

Impact of Technology on Education; Analysis, Implications, Solutions

Fiyinfoluwa Owoseje*

Texas Southern University, College of Education, Department of Educational Administrations and Foundations

*Corresponding Author

Fiyinfoluwa Owoseje, Texas Southern University, College of Education, Department of Educational Administrations and Foundations.

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Abstract

Technology has had a significant impact on education, transforming the way students learn and teachers teach. With the increasing use of technology in the classroom, it has become essential to analyze its impact, implications, and potential solutions. While technology has brought about many benefits, such as improved access to education, enhanced learning experiences, and collaborative learning, it has also presented some challenges, such as the digital divide, student distraction, and privacy concerns. This essay provides a comprehensive analysis of the impact of technology on education, explore its implications, and propose potential solutions to address the challenges it presents. By examining the various aspects of technology's impact on education, it is possible to gain a better understanding of its potential to improve the quality of education while addressing the challenges that come with its use.

Keywords: Education, Technology, Implications and Impact.

1. Introduction

The introduction of technology in education has transformed the traditional way of teaching and learning, offering endless possibilities to improve the educational experience. The integration of technology in education has brought numerous benefits, including increased access to information, personalized learning, collaboration, and enhanced student engagement. Technology has made it possible for students to access a wide range of educational resources from anywhere at any time, breaking down geographical and time barriers that once hindered learning. In this paper, the focus will be to understand the impact of technologies in education including the implications and solutions.

2. Access to Education

Technology has played a significant role in enhancing access to education for learners worldwide. According to Statista.com (2020), 65% of education faculty fully support the use of technology in education owed to the technology's potential to enhance accessibility to education. Some of the ways in which this has been made possible include the following ways:

• Online Learning Platforms

Online learning platforms have made education accessible to learners across the globe. These platforms offer a wide range of courses from various disciplines, which can be accessed from anywhere and at any time. Online learning platforms, such as Coursera, EdX, Udemy, and Khan Academy, have made it possible for learners to access high-quality education from top universities and

institutions worldwide. Online learning platforms have also made education more affordable, as many courses are available free of charge or at a reduced cost.

• Distance Learning

Distance learning has become a viable option for learners who cannot attend traditional educational institutions. With the availability of technology such as video conferencing, learners can attend live lectures and interact with educators and other learners in real-time. Distance learning has enabled learners to access education without having to travel or relocate, making it more convenient and accessible.

• Open Educational Resources (OERs)

Open Educational Resources (OERs) are educational materials that are freely available online. These resources include textbooks, videos, audio recordings, and other materials that can be used for teaching and learning. OERs have made education more accessible to learners who may not have access to textbooks or other educational materials due to financial constraints or limited access to educational institutions.

• Mobile Learning

Mobile learning has made education accessible to learners who may not have access to computers or laptops. Mobile devices such as smartphones and tablets can be used to access educational materials and resources, allowing learners to access education on the go. Mobile learning has made education more convenient and accessi-

ble, especially for learners in developing countries where access to computers and laptops may be limited. According to Statista.com (2020), 56% of students across the world have expressed the desire for tutors to allow them to use devices in the classroom. At the same time, 53% of teachers believe that increasing accessibility to computers amongst students will significantly make teaching easier Statista.com (2020). This therefore is an indication of a growing interest to integrate technology in education.

- **Virtual Reality**

Virtual reality (VR) technology has made it possible for learners to access education in a simulated environment. VR technology can be used to create immersive learning experiences, allowing learners to interact with the content in a more engaging and interactive manner. This technology has made education more accessible and engaging, especially for learners who may find traditional teaching methods boring or unengaging.

3. Enhanced Learning Experience

Technology has transformed the learning experience in many ways, making it more engaging, interactive, and effective. This has been realized in the following ways:

- **Multimedia Learning**

Technology has enabled the integration of multimedia content into the learning experience. Multimedia content, such as videos, images, animations, and audio recordings, can be used to explain complex concepts in a more engaging and interactive manner [2]. Multimedia learning has been shown to enhance comprehension, retention, and motivation among learners.

- **Gamification**

Gamification is the use of game elements, such as points, badges, and leaderboards, to enhance the learning experience [3]. Gamification has been shown to improve motivation, engagement, and retention among learners. Gamification can be used to teach a wide range of subjects, from mathematics to language learning.

- **Interactive Simulations**

Interactive simulations are computer-based models that simulate real-world scenarios. Interactive simulations can be used to teach a wide range of subjects, from science to engineering. Interactive simulations enable learners to experiment with different scenarios and observe the results, making learning more engaging and effective [4].

- **Adaptive Learning**

Adaptive learning is an approach to learning that uses algorithms to personalize the learning experience based on the learner's individual needs [5]. Adaptive learning algorithms use data from the learner's previous interactions with the content to create individualized learning paths that are tailored to their learning needs. This approach ensures that learners receive a learning experience that is personalized, engaging, and effective.

4. Collaborative Learning

Collaborative learning is a teaching and learning approach that involves learners working together to achieve a common goal [6]. Collaborative learning has been shown to improve learning outcomes, foster critical thinking and problem-solving skills, and enhance social skills. Technology has played a significant role in promoting collaborative learning by providing tools and platforms that enable learners to work together effectively. Some of the ways in which technology has promoted collaborative learning include:

- **Online Collaborative Tools**

Online collaborative tools, such as Google Docs, Microsoft Teams, and Zoom, have made it easier for learners to collaborate on projects and assignments from anywhere and at any time. These tools enable learners to share documents, collaborate on projects, and communicate in real-time. Online collaborative tools have made collaborative learning more accessible and convenient, especially for learners who may not be in the same location.

- **Social Media**

Social media platforms, such as Facebook, Twitter, and LinkedIn, have become popular tools for collaborative learning. Social media platforms enable learners to connect with each other, share information, and collaborate on projects. Social media platforms also enable learners to participate in online communities, where they can share ideas, ask questions, and receive feedback.

- **Online Discussion Forums**

Online discussion forums have become a popular tool for collaborative learning. Discussion forums enable learners to ask questions, share ideas, and receive feedback from other learners and educators. Online discussion forums also enable learners to participate in group discussions, debates, and peer review activities, fostering critical thinking and problem-solving skills.

- **Virtual Collaborative Environments**

Virtual collaborative environments, such as Second Life and Minecraft, have become popular tools for collaborative learning. These environments enable learners to work together in virtual spaces, where they can collaborate on projects, explore, and experiment. Virtual collaborative environments foster creativity, innovation, and teamwork skills.

Collaborative Learning Management Systems

Collaborative learning management systems, such as Moodle and Blackboard, have become popular tools for collaborative learning. These systems enable learners to work together on assignments, projects, and group activities. Collaborative learning management systems also enable learners to communicate with each other, share information, and receive feedback [7].

5. Other ways Technology Increases Education

Here are some additional ways technology can increase education beyond increased access, enhanced learning experience, personalized learning, and collaborative learning:

• Data Analytics

Educational data analytics is the process of collecting and analyzing data from educational systems to gain insights into student learning and teacher effectiveness. Data analytics can help teachers and administrators identify trends and patterns in student performance, such as which students are struggling with specific topics or which teachers are particularly effective. By using these insights, teachers can tailor their teaching methods to better meet the needs of individual students, and administrators can make data-driven decisions to improve educational outcomes.

• Mobile Learning

Mobile learning technologies allow students to access educational resources on their smartphones or tablets, making learning more convenient and accessible. This can be particularly beneficial for students who have limited access to traditional computer labs or classrooms, or who need to learn on-the-go. Mobile learning can include a variety of educational resources, such as eBooks, online courses, and educational apps. Mobile learning can also be used to supplement in-class instruction, providing students with additional resources and opportunities for self-directed learning.

• Digital Simulations

Digital simulations can be used to provide students with immersive learning experiences in a safe, controlled environment. For example, medical students can practice surgical procedures on virtual patients, allowing them to develop their skills without putting real patients at risk. Digital simulations can also be used to teach complex concepts in fields such as engineering, physics, and chemistry. By providing students with interactive, hands-on learning experiences, digital simulations can help improve understanding and retention of material.

• Interactive Whiteboards

Interactive whiteboards allow teachers to create engaging, interactive learning experiences that encourage active participation from students. With interactive whiteboards, teachers can easily incorporate multimedia content, such as videos, images, and interactive activities, into their lessons. Teachers can also use interactive whiteboards to track student progress, assess understanding, and provide instant feedback. Interactive whiteboards can be particularly effective in promoting collaboration and group work among students.

• Cloud Computing

Cloud computing technologies allow students and teachers to access a wide range of software tools and resources from any location or device with an internet connection. By storing resources and data on remote servers, cloud computing can help schools save money on software licensing fees and reduce the need for local storage. Cloud computing can also provide students with access to resources that may not be available locally, such as virtual labs and collaborative tools. With cloud computing, students and teachers can collaborate on projects, share resources, and communicate with each other from anywhere in the world.

Overall, technology has the potential to transform education in many ways, by providing students and teachers with new tools and resources that can enhance learning outcomes, increase efficiency, and make education more accessible to all. The continued development and use of technology in education can help prepare students for the challenges of the future and help ensure that everyone has access to high-quality education.

6. Economist Perspective

The use of technology in education has significant economic implications for schools, students, and the wider education system. While the initial costs of implementing technology in education can be high, the long-term benefits can result in cost savings and increased efficiency. However, the financial impact of technology in education depends on how it is implemented, the specific technology used, and the context of the education system.

One of the most significant economic benefits of technology in education is the potential to reduce costs associated with traditional education models [8]. This includes the cost of physical infrastructure such as buildings and classrooms, as well as other overhead costs such as heating, lighting, and maintenance. The use of technology can also reduce the need for textbooks and other learning materials, which can be costly to produce and distribute [8]. Moreover, online courses and virtual classrooms can reduce the need for physical resources and can be delivered to a larger number of students at once, resulting in economies of scale. The use of technology can also improve efficiency in the education system. For instance, automated grading and assessment tools can reduce the workload of teachers, allowing them to focus on other areas of instruction. Similarly, learning management systems can streamline administrative tasks, such as tracking attendance, assigning homework, and communicating with students and parents, resulting in time and cost savings.

Technology can as well generate revenue for schools and the education system [8]. For example, online courses can generate income from tuition fees, while partnerships with technology companies can provide funding for research and development of new education technologies. Furthermore, the use of technology can increase the attractiveness of schools and universities to prospective students, potentially increasing enrollment and revenue. However, the economic impact of technology in education is not always positive. The initial costs of implementing technology in education can be high, including the cost of hardware, software, and training for teachers and students. The cost of technology can be a barrier to entry for schools in low-income areas or countries, exacerbating existing inequalities in education [8]. Moreover, the ongoing costs of technology maintenance, upgrades, and replacement can also be high. This can be particularly challenging for schools and districts with limited budgets, resulting in a digital divide between schools with access to the latest technology and those without.

Finally, the economic impact of technology in education also depends on the specific technology used and the context of the edu-

cation system. For example, the use of virtual reality and artificial intelligence technologies may require a higher investment than other types of technology, but can also provide more significant benefits.

Essentially, the economic impact of technology in education depends on several factors, including the type of technology used, the context of the education system, and how it is implemented. While there are potential cost savings and revenue generation opportunities, there are also significant initial costs and ongoing maintenance expenses associated with technology in education. To ensure that technology in education is economically sustainable, it is essential to consider the long-term benefits and costs, as well as the specific needs of the education system and students.

7. Distance Education and Technology

Distance education and technology have become increasingly intertwined in recent years, as the prevalence of digital communication tools and online learning platforms has made it easier than ever to provide educational opportunities to students who are not physically present in a traditional classroom setting. This has opened up new avenues for learning and provided access to education for people who might not otherwise have had the opportunity to pursue their academic goals.

Distance education has a long history, dating back to the early 20th century when correspondence courses first emerged as a way for people to study at their own pace from a distance [9]. However, the development of digital technologies has revolutionized the way that distance education is delivered, making it possible to offer interactive, multimedia-rich learning experiences that simulate the traditional classroom environment. Today, distance education encompasses a broad range of formats, including online courses, webinars, podcasts, and video lectures, among others.

One of the most significant benefits of distance education is that it provides greater flexibility and accessibility for learners [10]. With online courses, students can study at their own pace, on their own schedule, and from virtually anywhere with an internet connection. This is particularly valuable for people who have other commitments, such as work or family responsibilities that would make attending traditional classes difficult or impossible. Distance education also makes it possible for students to access courses and programs that might not be available in their local area, opening up new opportunities for learning and professional development.

At the same time, the widespread adoption of technology in distance education has also brought about new challenges and concerns. For example, there is a risk that learners may feel isolated or disconnected from their peers and instructors in an online learning environment [11]. To mitigate this, many distance education programs incorporate interactive features such as discussion forums, chat rooms, and video conferencing to promote collaboration and engagement. Another concern is that some students may struggle with the self-discipline and time management skills required for

successful distance learning. To address this, many programs provide support and resources to help students develop these skills, such as time management tools and study groups.

In addition to these issues, there are also broader societal implications of the increasing use of technology in education. For example, some critics argue that the shift towards distance education and online learning may exacerbate existing inequalities in access to education. While digital technologies have made it possible to provide educational opportunities to people who might not otherwise have had access, there are still significant barriers to access for many marginalized communities, such as those without reliable internet access or the necessary technology [12]. Additionally, some argue that online education may not provide the same quality of learning experience as traditional classroom instruction, which could have long-term consequences for the skills and knowledge of the workforce.

Despite these concerns, there is no doubt that technology has had a significant impact on distance education and is likely to continue to do so in the coming years. As digital communication tools become increasingly sophisticated and accessible, we can expect to see new innovations in online learning, such as the use of virtual and augmented reality technologies to create immersive learning experiences. At the same time, it will be important to ensure that the benefits of these technologies are accessible to everyone and that the potential risks and challenges are carefully considered and addressed.

Essentially, the relationship between distance education and technology is complex and multifaceted, with both benefits and challenges. While technology has made it possible to provide educational opportunities to people who might not otherwise have had access, it has also raised concerns about the quality of learning experience and the potential for exacerbating inequalities in access. As we continue to explore new possibilities in online learning and digital communication, it will be important to remain vigilant about these issues and to work towards creating a more equitable and inclusive education system that leverages the best aspects of both traditional and online learning environments. This will require ongoing collaboration between educators, policymakers, and technology experts to ensure that distance education remains a viable and effective option for learners of all backgrounds

8. Implications on the Use of Technology in Education

The use of technology in education has brought about a range of benefits, including greater flexibility and access to educational opportunities, personalized learning experiences, and improved student engagement. However, as with any technological innovation, there are also potential side effects and implications that must be carefully considered.

One of the most significant side effects of technology in education is the potential for distraction and decreased focus. With the proliferation of smartphones, laptops, and other digital devices in the

classroom, students are increasingly tempted to check social media, text messages, or other non-educational content during class [13]. This can have a detrimental effect on student learning and engagement, as it takes their attention away from the lesson and can lead to a loss of focus and productivity. Additionally, the constant bombardment of notifications and alerts from digital devices can contribute to feelings of stress and anxiety, making it more difficult for students to focus and learn effectively.

Another potential side effect of technology in education is the risk of cyberbullying and online harassment. While technology has made it easier than ever to communicate and collaborate with peers, it has also created new opportunities for negative behavior such as cyberbullying. This can be particularly damaging for students who are already vulnerable or marginalized, such as those with disabilities or from minority groups. In addition to the emotional harm caused by cyberbullying, it can also lead to a decline in academic performance and mental health issues such as depression and anxiety.

The use of technology in education can also have implications for privacy and security. With the collection of vast amounts of data on student performance, behavior, and preferences, there is a risk that this information could be misused or shared without the student's knowledge or consent. Additionally, the use of digital devices in the classroom creates a potential security risk, as hackers may be able to access sensitive information or disrupt the learning environment through malware or other malicious software.

Another potential side effect of technology in education is the potential for increased social isolation and decreased face-to-face interaction. While digital technologies have made it easier to connect with others remotely, they can also contribute to a sense of detachment and disconnection from the physical world. This can be particularly damaging for young children, who need social interaction and physical activity to develop properly. Additionally, the emphasis on digital communication can lead to a decline in social skills such as active listening, empathy, and collaboration.

Finally, the use of technology in education can have broader societal implications, particularly in terms of equity and access. While digital technologies have the potential to provide greater access to educational opportunities for marginalized and underserved populations, they can also exacerbate existing inequalities in access to technology and the internet. This can create a digital divide, where students from low-income or rural areas may not have the same access to educational resources and opportunities as those from wealthier or urban areas. Additionally, the reliance on technology in education may exacerbate existing biases and inequalities in the education system, such as those related to race, gender, or socioeconomic status.

9. Solutions

As initially highlighted, some of the challenges associated with the use of technology in education include distraction, cyberbullying,

privacy and security concerns, and social isolation, and equity and access issues. Some of the potential solutions to these problems are detailed below:

10. Distraction and Decreased Focus

To address the problem of distraction and decreased focus in the classroom, educators can implement several strategies. One approach is to create technology-free periods or zones during class time. This means setting aside specific times or areas in the classroom where students are not allowed to use their phones, laptops or any other technological devices. These periods can be set for specific activities or lectures, and can also help students develop self-control and discipline. Another effective strategy is to make use of active learning techniques such as group discussions or hands-on activities. This approach can help to keep students engaged and focused on the task at hand, reducing the likelihood of distraction. Group discussions can help students to interact with one another, share ideas and develop a deeper understanding of the subject matter. Hands-on activities such as experiments, simulations or games can also help to keep students engaged and motivated, while promoting learning in a fun and interactive way.

In addition to these strategies, educators can also incorporate other elements that can help reduce distractions in the classroom. For example, teachers can vary their teaching style and use visual aids or other techniques to keep students interested and engaged. They can also create a positive learning environment by praising students for their achievements, using positive reinforcement, and encouraging collaboration and teamwork. Ultimately, the goal is to create an environment that promotes focus and concentration, while also promoting creativity and engagement. By using a combination of technology-free periods or zones, active learning techniques, and other strategies, educators can help students to develop the skills and habits needed to succeed both inside and outside the classroom.

11. Cyberbullying and Online Harassment

Cyberbullying and online harassment are major concerns in the modern digital age. It is the responsibility of educators to ensure that students are safe from such harmful behavior in the classroom and online. One of the ways to address this issue is to implement clear policies and procedures that aim to prevent and respond to cyberbullying and online harassment. Educators can work with their school administration and IT staff to develop such policies that clearly define acceptable online behavior and establish consequences for those who engage in cyberbullying and online harassment.

Educators can also train students on how to identify and report incidents of cyberbullying and online harassment. This training can include lessons on recognizing the signs of cyberbullying, how to report it, and how to provide support to those who may be experiencing it. Additionally, educators can use technology itself to raise awareness and provide resources to students, such as creating a designated channel on the school's online platform where students

can report incidents and access support.

Creating a culture of respect and inclusivity in the classroom is also critical to preventing cyberbullying and online harassment. Educators can model respectful online behavior, such as avoiding derogatory language and refraining from posting negative comments or messages. They can also foster a supportive and inclusive environment where all students feel safe to express their opinions and ideas without fear of retaliation. Encouraging open communication and regular check-ins with students can also help to identify potential issues before they escalate into cyberbullying or online harassment.

Basically, addressing the problem of cyberbullying and online harassment requires a multifaceted approach that includes clear policies and procedures, training for students, and a culture of respect and inclusivity in the classroom. By working together to prevent and respond to cyberbullying and online harassment, educators can create a safe and supportive environment where students can learn and grow without fear of harm.

12. Privacy and Security Concerns

The issue of privacy and security in the classroom is a critical concern in the digital age, as more and more student data are being collected and analyzed by technology providers. To address these concerns, educators can work collaboratively with technology providers to ensure that data is collected, stored, and used in a responsible and transparent way.

One important step is implementing strong security measures to protect student data from unauthorized access or breaches. This may include using encryption to secure data transmission, implementing secure login procedures, and regularly reviewing and updating security protocols.

In addition to security measures, educators can also work to ensure that student data is only used for educational purposes and is not shared or sold to third parties without student consent. This can be achieved through clear policies and guidelines around data collection, as well as ongoing monitoring and oversight to ensure compliance with these policies. Another important consideration is providing students with control over their own data. This means giving students the ability to review and edit their own data, as well as the ability to delete their data if they choose to do so. This can help to build trust and transparency with students and ensure that their privacy rights are respected.

Essentially, educators can play a critical role in educating students on the importance of digital literacy and responsible use of technology. This includes teaching students about best practices for protecting their own privacy and security online, such as using strong passwords, avoiding phishing scams, and being aware of potential threats. By equipping students with the knowledge and skills they need to be responsible digital citizens, educators can help to mitigate privacy and security risks and ensure that technology is used in a safe and responsible way in the classroom.

13. Social Isolation

Social isolation is one of the potential side effects of technology in education that educators need to be aware of. While technology has made it easier for students to access information and resources, it can also lead to a lack of social interaction and face-to-face communication. To address this issue, educators can encourage students to participate in face-to-face interactions and group activities.

One effective strategy to promote face-to-face interaction is by implementing collaborative projects or discussions. Educators can assign group projects or collaborative assignments that require students to work together in person. This not only promotes face-to-face communication but also helps students to develop important skills such as teamwork and collaboration.

Additionally, educators can provide opportunities for physical activity and outdoor learning. By incorporating physical activity into the curriculum, such as through outdoor games or sports, educators can help students to develop physical skills and improve their overall health while also promoting social interaction and team building.

Furthermore, educators can work to create a positive and inclusive classroom culture that values face-to-face communication and interpersonal relationships. This may involve setting ground rules for respectful communication and interaction, encouraging open discussion and feedback, and creating a safe and supportive learning environment where all students feel included and valued.

By promoting face-to-face interaction, incorporating physical activity and outdoor learning, and creating a positive and inclusive classroom culture, educators can help to address the potential for social isolation associated with technology in education. By doing so, they can foster important social skills and help students to build meaningful connections with one another, which can have a positive impact on their academic and personal success.

14. Equity and Access Issues

One of the biggest challenges facing educators today is addressing equity and access to technology in education. While technology can be a powerful tool for enhancing learning and increasing access to educational resources, it can also widen the digital divide between students who have access to technology and those who do not. This can exacerbate existing inequalities in the education system, particularly for low-income, rural, or marginalized communities.

To address these concerns, educators can work to provide equal access to educational resources and opportunities for all students. This may involve implementing programs and initiatives to provide technology and internet access to low-income or rural students who may not have access to these resources at home. This could include providing laptops or tablets to students, setting up computer labs or providing Wi-Fi hotspots in schools, or partner-

ing with community organizations to provide access to technology outside of school hours.

Additionally, educators can work to reduce the digital divide through policies and initiatives aimed at promoting access to technology for all. This could include working with government or community organizations to fund technology programs or initiatives, promoting digital literacy and technology skills in the classroom, and advocating for policies that promote equal access to technology and educational resources.

However, it is also important to recognize that access to technology alone is not enough to address equity concerns in education. There are many biases and inequalities in the education system that can contribute to unequal outcomes for students, particularly those related to race, gender, or socioeconomic status. To address these issues, educators must work to create a more inclusive and equitable education system that values diversity, promotes inclusivity, and recognizes and addresses the unique needs and challenges of all students.

This may involve implementing programs and initiatives to address implicit biases or discrimination in the classroom, providing support and resources for students who may face additional challenges, such as students with disabilities or English language learners, and promoting culturally responsive teaching practices that recognize and celebrate diversity. Essentially, addressing equity and access to technology in education is a complex and multifaceted issue that requires a comprehensive approach. By working to provide equal access to technology and educational resources, while also addressing biases and inequalities in the education system, educators can help to ensure that all students have an equal opportunity to succeed and reach their full potential.

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