

Transition Towards Technological Advancements of 5G, 6G for an Inclusive Infrastructure of Digital Education : A Commentary

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Abstract

This article explores the implications of 5G and 6G technologies on digital education and proposes an inclusive approach to address potential challenges. With the increasing adoption of online learning and remote education, the demand for high-speed internet connection has become essential. The article discusses the benefits of 5G and 6G technologies, such as high bandwidth, in enhancing the overall digital learning experience. However, the article also highlights potential issues such as the digital divide and the need for accessibility for all learners. An inclusive approach is required to ensure that technology is accessible to all and beneficial for all the people, irrespective of their socio-economic status, location, or disabilities. This article emphasizes the importance of addressing these challenges to ensure equitable access to digital education.

Keywords: Technology, Digital Education, Infrastructure, Digital Divide, Challenges

Introduction

With the increasing adoption of online learning and remote education, the demand for high-speed internet connection has become essential. The article discusses the benefits of 5G and 6G technologies, such as high bandwidth, in enhancing the overall digital learning experience. However, the article also highlights potential issues such as the digital divide and the need for accessibility for all learners. An inclusive approach is required to ensure that technology is accessible to all and beneficial for all the people, irrespective of their socio-economic status, location, or disabilities. This article emphasizes the importance of addressing these challenges to ensure equitable access to digital education.

This paper is divided into four sections. The first part focuses on the importance of the digital media in the realm of education and how digital education is the need of the hour. The second section studies the role of India in global governance by creating the roadmap for the

development of 5G and 6G. The third section focuses on the opportunities and challenges in this path. Lastly, we have concluded the paper by making recommendations on how maximum benefits can be reaped from these developments.

5G, 6G and Need for Inclusiveness

In today's dynamic world, changes are continuously taking place. Thus, changes in the field of education are clearly evident. Education is the key towards the development of the nation. It not only contributes to the life of the individuals but also shapes the society in a way in which we want our future generations to live. The rapid development of digital technology has revolutionized the way education is delivered and consumed. Digital education, mostly known as e-learning, refers to the use of technology to support and enhance learning. It has become increasingly important in the 21st century due to its flexibility and accessibility, allowing learners to

access education anytime, anywhere. The introduction of 5G and the aim of shifting to 6G has revolutionized the way in which the educators are able to create a learning environment and the students access their course materials.

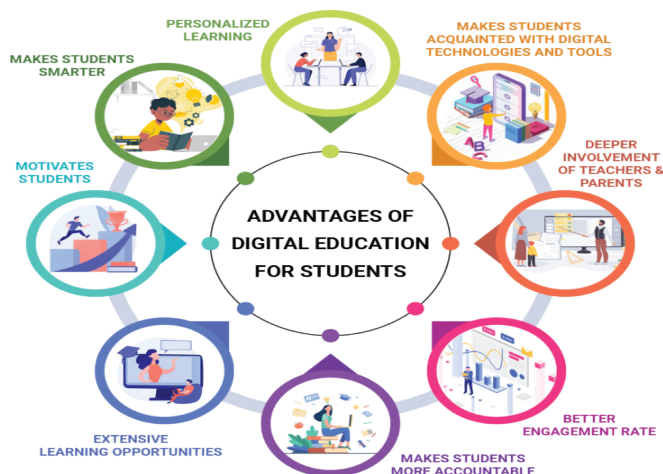
Digital education is a broad term that encompasses various forms of technology-based learning. It can range from simple text-based courses to immersive virtual reality experiences. The nature of digital education is highly customizable, allowing learners to personalize their learning experience to suit their preferences and needs. This flexibility has been especially crucial during the pandemic, where online learning has become the norm. The importance of digital education multiplied during the outbreak of the Covid-19 Pandemic when attending physical school was not a possibility. In this scenario, whether willingly or unwillingly, both the educators and learners had to adopt the path of technology-driven education. It had become the new norm of the day. Digital education has made education accessible to learners who previously faced barriers to access, such as distance, time, and financial constraints.

Digital education has brought a major transformation in the field of education. With time, it has become an essential component of education, and it is likely that its importance would increase in the future. It is a preferred form of education as it shifts from the conventional modes of education. Traditionally, the black-board based education lacked focus on visual representations but that has changed for positive now. Earlier, education focussed only on grades and examination-based studies but now the focus is on imparting skills and knowledge that would remain with students for years. Instead of just getting the degrees, now education's cornerstone is developing the ability of the students that would help them attain jobs in future.

The flexibility and accessibility of digital education make it a valuable tool for lifelong learning and skill development. Additionally, digital education has the potential to enhance the overall learning experience by providing learners with interactive and engaging content. Students can now personalise the curriculum as per their own pace and understanding. It also provides opportunities for collaboration and networking, which can further enrich the learning experience. It provides multiple opportunities to the learners to enrol for several courses and broaden their horizon. It allows students to access education from any part of the world by being in the comfort of their houses. Also, it encourages the learners to develop a rationale thinking as they have to sort out information from vast domain of available data on the internet. Moreover, it is extremely encouraging

for the students as the entire focus on technology has made the education system and the assessment pattern fast and transparent.

Advantages of Digital Education



Source: How Digital Learning is Changing the Face of Education, SkoolBeeps Blogs.

However, any technological advancement, gives rise to potential benefits and challenges, especially with the emergence of 5G and 6G technologies. The emergence of 5G and 6G technologies presents both opportunities and challenges for digital education. These technologies offer high-speed and reliable connectivity, which can significantly improve the digital learning experience. However, they also require significant infrastructure investment, which could reduce the earlier prevailing digital divide between learners who have access to these technologies and those who do not. An inclusive approach to digital education must ensure that all learners. Digital education has become an essential component of modern day sources of education.

Technological advancements have played a significant role in moulding the world. The industrial revolution was a turning point in human history. Currently, we are experiencing the fourth industrial revolution, mostly known as Industry 4.0. Each industrial revolution has brought about significant changes in the way of working and living over the decades.

The first industrial revolution which began in the late 18th century with the invention of the steam engine marked a shift from manual labour to machine-based manufacturing, significantly increasing productivity and economic growth. The second industrial revolution began in the late 19th century and saw the emergence of electricity and mass production, leading to the creation of assembly lines and the rise of consumerism.

The third industrial revolution, famously known as the digital revolution, began in the late 20th century. It started with the widespread adoption of computers and the internet. This revolution led to the automation of many manual tasks and the creation of new industries, such as e-commerce and social media. This was the same time when India adopted the Liberalization, Privatisation and Globalisation and the computers made a big way into the country.

The fourth industrial revolution is characterized by the convergence of physical, digital, and biological technologies. It is marked by the emergence of technologies such as artificial intelligence, the internet of things, and 5G, which are transforming the way we live and work. It marks a rapid interconnectivity in almost all fields. It has blurred all the lines of digital, physical and biological spheres. Klaus Schwab, the Executive Chairman of the World Economic Forum, in the book *The Fourth Industrial Revolution* mentions that the digital revolutions have changed the way we live. He further underlined that the science fictions of the previous decades have become a new reality and nothing seems impossible in future.

Globalization 4.0 is a term coined by the World Economic Forum to describe the current era of globalization, which is being shaped by technological advancements. It is characterized by the emergence of new technologies and the increasing interconnectedness of economies and societies. It can be seen as a landmark in the history as it provides several job opportunities to the people and gives them a scope to increase their income. Globalization 4.0 presents significant opportunities for economic growth and development by increasing the efficiency and productivity, but it also poses challenges, such as increasing inequality and job displacement. Andrew McAfee and Erik Brynjolfsson in their book *The Second Machine Age: Work, Progress and Prosperity in a Time of Brilliant Technologies* (2014) point out that even though the technological advancements might be focussing towards making the world a better place but it brings with a set of severe challenges that cannot be ignored as they have a tendency of perpetuating inequalities amongst the minorities and economically weaker sections of the society. The complexities associated with these technological advancements are so immense that humankind has hardly experienced anything of this sort till date. The involvement of multiple number of stakeholders makes the situation even more complicated.

India and Global Governance Leadership For 5G and 6G

India has emerged as a global leader in the field of information technology and is poised to take on a

leadership role in the development and deployment of 5G and 6G technologies. The government of India has taken several initiatives to promote the development of these technologies, such as setting up a task force to create a roadmap for the deployment of 5G in India. All this has to be done keeping in mind the need to connect billions of Indian citizens at the lowest cost possible. India's large and rapidly growing market presents significant opportunities for the development and deployment of these technologies. India has the potential to emerge as a global leader in the governance of these technologies, ensuring that they are developed and deployed in an inclusive and equitable manner. The functioning of a productive democracy is possible only if people can openly voice their opinions. These technologies serve as tools for making this possible as they increase the platforms for public engagement with the government. The development of 5G and 6G and the government's support in this creates an enabling environment wherein the public is encouraged to work towards innovation and capacity building.

The Government of India has taken several steps to combine the fields of education and technology to increase the access of internet and educational resources by overcoming the cost and geographical factors. PM e-Vidya is a comprehensive programme launched by the Government to accelerate India's aim of Atma Nirbhar Bharat by promoting multiple modes of education. The Bharat Network or the National Optical Fibre Network, started by Prime Minister Narendra Modi's government, aims to ensure that high speed internet connection reaches more than 2,50,000 gram panchayats to promote e-learning and e-commerce. This programme is further enhanced with the commencement of Vidya-daan wherein the Government has come up with a unique idea of making educational sources prepared by the urban educators available to the teachers from the rural areas at no cost. This would enhance the quality of education and help in bringing certain amount of similarity in the content being taught in urban and rural areas.

Digital Infrastructure for Knowledge Sharing (DIKSHA) is an online portal to provide reliable study material to students of schools and colleges. This initiative has also led to the formation of Swayam Prabha TV Channels in 32 Indian local languages so that the students without any internet access can also be provided with the required lectures related to their curriculum. A multi-gigabit national research and educational network has been established under as the National Knowledge Network (NKN). This project aims to connect all the eminent institutions of India like the IITs, IIMs etc., and is gradually developing as the backbone of the educational institutions in India.

Ministry of Education along with several private players in performing to maximum of their ability to ensure that every student in India has access to equal education at the lowest cost, be it digital or physical mode of education. Every subsequent budget of the country has seen a gradual increase in the amount allocated for the educational sector. But with such a large population, comes several implementation and budgeting issues. Now, the Government just needs to fill in these gaps to make digital education the new reality of modern India. This requires a planned public-private partnership that would be beneficial for all.

Factoring in Inclusivity in Digital Education Using 5G And 6G: Need For Synergies And Understanding Opportunities And Challenges

The emergence of 5G and 6G technologies presents significant opportunities for the advancement of digital education. These technologies can improve the accessibility and quality of education, particularly in remote areas, by enabling real-time streaming of lectures and interactive virtual classrooms. However, it is crucial to ensure that these technologies are deployed in an equitable manner to prevent further exacerbating existing inequalities in access to education. This vast availability of data helps researchers to study and analyse all the works done in their respective fields all across the globe.

To achieve this, there is a need for synergies between the government, private sector, and educational institutions. The government can play a crucial role in ensuring that these technologies are deployed in remote and underserved areas through policies and initiatives that promote inclusivity. The private sector can leverage their resources and expertise to develop and deploy these technologies in an inclusive manner. Educational institutions can collaborate with the government and the private sector to develop innovative and inclusive digital education solutions.

There are also challenges that need to be addressed, such as the cost of deploying these technologies and ensuring internet connectivity in remote areas. Since, the government and other authorities are still in the process of ensuring that internet reaches all parts of the country, it is still seen that the remote parts either do not have access to internet or have a poor connectivity. By providing sufficient funds, the government along with the operators need to work immediately on this front to ensure that an appropriate study environment can be created and no discrimination is done based on just the non-availability of internet. Keeping the current pandemic scenario in mind, internet and technology driven education is the only way to ensure that children of no section of society are left behind as far as their schooling and curriculum is concerned.

Also, misuse of this technology needs to be avoided at maximum cost. It needs to be ensured that issues like cyber-bullying and digital education inequalities do not create nuances in the society. Issues related to cyber-security need to be dealt with maximum care. Despite having enough advantages, parents need to manage the screen time of their children as students may find it extremely difficult to maintain self-discipline. They may misuse the available facility and spend more time online social media websites than on educational platforms. Additionally, there is a need to ensure that the deployment of these technologies does not lead to the replacement of human teachers with technology as it is teachers themselves who can guide the student and encourage them to think critically and rationally. Also, it needs to be understood by all that no online means can replace the student-teacher relationship that nurtures the most in a physical school and university campus. So, it is the responsibility of all institutions to train the teachers to combine the conventional and the modern means of education.

Conclusion

In conclusion, the emergence of 5G and 6G technologies presents significant opportunities for the advancement of digital education, but it is crucial to ensure that these technologies are deployed in an inclusive manner. The development and deployment of these technologies require synergies between the government, private sector, and educational institutions, which can address the challenges and promote opportunities for digital education. Furthermore, technological advancements have played an important role in shaping human history, and the fourth industrial revolution is transforming the way we live and work. An inclusive approach is essential to ensure that these technological advancements benefit everyone, and global leadership is crucial to harness their potential.

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