

The Trends, Challenges & Initiatives of Digital Transformation of Indian Education

Shubhra Bhatia

Department of Commerce, The Bhopal School of Social Sciences, Bhopal
shubhrabhatia@bsssbhopal.edu.in

Keywords: Education Sector, Covid-19, Digital Revolution

Abstract: The educational system in India is as diverse as our nation's culture, languages, heritage, etc. No industry was spared from the Covid pandemic's effects, and India's education sector was no exception. The acceptance of technology and the creation of fresh methods of teaching and learning were the only bright spots in a world beset by several unforeseen obstacles. In India, many schools had successfully given lessons online, but simultaneously, there were schools which were shut down. So, the schools that had previously prohibited the use of electronic devices had to adopt online learning. Both teachers and kids are now becoming accustomed to this new normal, which makes handling the issue more difficult for them. This study attempts to summarize several important areas of transformation in the education sector, the impact of the Covid-19 pandemic on the current educational landscape, and attempts to provide a road map for a future e-learning system. With the start of the pandemic's third calendar year, 2022 seems to be a significant year, particularly for education. Around the world, educational systems have had to deal with periodic closures, unequal access to educational technology and other tools for distant learning, and significant difficulties in preserving the physical and mental well-being of both students and teachers. While this is true, not all of the unexpected changes brought on by the epidemic have been negative; over the past three years, some encouraging new innovations, allies, and increased attention to the field of global education have emerged. The crucial question is whether 2022 and the years to come will result in a change of education or if students, instructors, and families will experience significant setbacks. In this study, we look into the digital revolution that the COVID-19 epidemic has brought in the education sector, as well as any obstacles that may have been encountered

1. INTRODUCTION

Digital education refers to the delivery of education to the general public with the use of technology, and a key effect of COVID-19, besides from the upheaval in the economy, is the reliance on the internet. The only way to continue studying was to use technology because the education system was in ruins as a result of the pandemic. The purpose of education was saved by online learning.

Although it has always been difficult for people to adapt to digital technology and stay up with the most recent advancements in the digital world, numerous research and innovations have made it easier for these sectors to function. The education sector has seen a number of changes as a result of digital technologies (Bhongade & Sarode, 2018). All industries, including education, healthcare,

agriculture, and industry, have benefited greatly from innovations brought about by digital technologies. Digital technologies have permeated every area of the Indian economy over the past twenty years in India (Bordoloi, 2018). Up until 2019, traditional teaching methods were largely used in schools and the higher education sector, with less reliance on digital resources and approaches. Throughout March 2020, Covid 19 suddenly came into effect, forcing the closure of educational institutions in India. India's government ordered a state-wide shutdown to stop the coronavirus sickness from spreading (Sahu, 2020). Online education is currently a widespread practice in the field of education and is regarded as the "New Normal" in our educational system. The state of events that felt exceptional in the past has suddenly become the "New Normal," or an ordinary behavior. Reimagining the role of online learning in the Indian

educational system and incorporating it into teaching-learning activities can be used to describe the new norm in education (Shenoy et.al., 2020).

There is no doubt that the digital transformation of education has intensified due to the Covid-19 pandemic, however, online education is only one example of how digital technologies are being used to alter the teaching and learning process.

There are close to a billion people in India who are connected online, and various digital technologies are penetrating their lives more and more each day. There is a lot of room for improvement in the education of students in the industry of education as well. At many levels of schooling, the use of digital and live virtual classrooms has increased in recent years. Students and teachers will have the flexibility to attend the session at any time and gain the superior understanding by utilizing open educational resources. At the same time, augmented reality and virtual reality concepts have begun so that students can understand the concept in a real-world setting and to increase accountability and involvement in learning.

Institutions now see the advantages of the digital education system, notwithstanding Covid-19's requirement that they adopt a digital strategy. Nowadays, educational institutions welcome the use of cutting-edge technologies.

2. OBJECTIVES OF THE STUDY

1. To understand the major trends and technologies enabling the digital transformation of education
2. To study the expectations and challenges of the digital transformation of the educational system.
3. To understand the Government's outlook & initiatives towards digital education in India.

2.1 DIGITAL TRANSFORMATION & EDUCATION

Digital transformation is the process of updating resources and processes to raise the bar for instruction and learning for all parties involved in education. Focus of the educational digital revolution is majorly on the following two points:

2.1.1 Accessibility:

Digital technology make learning materials more accessible to learners like students and employees at

lower costs than they would be with traditional schooling. People from different financial backgrounds and walks of life can access lessons and resources online. Thanks to innovations like text-to-speech, because of which the challenges for students with impairments have been eliminated.

2.1.2 Enhanced engagement

Interactive education: A variety of learning forms, including microlessons, films, interactive exams, games, etc., are transforming education. For example, engaging linguistics applications like, Duolingo claims to connect with US students who are interested in learning other languages.

Adaptive learning, which allows each learner to pursue their own learning path, is made possible by computer technology and artificial intelligence (AI).

Two of the most significant repercussions of the pandemic are distant learning and school closures, which highlight how crucial it is to integrate digital technology into education as soon as possible. The education sector was already going through a digital revolution prior to the outbreak. The reports by HolonIQ clearly demonstrates that between 2010 and 2019, the amount invested in worldwide education technology venture capital rose from \$500 million to \$7 billion, and the staggering effect of the pandemic almost tripled the investments in 2021.

2.2 RESEARCH METHODOLOGY

The major goal of qualitative research methodologies is to understand behaviour and interrelationships by portraying a complete picture of the subject. The secondary data provide the main foundation of the study. The literature review method was used for the research for this work. The data for the research was gathered from current online literature, relevant research journals, periodicals, and magazines. Several government reports have also been considered for the study.

3. REVIEW OF LITERATURE

Pulkit (2020) in his paper, explained the current educational system. India, according to his writing, is a major player in the global education sector. More than 260 million students attend more than 1.5

million schools across the country, which also contains more than 800 institutions and 65,000 colleges. However, there is a lot of room for ongoing development in the educational system. Given that India has the largest number of people in their tertiary years and the second-largest pool of graduates worldwide, the Indian education sector is prepared to experience tremendous growth in the next years.

(Kumar Jha, n.d.) India needs excellent infrastructure to support digital education. This will result in a significant increase in investment in democratic governance and infrastructure for the education sector. The study outlined the various issues facing digital education in India as well as potential solutions.

(Ravi et al., n.d.) concluded that the educational applications of the Digital India Project have greater effects on social, economic, financial, and educational activities. Numerous widely used programmes, like eScholarship, Digilocker, and SWAYAM, have greatly aided in the rise of digital literacy among students, youth, and job seekers in our nation.

(DIGITAL TRANSFORMATION IN EDUCATION SECTOR: THE WAY FORWARD FOR INDIA, 2021a) Stakeholders in education are expected to embrace change with optimism and stay up with technological advancements. The government should place a high premium on providing instructors and students with appropriate training. The integration of digital tools into the educational system should be the main emphasis of researchers and educators.

Faculty and students were compelled to adjust to changes such as institution closures, online communication and learning, a shift in learning from the classroom to the home, individualized learning, online examination formats, etc. while taking social distance norms into consideration (Dhawan, 2020)

Reimagining the role of online learning in the Indian educational system and incorporating it into teaching-learning activities can be used to describe the new norm in education (Shenoy et al, 2020).

An important turning point in the digital revolution of education toward Education 4.0 can be seen in the COVID-19 epidemic. In order to personalize the teaching and learning process, educators, students, and educational institutions are facing an accelerated shift to a new educational paradigm that heavily relies on the use of various digital technologies, such as data analytics to generate knowledge and information from large volumes of

data (Big Data). But this new paradigm also calls for new organisational structures, creative pedagogies, and social, interpersonal, and cognitive abilities from both instructors and students. (Katyeyudo & de Souza, 2022). Digital economy and education 4.0 Employment needs are shifting away from knowledge (concepts and theories) and towards the use of digital skills, information, and technology in an interoperable way. The new educational paradigm is being driven by Education 4.0 and is predicated on the need to upgrade and requalify, unlearn and relearn, and apply appropriate skills (Hong & Ma, 2020).

The development of online education is inextricably linked to meticulous planning and the creation of effective teaching tools. However, due to the overwhelming and rapid growth, the entrance of universities to online education is in doubt due to the lack of a solid plan, design, and development of online instructional programmes. (Li et al., 2021) One only needs to consider the dominance of ID and design and evaluation platforms as the only platforms for instructional design, delivery, and assessment to see how crucial instructional technology has been to education in aiding in the alleviation of the consequences of this global pandemic.

(Agarwal & Sharma, 2020) In order to comprehend how COVID-19 has influenced the digital transformation of the education sector, secondary research was conducted for this study. The study looked into how, during the COVID-19 lockdown, the educational sector adapted the usage of virtual resources. The assessment of secondary data sources served as the study's foundation. The shutdown inspired the development of virtual learning, the usage of open-source software and educational websites, and ultimately the industry's shift to online education.

(Jinal Jani and Girish Tere, 2015) The government of India's Digital India strategy will determine how far digital education may progress in the nation. The "Digital India Drive" was started by the Indian government in an effort to use digital technology to empower society at large. It will support the use of information technology by government agencies and help execute a number of government programmes and services. Digital India will facilitate the creation of jobs by offering digital lockers, high-speed internet, and other services. The development of digital infrastructure, online resource and service delivery, and digital education are the three primary pillars of the "Digital India" initiative.

1. DIGITAL TRANSFORMATION IN EDUCATION - THE TRENDING TECHNOLOGIES

1.1 ARTIFICIAL INTELLIGENCE

–

Applications using artificial intelligence can complete simple but time-consuming activities in the field of education, reducing the strain of teachers or other staff members. They can also be utilised to give pupils a better, more personalised learning experience. Among the applications are:

Increasing academic performance of the students

Students with hearing impairment benefit from voice-to-text systems that convert lectures into notes.

Text-to-voice technology enables dyslexic kids to learn more successfully by writing instead of reading.

In order to determine a student's preferred method of learning and adjust the curriculum accordingly, personalised learning may employ a variety of technologies, including AI. Examples of teaching strategies that integrate in-person instruction with online learning resources and promote students' discovery learning include blended learning and adaptive learning.

Increasing the productivity of the staff

Chatbots with artificial intelligence to answer inquiries regarding classes, homework, the campus, etc. College students can use chatbots as virtual advisors, freeing up instructors' time.

Chatbots for particular domains: The application process for college is challenging and stressful for high school students. College counsellors only have so much time to help so many students. Chatbots designed specifically for the admissions process can assist students during this difficult and crucial procedure.

Back-office operations like finance are also present in educational businesses. Back-office function inefficiencies can be found with the aid of process mining.

Support workers can save time by using individual automation technologies like RPA or by integrating numerous automation technologies (also known as hyper automation).

ANALYTICS –

With the help of digital technologies, schools may gather and examine a variety of data on their kids' performance in order to track and improve it. They can identify areas where students struggle and succeed, create new approaches, and verify whether these ways produce the desired results using standard and advanced analytics.

1.2 VIRTUAL OR AUGMENTED REALITY

Students can be better engaged in the subject by using augmented reality and virtual reality (AR/VR) technologies to build interactive and virtual settings. These technologies can support learning-by-doing in the practical sciences and in health, as well as virtual field trips to historical sites. With AR/VR technology, the experience of remote learning can also be enhanced.

1.3 INTERNET OF THINGS (IoT)

By facilitating real-time communication and data transfer, the usage of cell phones and other cutting-edge technology is increasing, which improves connections between students and their educational institutions. The presence or absence of young children from class may be tracked using IoT devices, which can also notify teachers and parents to ensure their safety.

1.4 ONLINE EDUCATION

Schools and colleges used Skype or Zoom to offer distance learning as a last resort in response to the pandemic. Institutions of higher learning can create their own online course management systems and include them into their websites or online platforms. They will be able to adjust the online learning environment to meet the needs of the students or the course's content as a result.

1.5 SMART CLASSROOMS

Face-to-face learning has also been boosted by digital technologies. Smart classrooms with smart boards, laptops, internet connections, projectors, etc. open up new possibilities for providing students with educational tools that were previously impractical with a blackboard and chalks.

Apart from the above technologies, (Mhlanga,2023), reviewed that the extraordinary invention of OpenAI, ChatGPT, is set to have a significant impact on the education market in emerging nations, where access to possibilities for high-quality education is frequently limited. As per him, our relationship with technology has

been significantly changed by OpenAI, an AI-focused technology business. ChatGPT, a huge language model with several features including query response and text generation, stands out among its impressive improvements. Particularly in the education sector in emerging nations, there has been a significant increase in interest in the potential benefits of OpenAI and ChatGPT.

2. CHALLENGES OF THE DIGITAL TRANSFORMATION IN EDUCATION

There are many evident & apparent advantages which the digital transformation brings to the education sector. Collaborative learning, future oriented curriculums, increasing parent-teacher engagement, monitoring of student performance, enhanced outcomes using data analytics are few of them. But, besides having so many advantages, the education sector still face many challenges. The major challenges are discussed below:

2.1 Challenges with regards to resource availability & internet connectivity:

Poor internet connectivity in rural and some urban regions is one of India's biggest obstacles to digital education. In India, the vast majority of people still do not have access to the internet, and many individuals living in rural areas do not even know the fundamentals of digital technology. It takes fresh ideas to make digital education more resilient and dynamic.

2.2 Lack of Qualified Teachers:

One major obstacle to the use of digital education is a lack of knowledge and abilities. Teachers with professional training in digital technology are hard to come by. Some academic institutions in rural areas have college professors and teachers that are not interested in using digital technologies in the classroom. They prefer the more traditional teaching methods of using chalk and a chalkboard since they feel that the digital media communicates a lot of information to the pupils at once. Because they believe that these disruptive technologies would eventually completely replace them, in remote places, older teachers and elementary teachers are reluctant to use digital tools for digital education in the classroom and to attend training.

2.3 Challenge related with language & content:

Language is one of the main barriers preventing digital education in India from progressing. Since there are many different regional languages spoken throughout the nation in various states, getting digital material into all of these languages might be difficult for organisations.

2.4 Equipment upgrades and maintenance issues with digital devices:

One of the biggest challenges in some areas of India is keeping digital equipment updated and maintained. Government funding limits play a significant role in this. Rural schools' digital education initiatives do not support themselves. The government initially created a number of programmes to advance digital education, but subsequently they were not given the attention needed to maintain the technology, which has a negative impact on the growth of digital education in rural areas.

2.5 Lack of Adequate funds:

Utilizing the best and most up-to-date hardware and software on the market is a key component of digital education. Digital technology integration into educational systems is a challenging task in developing nations like India since it requires significant funding and infrastructure. Through the Digital India plan, the government committed to finance the implementation of technology; yet, sometimes, the insufficient funding may result in redundant and antiquated infrastructure and equipment in rural schools.

2.6 Digital Literacy of all the stakeholders

The level of digital literacy among all stakeholders is a major issue. Students, alumni, professors, administrators, parents, corporates, and society, among others, all come from different backgrounds and use technology in different ways. The capacity of these various stakeholders to adopt new technologies and utilise them effectively is crucial to the success of a digital strategy.

2.7 Meeting the dynamic needs of the students:

Meeting the students' changing needs and expectations is another challenge. With elements like the digitalization of administrative processes, unrestricted 24-hour access to all information and services utilising numerous platforms, or digital curriculum, students are increasingly

demanding an upgrade in the "basics" of their experience. The student experience is one of the key drivers of digital transformation, thus choosing the appropriate digital strategy that fits their demands is essential.

2.8 Creation of a strategic vision for digital transformation:

Educational institutions require a strategic vision so that the entire organisation can work together to achieve the digital efforts. Strong leadership and a specialised staff that can confidently present and carry out their plans are crucial for this. The team and stakeholders will be more engaged and invested in the process of digital transformation if there is a clear vision.

Other Challenges: The usage of digital technology is expanding, and everything is becoming more connected, which poses new issues for security, compliance, data protection, and legislation. The digitization of data and the automation of business operations can boost organisations' agility, but they also considerably raise cybersecurity risks and threat levels. Another difficult task is putting integrated digital projects into practise, which can only be done with the aid of a framework.

3. GOVERNMENT INITIATIVES TOWARDS DIGITAL TRANSFORMATION IN THE INDIAN EDUCATION

The Indian government is developing digital pedagogy for e-learning as part of a long-term plan for the education sector. It has aided in the development of a new, non-school learning era. In order to develop an improved learning environment for the students, the concept of learning by all, with all, and for all is currently being worked on by the Ministry of Education.

To address digital education with fair learning in India, the government has launched a number of programmes including Digital Education Guidelines with criteria.

The method of education known as "digital education" makes significant use of technology and digital technologies. This extensive and technologically advanced educational paradigm enables students to learn from any location in the nation. Through its many programmes, the government has put up a number of avenues for wide sources of digital education. Every State/UT has implemented a variety of actions that are inclusive to close the digital divide and increase student digital literacy. To boost digital education, several state governments have started handing out cell phones and tablets.

With a transformational move of introduction of NEP, the Indian education sector expects a lot of hope. With NEP,

the government is aiming to lay down a systematic framework towards a holistic approach to education with emphasis on skill development. Due to the nearly year-round lockdown, a change of this significance would require the active and ongoing involvement of all stakeholders, which was not possible. A significant endeavour is the National Digital Educational Architecture (NDEAR), which aims to make it easier to employ digital architecture in educational planning, governance, and administrative tasks for the Centre, the States/Union Territories, as well as teaching and learning activities. By giving them the technological and digital assistance required for them to receive education with just a single click utilising digital tools, the Indian government is committed to improving and providing for every child in the nation's remote locations in terms of education. The government of India has modernised and revitalised the education system with its ICT initiatives.

In addition to closing the digital divide, it has been crucial in demonstrating the excellence and digital reach of its programmes for a better tomorrow for the students in our nation.

4. DISCUSSION & CONCLUSION

No industry was spared from the pandemic's effects, and India's education and skill development sector was no exception. The acceptance of technology and the creation of fresh methods of teaching and learning were the only bright spots in a world beset by numerous unforeseen obstacles. In India, close to a third of schools had successfully given classes online. But during the lockdown, more than two thirds of India's 1.5 million schools were closed.

The pandemic's impact on learning loss of the students is astounding. In order to determine the degree of learning loss among children in 44 districts across India in grades two through six, a survey was published in 2021. The findings revealed that over 82% of people had forgotten their fundamental math skills and over 92.2% had forgotten their fundamental language skills.

The socio-emotional health of the pupils was also impacted by the closing of the schools. The prevalence of poor mental health was estimated to be 33% among children aged 5 to 13 and 14 to 18 years old.

The learning difference between the genders widened. Due to the pandemic, about 10 million girls in India are going to stop attending school.

But in spite of a number of challenges, the digital transformation brought a number of opportunities for the education sector. Technology adoption and a sizable emphasis on skill development and upskilling in the education sector, which is undergoing upheaval, were seen in 2021. With a transformational move of

introduction of NEP, the Indian education sector expects a lot of hope.

Due to the adoption of technology for teaching and learning, the pandemic also sped up the growth of EdTech enterprises. In 2021, they kept expanding and underwent some intriguing changes. This year's rise of EdTech businesses was also fueled by the shifting skill requirements of the workforces in various industries. Let's examine some of the major developments in edtech:

In tier II and III cities, many educational institutions adopted digital technology in 2021 as the standard for hybrid or online teaching and learning, as well as for content creation and as a delivery method for instruction. The "personalization" of learning is a further trend that has plagued the Indian EdTech sector. The "Personalised Adaptive Learning (PAL)" technologies were used by both public and private institutions to mass-customize learning.

The necessity to create vernacular material to appeal to a larger group of consumers and students from tier II and tier III cities was immediately recognised by Indian EdTech players as well.

According to previous researches, it is important to embrace technology responsibly and with a thorough awareness of its consequences, even though the new trends have the ability to alter education in developing countries. Some of the negative effects of technology on education that should be reduced are a lack of data privacy, unequal access to technology, and the need for educators to refresh their skills. Future suggestions include more study to comprehend the effects of cutting-edge technologies on schooling in developing countries. It's critical to make sure that the positive impacts of these technologies are maximised while the bad ones are kept to a minimum. The ultimate objective should be to employ AI to provide everyone access to more effective

Without a doubt, the new National Education Policy (NEP) will lead to substantial improvements in the field of education. The next several years will see a significant push towards STEM-based learning as skill-based education gains momentum. Many targeted policy advancements have been made with an eye towards tech-enabled solutions in the field of education, with the goal

Educators and lawmakers have learned from the COVID-19 epidemic, and it has set a precedent for the foreseeable future. The efficient policies and strategies put in place now will provide the groundwork for the Indian educational system's future resilience to crises without experiencing major disruptions. It has also aided in our realization that education need not be a rigid, one-

Additionally, EdTech has a big impact on higher education. In a study conducted in 2021, 31% of respondents stated that they felt stuck as a result of the pandemic, while 65% of those surveyed claimed to have engaged in upskilling courses in the preceding year to further their professions. Data & AI (48%) Project Management and Scrum (34%), Cloud Computing/DevOps (32%), and Digital Marketing (32%) were the most popular courses (21 per cent).

Even though the pandemic era had its share of difficulties, it has also gave rise to a number of opportunities for both public and private institutions in the industry. Infrastructure, hardware, and application suppliers in the EdTech space, in particular, anticipated substantial revenues. In this area, it also witnessed the emergence of numerous unicorns and "Soonicorn," which sparked a flurry of investment activity. The education system is on the verge of revolution, driven by a policy that looks to the future, from accelerating the adoption of technology to focusing on skilling and upskilling. This may very well be the foundation for India to truly become a knowledge economy in the future years.

and equitable educational opportunities. The education as a sector has no doubt transformed tremendously after the Covid pandemic & the comprehensive impact is now being witnessed. The technologies adopted in this sector has revolutionised access to information by offering a wide range of tools and resources, including e-learning platforms, tools for student interaction in the classroom, and chances for skill development and continuous learning in higher education. Furthermore, the industry's development has been expedited by favourable government policies and technological advancements resulting from widespread internet usage and the introduction of 5G.

of promoting inclusivity in terms of access to high-quality teaching techniques and fostering digital literacy. With the growing popularity of experiential learning, all school curricula will undergo significant adjustments as NEP sets off on its journey. Soon, educational institutions will begin introducing initiatives whose main objective is to make learning enjoyable.

way process. Despite the significant change brought about by technology and recent legislative reforms like the NEP, EdTech will remain essential to society and provide a strong foundation for the coming generation. It's time to embrace the cutting-edge developments in education that technology is bringing about and to look forward to a prosperous and progressive future.

REFERENCES

Agarwal, S. K., & Sharma, A. (2020). *THE DIGITAL TRANSFORMATION OF EDUCATION IN INDIA DURING THE PERIOD OF LOCKDOWN DUE TO COVID-19* (Vol. 7). www.jetir.org

Alafnan, M. A., Dishari, S., Jovic, M., & Lomidze, K. (2023). ChatGPT as an Educational Tool: Opportunities, Challenges, and Recommendations for Communication, Business Writing, and Composition Courses. *Journal of Artificial Intelligence and*

- Technology, 3(2), 60–68.
<https://doi.org/10.37965/jait.2023.0184>
- Baas, M., Admiraal, W., & van den Berg, E. (2019). Teachers' adoption of open educational resources in higher education. *Journal of Interactive Media in Education*, 2019(1), 1–11.
<https://doi.org/10.5334/jime.510>
- Barbero, S. M. (2020, December 11). COVID-19 has accelerated the digital transformation of higher education. *World Economic Forum*.
<https://www.weforum.org/agenda/2020/07/covid-19-digital-transformation-higher-education/>, accessed 14 September 2021
- Barron, M., Cobo, C., Sanchez Ciarrusta, I., & Munoz Najar, A. (2021, April 27). What is Hybrid Learning? How can countries get it right? *World Bank Blogs*.
<https://blogs.worldbank.org/education/what-hybrid-learning-how-can-countries-get-it-right>, accessed 15 September 2021
- Basilaia, G., & Kvavadze, D. (2020). Transition to Online Education in Schools during a SARS-CoV-2 Coronavirus (COVID-19) Pandemic in Georgia. *Pedagogical Research*, 5(4).
<https://doi.org/10.29333/pr/7937>
- Bhongade, D., & Sarode, Y. M. (2018). Prospect of E-Learning in Indian Higher Education: Trends and Issues. 5, 2394–0697.
- Bordoloi, R. (2018), "Transforming and empowering higher education through Open and Distance Learning in India", *Asian Association of Open Universities Journal*, Vol. 13 No. 1, pp. 24-36.
<https://doi.org/10.1108/AAOUJ-11-2017-0037>
- D. (2021, August 26). How IoT Is Used in Education: IoT Applications in Education. *Digiteum*.
<https://www.digiteum.com/iot-applications-education/>, accessed 17 September 2021
- Dhawan, S. (2020). Online Learning: A Panacea in the Time of COVID-19 Crisis. *Journal of Educational Technology Systems*, 004723952093401.
<https://doi.org/10.1177/0047239520934018>
- Dhawan, S. (2020). Online Learning: A Panacea in the Time of COVID-19" target="_blank" href="https://en.wikipedia.org/wiki/COVID-19">COVID-19 Crisis. *Journal of Educational Technology Systems*, 004723952093401.
<https://doi.org/>
- Dictionary, C. (n.d.). The new normal definition and meaning | Collins English Dictionary. Collins Dictionaries.
<https://www.collinsdictionary.com/dictionary/english/the-new-normal>, accessed 17 September 2021, accessed 17 September 2021
- Ehlers, M., Schuwer, R., & Janssen, B. (2018). OERs in TVET: Open Educational Resources for Skills Application of ChatGPT to Emerging Economies. *Education Research International*, 2023, 1–13.
<https://doi.org/10.1155/2023/7605075>
- OLIVEIRA, K. K. d. S., & de SOUZA, R. A. C. (2022). Digital Transformation towards Education 4.0. Development. UNESCO-UNEVOC International Centre ..., 12. <https://eric.ed.gov/?id=ED590227>
- Fàbrega, M. (2021, April 5). Hybrid learning in the post-covid era. *Opentrends*.
<https://www.opentrends.net/en/hybrid-learning-in-the-post-covid-era>, accessed 20 September 2021
- Gunawan, G., Sahidu, H., Susilawati, S., Harjono, A., & Herayanti, L. (2019). Learning Management System with Moodle to Enhance Creativity of Candidate Physics Teacher. *Journal of Physics: Conference Series*, 1417(1). <https://doi.org/10.1088/1742-6596/1417/1/012078>
- Hong C., Ma W.W.K. (2020) Introduction: Education 4.0: Applied Degree Education and the Future of Work. In: Hong C., Ma W. (eds) *Applied Degree Education and the Future of Work. Lecture Notes in Educational Technology*. Springer, Singapore.
https://doi.org/10.1007/978-981-15-3142-2_1
- Impey, C. (2020, July 23). Massive online open courses see exponential growth during COVID-19 pandemic. *The Conversation*.
<https://theconversation.com/massive-online-open-courses-see-exponential-growth-during-covid-19-pandemic-141859>, accessed 17 September 2021
- Jinal Jani and Girish Tere (2015). Digital India: A need of Hours. *International Journal of Advanced Research in Computer Science and Software Engineering*. P.8 SSN: 2277 128X
- Kaur, D. (2021, April 8). Here's how blockchain could transform higher education. *Tech Wire Asia*.
<https://techwireasia.com/2021/04/heres-how-blockchain-could-transform-higher-education/>, accessed 18 September, 2021
- Katyeudo, K. K., & de Souza, R. A. C. (2022). Digital Transformation towards Education 4.0. *Informatics in Education*, 21(2), 283–309.
<https://doi.org/10.15388/infedu.2022.13>
- Kumar Jha, A. (n.d.). *Digital Education In India: Challenges and their Solutions*.
<https://doi.org/10.13140/RG.2.2.32600.32000>
- Lall, S., & Singh, N. (2020). COVID-19: Unmasking the new face of education.
- Li, Y., Hao, Y., Xiao, P., Dai, Z., Bi, B., & Fu, D. (2021). *Opportunities and Challenges Faced by the Online Educational Services in the Post-COVID-19 Medical Biofilm Control View project Asia Education Institution View project Opportunities and Challenges Faced by the Online Educational Services in the Post-COVID-19*.
<https://www.researchgate.net/publication/352935943>
- Mhlanga, D. (2023). Digital Transformation Education, Opportunities, and Challenges of the Informatics in Education, 21(2), 283-309. doi:10.15388/infedu.2022.13
- Pal, B., & Chahal, S. (n.d.). Challenges and Opportunities for Online Education in India Covid Issues and Employment View project Knowledge Management and Teaching Learning Process View project

- Challenges and Opportunities for.
<https://www.researchgate.net/publication/343381025>
- Ravi, I., Kennedy, K., Thangiah, R., & Xavier', S. (n.d.). *Digital India Initiatives in Education An Overview*.
<https://doi.org/10.6084/m9.figshare.14398727>
- Ray, P. P. (2010). Web-Based E-Learning in India: the Cumulative Views of Different Aspects. *Indian Journal of Computer Science and Engineering*, 1(4), 340–352
- Rodrigues, L. S. (2017). *Challenges of Digital Transformation in Higher Education Institutions: A brief discussion*.
<https://www.researchgate.net/publication/330601808>
- SINKU, D. S. (2021). DIGITAL TRANSFORMATION IN EDUCATION SECTOR: THE WAY FORWARD FOR INDIA. *JETIR*, 38-48.
<https://research.aimultiple.com/digital-transformation-in-education/>
<http://www.nkn.gov.in/en>
<https://www.drishtiias.com/dily-updates/daily-news-editoria\ls/digital-education-in-india>
<https://timesofindia.indiatimes.com/education/online-schooling/government-initiatives-for-digital-education-in-india/articleshow/94532897.cms>
- <https://www.emerald.com/insight/content/doi/10.1108/AOIJ-11-2017-0037/full/html>
- <https://www.digiteum.com/iot-applications-education/https://www.caclubindia.com/articles/digital-learning-42730.asp>
- www.mhrd.gov.in/sites/filesPDF/Webresults/IndiaReport-DigitalEducation-MHRD
- <https://home.kpmg/in/en/blogs/home/posts/2022/01/education-skill-nep-digital-mantra.html>
- <https://research.aimultiple.com/digital-transformation-in-education/>
- <https://timesofindia.indiatimes.com/education/online-schooling/government-initiatives-for-digital-education-in-india/articleshow/94532897.cms>
- <https://www.holoniq.com/notes/global-edtech-venture-capital-report-full-year-2021>
- <https://www.leadsquared.com/industries/education/digital-transformation-in-education-trends-strategies/>
- <https://www.thirdrocktechkno.com/blog/digital-transformation-in-education/>
- <https://timesofindia.indiatimes.com/blogs/voices/the-future-of-education-in-india-predictions-and-trends-for-2023/>
- <https://techwireasia.com/2021/04/heres-how-blockchain-could-transform-higher-education/>
- <http://chintamani.edu.in/cccp/images/Souvenir%20International%20Conference%20n%20-Digitalisation%20of%20Library%2020%20May%202021.pdf>