Nitte (Deemed-to-be-University), Karkala, Udupi, India; E-mail: ushachavali@gmail.com

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necessity for technological development. In this case, data mining (DM) is utilised. Examining datasets, extracting information, and organising that information for later use are all steps used by DM techniques (Rastrollo-Guerrero *et al*., 2020).

The practice of using electronic tools to access educational resources outside of a traditional classroom is known as online education. This term refers to a course, programme, or degree that is only offered online. "An approach to teaching and learning, representing all or part of the applied educational paradigm, that is based on the use of electronic media and devices as instruments for enhancing access to training, communication, and interaction and that supports the adoption of new ways of understanding and developing learning," according to the American Council on Education.

Online education has a number of drawbacks, including lower costs, quicker delivery, a larger audience, and more specialised teaching. Making a course suitable for students from various backgrounds is the most difficult aspect of course design. Machine learning models provide the main computational technique required for processing this data to forecast children's performance, grades, or risk of dropping out of school. We propose creating a machine learning model that evaluates and predicts the students' academic performance as a part of the project. We will then utilise these results to forecast the effects of online schooling.

This project is essential because it defines and breaks down a number of concerns linked to online learning. By predicting a student's performance, we may get a rough picture of what to expect from them and how the course has helped them learn. In addition, as a result of this effort, a student can get specific guidance regarding his or her lessons. The capacity to recognise underachievers and take preventative measures to avoid course dropouts based on expected grades is another essential component. Teachers can also divide up their class according to projected grades.

2. LITERATURE SURVEY

Latent semantic analysis (LSA) and K-means clustering approaches have been proposed by (Sorour *et al*., 2015) as a strategy for forecasting student performance. Using the feedback provided by the students at the conclusion of the lecture, this method analyses the level of student comprehension of the subject, assisting the instructor in improving preparation for the subsequent lecture. After using the k-means clustering method, this method's average prediction accuracy was 66.4%.

According to (Zohair *et al*., 2019), the radial kernel support vector machine classifier performs better than other classifiers at predicting students' achievement in all courses, including the grade they would receive for their dissertation projects. Here, a small data set with a few characteristics—particularly those relating to postgraduate students—was used to make predictions about the students' grades and performance. This data set has limitations because it only contained administrative data and excluded elements like attendance and internal performance that may have been used to forecast students' final grades.

Among the machine learning methods used by (Altabrawee *et al*., 2019) to forecast student performance were Artificial Neural Networks, Naive Bayes, Decision Trees, and Logistic Regression. Their study focuses in particular on how students' use of the internet and social media as learning resources affects their academic achievement. These results are the result of features that track how much time youngsters spend on social media and whether they utilise the internet for learning.

Research on the several free online courses was done by (Al-Shabandar *et al*., 2017). Numerous students from other countries are enrolled in these courses. The findings indicate that, despite flexible accessibility, the completion rate is quite low. Two new areas of research, learning analytics and educational data mining, aim to improve the way that education is delivered by utilising various statistical and machine learning techniques. According to a thorough review of the literature, there aren't many remarkable studies in the field of MOOC (Hew *et al*., 2018) data analysis, particularly when user behavior is taken into account. The purpose of this study was to determine how effectively two groups of learner behavioral feature-based variables could predict course outcomes for MOOC participants.

A social science course at the Open University employed (Hussain *et al*., 2018) machine learning (ML) algorithms to detect low-engagement students in order to look into how involvement affects student achievement (OU). The highest educational attainment, final grades, assessment grades, and the number of clicks on virtual learning environment (VLE) activities, such as Dataplus, forums, glossaries, open university cooperation, open university material, resources, subpages, homepage, and URL, during the first course assessment were all taken into consideration as input variables for the study. The proportion of pupils who engaged in different activities served as the output variable.

A computer tool for facial analysis has been proposed by (Ghani *et al*., 2021) to help teachers identify which students in an online class are paying attention and which are not (Deng, 2022). Instructors can tell which students are paying

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