The Impact of Digitalization in Higher Educational Institutions

Shailaj Kumar Shrivastava, Chandan Shrivastava

Abstract: Digital Technology has changed the education scenario in the educational institutions by enhancing teaching and learning, research and governance. There is great need of adequate infrastructure, better internet connectivity, up to date digital equipment's, safe platform and digitally competent professionals. In India, higher education institution is evident with the increasing use of ICT, cloud computing, artificial intelligence, robotics and virtual reality in day-to-day practices which enhances competencies and help in aligning with industry-based skills. This article presents the issues related to implementation of digitalization process in higher education institutions.

Keywords: Automation, Government Initiatives, Digitalization, Higher Education

I. INTRODUCTION

The digital technology has improved the quality of education by supporting teachers in computer assisted learning. The teacher helps students in surveying various resources on relevant topic for their innovative and collaborative learning. The need based theoretical and practical classes in the form of different courses at various level has been implemented in the institutions. Teaching in the smart class room has been adopted as a new paradigm in education [1]. The distance education in different courses at various level has improved gross enrollment ratio. The Massive Open Online Courses (MOOCs) offers online learning environments at all level. A single centralized online entrance examination for students reduced the cost burden and simplified the selection process. The technical knowledge and digital skill will help students in their job settlement [2]. All students must be computer savvy to avoid struggle in future. Adoption of digital innovation is now essential for every institution. For systematic digitalization of an institution change in culture and leadership for data management system is required. Adoption of standard data management system is required for managing data accessibility and integrity, disaster recovery, data quality and effective backup of data. If institutional data is sensitive then digitalization will be the best option.

Digitalization has created unprecedented level of transparency and accountability in the financial administration of the institution. Recently, the digitalization of education initiated the scope of establishment of virtual university, smart university, digital university, e-university, agile university, university 4.0 and so on. In India, during COVID-19 crisis, teaching of more than 287 million children up to secondary level are affected. However, in higher education the academic sessions during the entire semesters from 2019-2020 to current session have been saved using online teaching and learning tools. [3,4]. The Digital India Program also encouraged digitalization of higher educational institutions.

II. DIGITAL LEARNING TOOLS

The innovations and advancement in the field of science and technology has reduced the size of digital tools and increased the data processing speed. Digital tools are used according to learner's choice, learning environment and learning setups. The teachers are choosing digital tools wisely considering various aspects and levels of learner. In India more than 150 million people are using affordable mobile anytime without the barrier of location. Digital tools and software are available for interactive learning with the help of a computer and internet connection. Lecture recording on various topics with inclusion of music or video contents on podcasts is commonly used today and students can download lectures on their device for listening later on. Multimedia simulation of teaching practices may help in overcoming teacher isolation [5]. The websites links and multimedia allows to recognize patterns of stress, rhythms and intonation in better ways. Interactive white board enables teachers to deliver a particular lesson with touch of finger. The icons are pressed to show video clips to explain concepts. ICT contribute very effectively in development of language skills which include listening such as pronunciation problems for nonnative speakers. Tools are designed for transcription services are helping hearing impaired students to easily understand the entire lecture. Students and teacher can access their work and interact from anywhere and anytime using Learning management system (LMS) such as Moodle, Blackboard, Piazza etc. Visme, Google classroom and Zoom are online interactive teaching tools available. Skype is also a video conferencing tool for effective communication and learning. Slideware is a tool that is used to create slides for presentations. Online discussion Forum (ODF) is a supportive tool for interactive learning [6].

In India more than 70% teachers feels that teaching and learning process is easier with digital tools and almost 60% teachers using it in their teaching and research work.

III. OFFICE AUTOMATION

Office automation in higher education institution coordinates and control all office activities in transparent ways [7,8]. Automation may be used for digitalization of process at source, creating smart forms, creating work flows and document managements, automation of student service request and creating self-service platforms. Office automation enables administrative solutions, data security, detect cheating, data storage and better collaboration across campuses. The overall digitalization process depends on plans, strategies and funding.

A. General Administration

The main impact of digitalization on general administration includes the use of college website to display important information about the institution. Computers are extensively used by all official staff having administrative duties in the institution. The official notices to staff are given through e-mails or WhatsApp group. All teachers, staff and students are using separate WhatsApp group for communication of information. Admission and registration are done through online platform and the admission status can be monitored from anywhere in real time. Online information's are provided to students about course contents, time table, lectures, allocation of hostel accommodation, results and assessments, etc. Payment of tuition fee, hostel fee or any fee are processed online avoiding long queues. Biometric attendance is maintained through machine installed in administrative building. The leave management, stock entry and work distribution are done digitally through computers. Microsoft office is used to type letters and make presentations of reports.

B. Financial Management

Cloud based accounting automation tools enables accountant and financial team to work from anywhere. Microsoft Excel are used to analyze financial data of the institution. Various accounting software's are also used for analyzing data. Accounting automation takes most of the account section work and does them automatically and instantly without any errors. A large portion of financial transactions are done online using user id and password. Many colleges are becoming cashless by allowing payment via mobile apps or through net banking.

C. Student Administration

In educational institution admission, registration, course allotment, class schedule, processing of merit list and attendance monitoring are done through e-media. The maintenance of all academic records, assignment and projects, assessments and evaluation are done digitally. All activities starting from admission to till processing of results are recorded and stored digitally in the institution. Some institutions are using big data analytic platform for collecting, managing, analyzing and sharing reports

D. Examination System

The institutions take examinations forms and conducting examinations online. This will bring transparency, reliability and eliminating cheating and manipulation in the examination system. Online objective examination on OMR sheet and declaration of examination results are done without any delay. It is easy to control and monitor the whole examination process by the controller of examination.

E. Library Services

The library users can access information digitally through networking system. Online Public Access Catalogue (OPAC) is very useful in performing the routine work in library. The emergence of internet as the largest repository of information and knowledge has changed the role of traditional library and shifted it to virtual service environments. E-Granthalaya library management system developed by National Informatic Centre (NIC) is very useful library services.

IV. DIGITAL SMART LEARNING ENVIRONMENTS

Many new frontline technologies [9] promotes the digital smart learning environments in higher education institutions. Some of them are discussed below.

A. Cloud computing

Cloud computing is an emerging network-based computing technology. In cloud, all types of information including files, email etc. are stored and can be shared with several people at the same time. Cloud computing technology make the digital storage and provide access to the multimedia content via the internet. Cloud enables data security because of network backups. The cloud service provider has ultimate control over it. In cloud computing, the convenient and secure learning environments as well as real time collaboration can be realized in better way. Cloud computing is cost effective since no physical hardware is needed. However, there is security risk in adopting cloud technology due to sharing of sensitive information to the service provider. Cloud computing in higher education is expected to grow 26% by 2027.

B. Internet of thing (IoT)

The Internet of thing (IoT) is a wireless network between several hardware devices to share information. Every connected device may be corrupted if bugs are found in any one device. The switching on and off of electric supply in the college campus can be done automatically with IoT. IoT helps in attendance and CCTV Camera recording in institution. IoT based sensors are used to locate exact area of short circuit and activate alarm in case of any fire inside the college campus.

C. Artificial intelligence

Artificial intelligence has simplified the teaching methodology and create a personalized learning experience by enhancing online and adaptive learning technologies.

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The role of AI in the education sector is in speech recognition, problem solving and planning and in automation of administrative tasks. AI algorithms correct errors in real time. AI can be used in developing worthy study materials, accurate grading of papers, speedy release of student results etc. AI can judge the performance of students in the class through facial recognition. There is need to concentrate on correct understanding of AI for research and development models to explain complex phenomena since it requires a large number of processing resources to complete the work. The AI techniques will take some more time to fully incorporate it in the higher education institution due to insufficient computing capacity.

D. Quantum computing

Quantum computing can help in solving numerous probabilities at once. Information storage in quantum computers is based on qubits. Quantum computers are working with less than 100 qubits. Discrete algorithms, integer factorization and scientific calculations are solved in few seconds with quantum computer. Quantum computers are extremely sensitive to heat and electromagnetic field. There is need to overcome 'quantum decoherence', which results in data loss in quantum computing.

D. Mixed reality

In augmented and virtual reality (AR and VR), an artificial (imaginary) world is created with the help of computer using audio and video which looks like real world. The user feels this artificial environment as real. This technique is used in digital gaming, military training, engineering design, robotics and medical training. This technique will make easy understanding of process. A person using AR and VR feel relief from tension and depression. However, its maximum use will affect eye and lead to health problem. It is difficult to implement AR and VR because pedagogical guide and best practices has to be established in higher education institutions.

E. Blockchain

Block chain technology is an open source platform where digital records are stored as a ledger. It is a database of several blocks which contain information. If one block is full of information then it automatically connected with other block and this process continues.

Blockchain technology offers security of data management mechanisms, ameliorated efficiency and technological improvement in higher education. Adoption of this technology will bring transparency and eliminate corruption. All records at the time of establishment of institution will be stored securely because it is not under the control of one person. It is impossible to change the information stored in block chain.

Block chain system maintains records of transaction across several computers, allows decentralized open data [10]. Block chain technology are used to exchange degree and diploma certificates among institutions.

F. Big data analytics

The institutions are using big data techniques to track the performance of students. The data analysis is performed at an adequate speed using various data structure and suggests the best solution among several choices. This technique predict the future occurrence and analyze the past performance. Any errors are detected in real time and solved. Every year thousands of students are enrolled in variety of courses in different institutions and a large amount of data is generated.

The student data include course details, enrollment year, student ID, examination gradation and marks obtained in individual subject. These big data can be used to screen students by performing productive analysis for understanding how student might perform in future. It will help in selection and recruitment process and reduce the time spent in this process. Big data and automatic learning analytics allow personalization of learning process.

V. GOVERNMENT DIGITAL INITIATIVES

The digital India initiative intend to strengthen digital infrastructure and expand internet accessibility among their citizens. The internet penetration rate in the country is expected to reach more than 55 % by 2025. A brief description of some of the digital initiatives taken by government in higher education is as follow [11].

A. Swayam

SWAYAM is an IT platform available free of cost for all students from 9th standard till post-graduation. This platform host 2000 courses. Details of SWAYAM courses are available on SWAYAM official website: SWAYAM.GOV.IN. All courses on SWAYAM provide printed materials (PDF)and have the facilities of online test and online discussion forum. SWAYAM educational portal is very useful for those students where teachers are not available.

B. Swayam Prabha

Video tutorials of all courses available with SWAYAM PRABHA are telecast in TV. This service is useful to those students who is not having internet facility. For SWAYAM PRABHA 32 TV channels are available. The channels broadcast new content for a minimum of four hours every day. For subscribing SWAYAM PRABHA channels student should visit official website swayamprabha-gov.in and get registered using email-id and mobile number. After being registered, student will be provided with SMS alert regarding transmission on new topic.

C. National Digital Library of India (NDLI)

The National Digital Library is the biggest online library of more than 72 lakhs digital books. Books are digitally scanned and uploaded on NDL.

D. National Academic Depository (NAD)

National Academic Depository is a digital bank of academic awards like certificates, diploma, degrees, marksheet etc. lodged by the academic institutions. NAD works in an 24x7 online mode for providing academic awards and there is no risk of losing, spoiling or damaging of academic awards.

E. E-PG Pathshala

In 2015, the government of India launched E-PG PATHSHALA portal to host high quality curriculum based interactive e-contents in Indian languages such as Hindi, English, Sanskrit and Urdu.

F. e-Yantra

e-Yantra is an initiative to create the next generation of embedded system engineers to provide practical solutions to some of the real-world problems. e-Yantra enabling effective education on embedded systems and robotics. e-Yantra helps colleges in setting up robotics labs and make it a part of their routine training curriculum.

G. Free and Open-Source Software in Education (FOSSEE)

This project aims at promoting the well-established open-source software such as Open FOAM, DWSIM, Scilab etc. Its aim is to reduce the dependency on proprietary software in educational institutions. It also upgrades existing tools to meet the requirements in academic and research.

H. Spoken Tutorial

Spoken tutorial ensure that anybody with computer can learn a language of their choice. It is recording of computer session which explain some software along with running commentary. All tutorial is available via audio and video tools in various regional languages. While using different language the video content of the tutorial remains the same only audio is replaced. Student can learn 45 programming languages and software free of cost. All enrolled student finally appear in the examination will get certificate only after securing minimum 40% marks. All answer to the queries is available at spoken tutorials online forum. By combining spoken tutorial of 10 minutes duration advance topic can also be taught in small steps. The spoken tutorial classes give training to a person without the support of physical teacher.

I. Virtual labs

In virtual lab the simulation-based experiments can be accessed remotely via internet. The creation of an iCloud of laboratory spaces will help students to conduct live experiments remotely at any time and any place. It reduces the high cost of laboratories and provide the individual student access to the latest equipment including web resources, video lecture and animated demonstrations. Automated laboratory experiments are accessible to thousands of engineering student at a time. The interfacing is done using a computer connected to the network. The cost of automation of many experimental setups is reasonable.

J. E-Shodhsindhu (eSS)

The e-Shodh Sindhu provide access to more than 15000 Journal, citations and factual databases in different disciplines.

K. Annual Refresher Programme In Teaching (ARPIT)

ARPIT is an online Annual Refresher course which allows in service teaching faculties using the MOOCs platform SWAYAM to undergo training without disrupting the academic schedule of the institution. The training will be on latest developments in the subject, emerging trends in the area of subject and the pedagogical improvements needed. The entire course duration will be of 40 hours. After successful completion of the course a certificate will be given to all faculties.

L. Plagiarism Detection Software

Plagiarism detection software easily detect plagiarized content in the articles, theses, research reports, project works, etc. To publish others researcher language in an article without giving right reference or without taking permission is unethical. There is loss of royalty of a person who originally work on it. The plagiarism checker software like Duplichecker, Turnitin etc. check the plagiarized content and locate the address from where the sentence has been copied. Duplichecker can check 1000 words at a time. If a word or a sentence is copied then it will be a copyright issue and the author may be punished.

M. VIDWAN

VIDWAN is a premier database portal which is specially designed for scholars, faculties, experts, scientists, policy makers and national or international awardee. The experts should have post graduate or doctorate degree in their respective subject with 10 years of professional experience. The database of profiles of scientists and faculty members working at leading academic institutions and R&D organization provide their address, experience, publications, achievements etc. Researcher can contact directly with the experts in their respective field for funding opportunities and research collaborations. This database can be used in identifying resource person in respective field and for the selection of panels of experts for various committees.

N. Digilocker

Indian citizens can store soft copy of important documents like voter-ID card, PAN Card, Driving License, educational certificate etc. in DigiLocker. Documents in DigiLocker never be destroyed and can be used anywhere with internet connection. Soft copy of all documents will be accepted for verification as per government guidelines. User-id and password are created in DigiLocker and it should be linked with Aadhaar card and registered mobile number.

O. National Digital Educational Architecture (NDEAR)

The government of India established the National Digital Educational Architecture (NDEAR) to strengthen digital infrastructure for innovation in the education ecosystems and for supporting activities related to education planning. The NDEAR is an architectural blueprint for technology driven solutions. It will offer a digital foundation where technology can be developed and built by anyone.

P. National Scholarship Portal (NSP)

National Scholarship Portal (NSP) is a digital gateway for implementation of scholarship scheme offered by the central and state government from school to university level. To check the eligibility for scholarship student should go on National Scholarship website.

For students seeking higher education such as LLB, B. Tech, M.Tech, BCA,MCA etc. are benefited. This portal provides transparent database of all types of scholarship for SC/ST/OBC/minority and general category students whose income is less than 100000 and ensure payment of fund directly to the bank account of students without any hinderance.

VI.   CHALLENGES OF DIGITALISATION

The benefits of digitalization have been established in higher education institution. However, only 15% of institutions have opted digital initiatives in their work. The lack of efficient computers and its peripherals, virus threat, scarcity of educational software and insufficient broadband internet accessibility is the largest barrier to the successful implementation of digital technology. Due to several different languages spoken and used in different states across country the translation of all the digital contents in all these regional languages sometimes becomes difficult for the agencies. Universities are facing greater demand for IT staff. Data security is the major challenge in higher education. The use of unlicensed software and using other people's work as their own are unethical issues of digital facilities. Plagiarism results in decline of educational standard. Due to heavy engagement on computer people are losing human relation and forgetting their family responsibilities and becoming opportunist. It is challenging for the institution to store huge database with strong protection round the clock. The administration must know how to secure their online data. The institution needs maximum connectivity with minimum cyber security risk. With the use of digital technology and advance device students study the subject by themselves without any interactive discussion with teachers. Most of the students are active on social media and found busy in searching the post and status updates of their friends. Students are losing habits of regular writing therefore their handwriting beauty are deteriorating. Smart phones with internet accessibility have given enough opportunities for cheating because it is easy to find answers with the help of internet.

VII.   CONCLUSION

Digitalization is an instrumental in tackling the impacts of internationalization in higher education. To integrate ICT in higher education there is need to ensure good quality, easily accessible and affordable education for people in the remote areas. The government is developing strategies to increase intellectual capital via funding for the development of adequate technological infrastructure in the institution. In new National Education Policy (NEP)-2020, digitalization of education will be one of the top priorities of government.

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AUTHOR PROFILE

Shailaj Kumar Shrivastava worked as Research fellow at National Physical Laboratory, New Delhi and obtained his Ph.D. degree in Physics from Delhi University. His research interest is directed towards Physics and higher education. Presently he is Principal at Anugrah Memorial College, Gaya, Bihar (A Constituent Unit of Magadh University, Bodh Gaya). He has 26 years of teaching, administrative and research experience with more than seventy research papers publications in various Journals and conferences. He is member of several academic/professional bodies/associations/committees. He got several awards including 'Young Research Award' at IUMRS-ICA-98 held at IISc Bangalore.

Chandan Shrivastava is B.Tech student of computer science engineering department at International Institute of Information Technology (IIIT), Hyderabad interested in software development and technology.