

The changing landscape of digital education: opportunities and challenges

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ABSTRACT

In the 21st century education sector's dependence on technology is on increasing spree. The widespread use of Information and Communication Technology in education has become a pillar of education policy worldwide. Covid-19 worked as a catalyst in progress of online education. Digital learning provides flexibility for students to learn anytime and from anywhere along with access to a wide range of resources thereby making learning more engaging and diverse. Students can also learn at their own pace, revisit difficult topics as and when required. Unfortunately digital divide is a challenge which impacts the most vulnerable in society, including those who are socio-economically disadvantaged and/or residing in rural areas. Robust measurement of digital technologies in education is critical for informing policy and action as well as for monitoring progress. This paper discusses the rationales, benefits and challenges in integrating digital technologies in education and its analysis in terms of UN defined three essential keys namely contents, capacity and connectivity.

Keywords: Digital Education, Online Education, Artificial Intelligence, Generative AI, ICT, NEP 2020, Higher Education, Pedagogy, Content, Capacity, Connectivity.

INTRODUCTION

Satellite Instructional Television Experiment, a Satellite based educational programme introduced in India in 1975-76 was followed by Educational Television Broadcasts started through INSAT satellite in 1982. Educational Technology was considered vital for improvement of quality of education since the times of National Policy on Education 1986 which was modified in 1992. Another Satellite EDUSAT was launched in 2004. Significance of role of ICT in education was further highlighted in curriculum framework in 2005. During 2020 the world had to undergo an unprecedented complete halt due to Covid-19. Education sector was not an exception as schools and colleges were closed and continuance of education was a big question mark. Education sector already on the path of digital revolution witnessed a paradigm shift during lockdown and it shifted in no time on e-learning and online classes.

Teachers equipped themselves with the requisite skill set necessary for imparting online education and made the e-classes successful with their overwhelming determination, zeal and perseverance. During the COVID-19 lockdown traditional classroom teaching was largely replaced by online education accelerating the adoption of digital learning practices. This transformation is likely to expand further as the National Education Policy (NEP) 2020 emphasizes online and digital education to promote equitable access to technology and ensure inclusive learning opportunities. At the international level also efforts are being done by United Nations. In its "Transforming Education" Summit- 2022 UN Secretary General affirmed, **"We must harness the power of the digital revolution to ensure quality education is provided as a public good and a human right with a particular focus on the most marginalised. Also we must marshal the strengths of digital technology to advance our national and international aspirations for education and lifelong learning."** He also addressed that in order to unlock the power of digital teaching and learning to make it more universally accessible and a more reliable pillar of holistic educational experiences we must use three keys namely content, capacity and connectivity.

The digital content available must be high quality, relevant to curriculum and available to all students, teachers and associates. Capacity must be built to use digital technology to ensure teachers, learners and all other stakeholders have the requisite skills and knowledge to leverage digital tools for effective learning. The foremost requirement is that of connectivity in order to access the digital resources and platforms for effective learning. This is evident from the fact that all around the world 2.9 billion people are offline and 90 percent of these people live in developing countries. This digital divide is due to various reasons like infrastructure unavailability and affordability. People in wealthy countries on an average use 35 times more digital data than people in poorer countries. This must be narrowed in order to connect everybody to digital platforms and learning.

REVIEW OF LITERATURE

Digital education is defined as imparting education by using digital tools and technology including the internet, ICT devices and e-learning platforms. It not only provides an alternate to traditional teaching method but also enhances the teaching and learning experience. Digital learning or e-education enables interactive, immersive and technology enhanced education. It creates a digitally empowered society through innovative learning methods and digital productivity tools. Digital education uses various practices like online learning, blended learning, open educational resources (OER), adaptive learning technologies and mobile learning as well.

The remarkable growth of advanced communication technologies has driven universities, businesses, and educational institutions into experimenting with alternatives to conventional teaching methods in classrooms (**Favretto et al., 2003**).

Despite its potential digital education can inadvertently widen existing inequities i.e digital divide. It is a term given by **Warschauer (2004)** to describe disparities in access to technology and the skills required to use it effectively. ICT's growing pace and distribution already shows that our local universities and learning and science groups are no longer purely local, but have gone global (**Beebe, 2004**) (**Nawaz & Qureshi, 2010**).

Christensen and colleagues (2008) add that the way technology is implemented into classrooms only slightly strengthens the way teachers teach and the way the school is run, never enabling schools to take full advantage of technologies (**Salavati, 2016**). However, the situation changed necessarily after Covid-19 and ICT replaced traditional teaching for a while. **Laurillard (2012)** in his study finds that Massive Open Online Courses (MOOCs), learning platforms for gamification and interactive simulations have expanded learning opportunities beyond traditional classrooms and it is particularly helpful for adult learners and working professionals. In his study **Means et al (2014)** states that Digital education can enhance student engagement, provide real time feedback and support differentiated instruction. **Bates (2015)** describes digital education as an ecosystem in which technology helps human in learning, improving access and personalization while maintaining instructional quality. **Selwyn (2016)** describes digital education as which uses digital tools, platforms and media to support teaching and learning. It also provides flexibility, scalability and learner specific experiences.

Digital technologies in education can be characterized as mainstream or frontier technologies and can be general purpose or education-specific in form. They can enter the formal and non-formal education system at different levels (**Nusche & Minea, 2020**). **Zou et al. (2025)** state that digital learning is transforming education through technology integration. As far as rural communities, low-income households and marginalized groups are concerned they are most affected due to digital divide (**Van Dijk, 2020**). Moreover digital literacy is also unevenly distributed which further limits the participation.

Rashmi Begum (2024) in her study explains the benefits of digital education. Some of the benefits are it allows students to learn at their own pace, may access a wide range of resources and continue their education even during disruptions. Teachers can also use digital tools to make lessons more interactive and engaging. It also points out several challenges like digital divide.

Kiruba Joshuakumar and Prof. G. Anburaj (2024) explore in their study how traditional classroom learning differs from modern digital education. It highlights that digital learning provides flexibility for students to learn anytime and from anywhere. It provides access to a wide range of resources including videos, simulations and global content which can make learning more engaging and diverse. Students can also learn at their own pace revisiting difficult topics as and when required.

Digital education is no longer just an option but it has become essential for ensuring continuity and quality in learning. While most existing literature on the subject highlights the benefits and challenges of digital education, this paper focuses on faculty perception regarding these factors. Additionally, it assesses the current state of digital content, capacity and connectivity, supplementing these findings with an evaluation of secondary sources. The paper also gives suitable suggestions and recommendations.

RESEARCH METHODOLOGY

The study has the following research objectives:

1. To evaluate digital education in terms of content, capacity and connectivity
 2. to give suitable suggestions and recommendations
- The research is descriptive in nature and data has been collected using interviews and discussions with faculty.

The faculty under study was from diversified fields covering arts, commerce, management, sciences. The interview cum discussion was held in the form of structured questions in order to explore the future of digital education,

pedagogical opportunities and challenges. The data was filled by 200 faculties across the states of Haryana, Punjab and Chandigarh. Personal observation and interview method was also used for data collection. The structured questionnaire included both closed and open-ended questions. Secondary sources such as newspapers, magazines and websites articles were also used to have clear understanding of the concept and to give direction to the study.

The respondents were selected using convenience sampling, a method that involves choosing individuals who are readily accessible and willing to participate. This sampling technique was deemed appropriate given the exploratory nature of the study and the practical constraints related to time and resources. The structured format ensured that the data collected was comprehensive and could be easily analyzed statistically.

ELABORATIONS AND DISCUSSION

New technologies involving artificial intelligence, machine learning, block chains, smart boards, handheld computing devices, adaptive computer testing for student development and other forms of educational software and hardware has not only changed what students learn in the classroom but also how they learn.

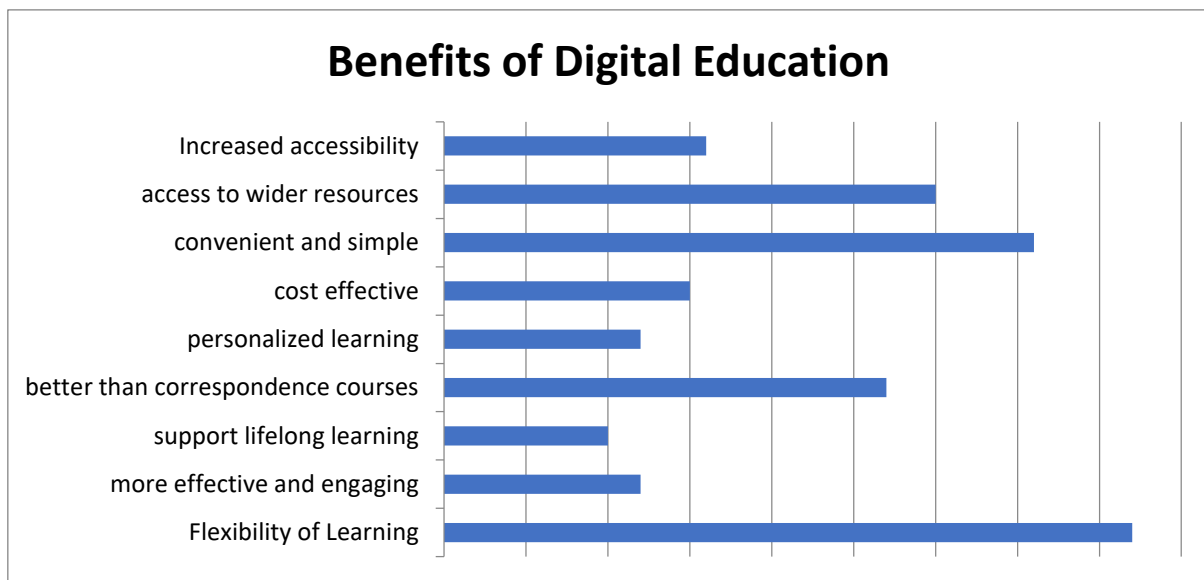


Chart 1

The chart highlights several important benefits of digital education. Among the benefits shown **flexibility of learning** emerges as the most significant advantage. Digital education allows learners to study at their own pace and according to their individual schedules making education more adaptable to different needs and circumstances. The second major benefit is that digital education is **convenient and simple**. Learners can access educational content from home or any other location using digital devices. This is followed by **access to wider resources** as online platforms provide students with access to e-books, digital libraries, videos, lectures, journals and other learning materials beyond traditional textbooks. Digital education is also considered **better than correspondence courses** as it provides greater interaction, multimedia content and opportunities for communication between teachers and learners. **Increased accessibility** is another important advantage because digital platforms can reach learners who may face geographical or institutional barriers. The chart also identifies **cost-effectiveness** as a benefit since online learning can reduce expenses related to travel, accommodation, printed materials and physical infrastructure. Furthermore digital education supports **personalized learning** enabling students to select learning materials and progress according to their abilities and requirements. **Zizikova (2021)** also revealed in his study that personalization in digital education enhances the learning experience by providing students with the right resources at the right time thus promoting better engagement and outcomes. Another significant advantage is that digital education can make learning **more effective and engaging** through videos, animations, interactive activities, online assessments and virtual classrooms. Finally it **supports lifelong learning** by allowing individuals to continue acquiring knowledge and skills beyond formal educational institutions. In a country like India where regional, social, cultural diversity and beliefs affects the education of children and particularly of women it is not unlikely that digital learning opportunities show existing inequalities. Rural learners may lack devices and connectivity; learners with disability face accessibility barriers and under privileged may be excluded by content that does not reflect their contexts. To ascertain the position of digital education it is necessary to know the situation of digital contents, capacity and connectivity.

Digital Content

The digital content available must have the characteristics like interactivity, multimodality, accessibility, flexibility, adaptability, personalization, reusability etc. Instead of reading plainly on the screen the digital content should allow

students to actively engage through clicks, taps, simulations, games etc. Multimodality is based on the concept of combining text, graphics, audio, animated videos, 3D models and augmented reality / virtual reality (AR/VR) so that it may suit to diverse learning styles. There should be flexibility to access the digital content from anywhere and anytime and from any device i.e. tablets, PC, laptop or smart-phone irrespective of geographical location. The content should be reusable and updated in real time so that authentic, correct information is available to learners always. The digital platform/ website should not capture student's data inappropriately and sell it and must not expose students to advertising or cyber frauds. In a recent UN survey (2022) on over 150 edu-tech products worldwide, it has been found that approximately 90 percent products were engaged in data practices that risked or infringed on children's rights. Many countries unlike India still have no publicly sanctioned platforms and content for digital learning. People cannot get the right information from the website/app if content is not up to date, incomplete, inconsistent or scattered. Websites/apps with poor design methodology may not be accessible with slow internet connectivity. Quality criteria for websites/apps are essential to ensure a website/app is trustworthy, reliable and engaging for users. A website/app should be easy to use, accessible to all users, load quickly, have high-quality content, be secure, optimised for mobile devices and have a visually appealing design.

Web accessibility means that people with disabilities (visual, auditory, physical, speech, cognitive and neurological disabilities) can also perceive, understand, navigate and interact with the web and can contribute to the web. It must be accessible by all people irrespective of their hardware, software, language, culture, location and physical or mental ability. Organisations must provide protection of against malfunctioning, phishing, cyber-crimes or cyber attacks to avoid data loss of the organisations or customers.

Following are the responses of the faculty with regard to the content available across different digital platforms with respect to digital education. As far as quality of contents is concerned majority of faculty is convinced that quality education material is available on digital education platforms whereas majority agrees that it is not available in local languages. This has far reaching effects on learners because if quality education material is not made available to learners in their local languages then learning curve would head to southwards and it will further widen the digital divide.

Table 1

Statements/ Questions	Yes	No
Do you think quality education material is available on digital education platforms?	112	88
Do you think digital contents are up-to-date, complete and consistent on educational platforms?	92	108
Do you think content available is responsive across various digital devices?	46	154
Do you think access to digital content is secure for learners from cyber security point of view?	70	130
Do you think quality digital education material is available in local languages?	40	160
Do you think quality digital education material is available for persons with disabilities?	15	185

On the question of accessibility to persons with disabilities very few faculty (7.5%) said that it is accessible. However, secondary sources suggest that after enactment of "The Rights of Persons with Disabilities Act, 2016" the situation has improved. It mandates ICT accessibility to disabled persons. The Unique Disability ID (UDID) scheme has generated 1,34,73,833 digital disability cards (8,906,328 male; 4,565,166 females; 2,338 others) which ensures streamlined access to welfare benefits nationwide. Further the Indian Sign Language Research and Training Centre has developed the world's largest Indian Sign Language digital repository with 3,189 e-content videos, including 100 STEM terms and 18 National Book Trust titles in ISL (Indian Sign Language) format expanding accessible education and ensuring digital inclusion on the basis of rights. Government of India has also provided guidelines for Government websites with respect to accessibility to differently able persons.

Capacity

A decade ago the digital divide in India was very wide as high-speed internet was largely urban, rural connectivity was limited and access to online services depended on location, income and digital literacy. Over the years broadband networks and extensive optical fibre infrastructure has expanded improving both the reach and quality of connectivity across villages and remote regions.

Table 2

Statements/ Questions	Yes	No
Do you think proper hardware infrastructure capacity is available for digital education platforms?	67	133
Do you think proper software infrastructure capacity is available for digital education platforms?	88	112

Do you think proper teacher's training is available for digital education platforms?	60	140
Do you think proper learner's training is available for digital education platforms?	42	158

However, majority of faculty feels that there is no proper hardware and software infrastructure facility and teachers and learners do not have proper training for digital education platforms. This situation is far better than the perception of faculty under study.

BharatNet, launched in 2011, expanded optical fibre network which extends high-speed internet to rural India. As of early 2026, over 2.15 lakh Gram Panchayats are connected with optical fibre cable deployment extended from 19.35 lakh route km in 2019 to 42.36 lakh route km in 2025 nationwide (Table 3) building a strong backbone that bridges the urban-rural gap and provides reliable connectivity to remote areas.

Table 3 (Source pib.gov.in)

Year	Optical Fiber Route Km. (Rural)
2019	19.35 lakh
2025	42.36 lakh

National Mission on Education through ICT (NMEICT) which has bridged gaps in higher education after its launch in 2009 by expanding broadband connectivity, virtual labs and digital resources also ensures that remote campuses match premier institutions in quality and access. Early efforts through the National Digital Literacy Mission (NDLM) or Digital Saksharta Abhiyan (DISHA) (2014–2016) trained 53.67 lakh beneficiaries against a 52.50 lakh target, with nearly 42% from rural areas. Thereafter in 2017 the Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA) aimed to digitally empower 6 crore rural households (one person per household). As of March 2024, it achieved a remarkable 6.39 crore trained individuals, creating one of the world's largest rural digital literacy programmes and expanding access to online services and financial inclusion. Under the NEP 2020, national platforms like DIKSHA (Digital Infrastructure for Knowledge Sharing) and SWAYAM (Study Webs of Active-Learning for Young Aspiring Minds) are providing access to quality education across school and higher education through large-scale digital courses and certifications.

Table 4(Based on the 2025–26 official data from the Ministry of Education, India)

Platform	Courses Offered	Enrollments	Completion
DIKSHA	19698	182.3 million	145.7 million
SWAYAM	18500	6.1 crore	53.7 lakh

This capacity building should be strengthened further by public private partnership so that digital divide is narrowed.

Connectivity, Access

Universal Digital Connectivity & Affordability is necessary for the digital revolution of the country. It should provide inclusive growth, better governance, economic opportunities and social empowerment for every citizen. However, rural connectivity is still poor in India as per the NSSO data.

Table 5 Source: NSSO Data

Household	Internet Connectivity
Rural	24%
Urban	66%

Table 6

Statements/ Questions	Yes	No
Do you think proper internet connectivity is available in urban areas of the country?	146	54
Do you think proper internet connectivity is available in rural areas of the country?	88	112
Do you think internet connectivity is available at affordable cost?	160	40
Do you think digital divide is prevalent in Indian society?	122	78

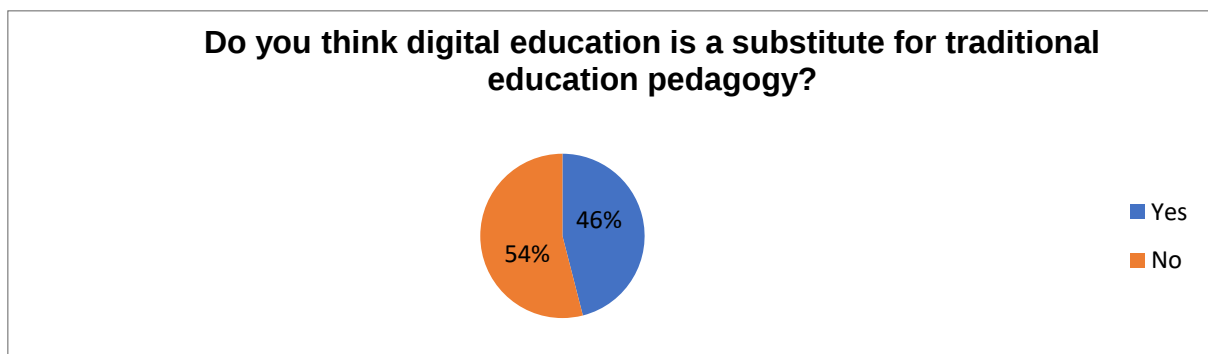
This lack of infrastructure and awareness in rural areas creates a ripple effect thereby limiting access to quality education, employment opportunities and economic growth. Women in rural communities face an additional hurdle in the form of gender digital divide. NFHS 6 (National Family Health Survey) data shows about 80.5% of men have used the internet, compared to 64.3% of women, leaving a national gender gap of 16.2 percentage points. Social norms and limited access to digital resources further restrict women's participation in the digital world, hindering their access to education, healthcare and online employment opportunities. This gender digital divide is contrary to the cause of inclusive growth and it must be given due consideration and more women must be brought to the ambit of digital connectivity who are deprived of this facility.

Digital Divide in India: NFHS-6 Data (2023-24)

INDICATOR	URBAN (%)	RURAL (%)	TOTAL (%)	NFHS-5 (2019-21) TOTAL (%)
Women who have ever used the internet	77.3	58.6	64.3	33.3
Men who have ever used the internet	87.1	77.1	80.5	51.2
Women having mobile phone they use	77.6	57.4	63.6	53.9

As far as disadvantages of Online/Digital Education are concerned screen fatigue and related health issues, poor social skills of learners, lack of motivation, poor writing skills and less personal interaction are the major disadvantages in order of higher to lower as per the views expressed by faculty under study.

On the question of digital education replacing the traditional education majority of faculty (54%) said No while only 46% said YES.



On the question of future of digital education everyone was of the view that digital education will grow further but it will not be a substitute of traditional or classroom teaching but blended mode of learning will be future. S K Joshuakumar (2024) also suggest in his study that instead of viewing these two methods as opposing systems, they should be seen as complementary. A blended approach, combining the strengths of both conventional and digital education, can provide a more balanced and effective learning experience. Such an approach can ensure flexibility while still maintaining human interaction and guidance. Digital education is not just a temporary solution but a necessary evolution in the education system. By addressing its challenges and strengthening its implementation, it can create a more flexible, inclusive, and future-ready learning environment.

SUGGESTIONS

- The digital learning platforms should have quality content based on the educational curriculum of the students and these resources should be free, open and accessible to all specially for the under-privileged and rural and remotely located students.
- The platforms must protect the privacy, safety and data security of the learners and educators. The information should be authentic and up-to-date whenever accessed.
- The capacity building programmes should be built with a special focus on women and girls in order to narrow down the gender divides.
- Special emphasis should be given to the capacity building of all the teachers and associated education personnel in order to be able to guide better to their students and learners.

- Every school and college in the country must be connected to internet. Every household and individual should be having access to internet services and education at affordable price.
- The deprived segments of society, under-privileged, disabled, girls and women must be provided free access to educational platforms, websites etc.
- All the policies should be framed keeping in mind marginalized learners and under-privileged.

Overall digital learning is creating new opportunities for education but it requires proper support, training and infrastructure to ensure that everyone benefits equally. The digital education is not a substitute of traditional education but this compliment to each other and future is of blended mode of learning harnessing the positives of both the pedagogies.

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