

Impact of IoT on Education Sector After COVID-19 Pandemic

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Abstract

The Internet of Things (IoT) is transforming the education sector by offering new and innovative ways to improve teaching and learning experiences. IoT devices and applications are being used to create smart classrooms, enhance student engagement, and provide personalized learning experiences. This paper explores the impact of IoT in the education sector, highlighting the benefits and challenges of its adoption. The Internet of Things (IoT) is a network of physical devices, vehicles, home appliances, and other objects embedded with sensors, software, and connectivity, which enables them to connect and exchange data. IoT has been transforming various industries, including healthcare, transportation, and agriculture, and it is now revolutionizing the education sector.

Keywords: Smart classrooms, Personalized learning, Real-time feedback, Collaborative learning, Augmented reality, Virtual reality, Adaptive learning, Remote learning, Internet of Things (IoT)

INTRODUCTION

The impact of the Internet of Things (IoT) is a technology which allows users to get connected to a system of interrelated devices which can be mechanical, digital or computing devices which will help facilitate human – human or human – computer interaction. Necessity is the mother of invention and the pandemic has thus necessitated remote learning as a means to continue education. IoT has played a crucial role in enabling this shift. IoT devices such as smartboards, laptops, and other tools have made virtual learning possible, allowing students to participate in interactive classrooms from their homes. This has made education more accessible especially to students with disabilities, who now participate in online classes without facing any barriers.

IoT has also enabled personalized learning. This has resulted in an increased student engagement and has also helped improve the learning outcomes. Teachers now can collect and analyse the data pertaining to a student's learning patterns and behaviours, and use this information to modify their lessons to suit the specific needs of each student. This will also result in a student friendly teaching – learning environment.

However, the widespread adoption of IoT in education has also brought to the forefront the need for robust technological infrastructure, including high-speed internet access, to support remote learning. Teachers must also be trained to effectively use IoT in the classroom, including the use of virtual learning management systems and online collaboration tools. Also in a vast country

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like ours, with a large population still being below the poverty line, access to such devices and facilities is still a matter of concern.

It is hence very important to consider equity in access to IoT devices and the internet, to ensure that the impact of IoT on education is positive and sustainable. If access to these technologies is limited by socio-economic status, the benefits of IoT in education will be restricted to only a portion of the student population.

Impact of IoT in Education:

1. *Smart Classrooms:* IoT devices, such as sensors, smart boards, and wearables, are being used to create smart classrooms. These devices are used to collect and analyze data, which can be used to optimize learning environments, monitor student behavior, and provide real-time feedback.
2. *Personalized Learning:* IoT is enabling personalized learning experiences by providing customized content based on the student's learning style, performance, and interests. This helps students learn at their own pace and improve their understanding of the subject matter.
3. *Student Engagement:* IoT is enhancing student engagement by making learning more interactive and collaborative. IoT devices, such as virtual reality headsets and interactive whiteboards, are being used to create immersive and engaging learning experiences.
4. *Campus Safety:* IoT is being used to improve campus safety by providing real-time monitoring of campus facilities, such as classrooms, labs, and dormitories. IoT devices, such as security cameras and smart locks, can detect and prevent unauthorized access to campus facilities.

Challenges of IoT in Education:

1. *Cost:* The adoption of IoT devices and applications can be expensive, which can be a barrier to their widespread adoption in the education sector.
2. *Security:* IoT devices are vulnerable to cyber-attacks, which can compromise the privacy and security of student and teacher data.
3. *Privacy:* The use of IoT devices in classrooms raises concerns about student privacy, as these devices can collect sensitive data about student behavior and performance.

Significance of Research

1. *Enhancing learning experience:* IoT technology can enhance the learning experience by providing students with more interactive and immersive learning opportunities. For example, IoT devices can be used to create virtual classrooms, where students can interact with teachers and peers in real-time from different locations.
2. *Increasing efficiency and productivity:* IoT devices can help automate administrative tasks, such as attendance tracking, grading, and scheduling, freeing up teachers to focus on teaching and students to focus on learning.
3. *Improving safety and security:* IoT devices can be used to monitor classrooms and campuses for safety and security threats, such as fires, floods, or intruders, ensuring that students and staff are safe.
4. *Promoting sustainability:* IoT devices can be used to monitor and optimize energy consumption in schools and universities, reducing their carbon footprint and promoting sustainability.
5. *Preparing students for the workforce:* As IoT becomes more prevalent in the workplace, studying its impact on education can help prepare students for the demands of the modern workforce, where knowledge of IoT technologies is becoming increasingly important.

Objective of the Study

- The main objective of this study is to understand the impact of IoT on the Education Sector and its stake holders, namely the educational institutions, students, teacher and the parents.
- This study also tries to understand the impact of IoT on the teaching-learning process.
- His study also focuses on the various issues and challenges faced by the Education Sector while adapting IoT in the teaching- learning process.

REVIEW OF LITERATURE

1. *"IoT-based smart education: A review of the literature and future directions"* by Soomro et al. (2018) This study presents a comprehensive review of the literature on IoT in education, focusing on the potential benefits, challenges, and future directions. The authors suggest that IoT can enhance student engagement, personalize learning experiences, and improve teacher-student interactions [1].
2. *"IoT in education: A survey"* by Mukherjee et al. (2017) This study presents a survey of IoT applications in education, highlighting the potential benefits and challenges of IoT adoption in classrooms. The authors argue that IoT can improve student learning outcomes, streamline administrative tasks, and provide new insights into student behavior [2].
3. *"An IoT-based smart classroom for enhancing teaching and learning"* by Niu et al. (2019) This study describes the development and implementation of an IoT-based smart classroom, which integrates various IoT technologies to support teaching and learning activities. The authors report that the smart classroom has improved student engagement and teacher productivity, and has led to better learning outcomes [3].
4. *"IoT-enabled learning environment: A review"* by Singh et al. (2021) This study provides a comprehensive review of the literature on IoT-enabled learning environments, which use various IoT technologies to support teaching and learning activities. The authors argue that IoT-enabled learning environments can provide personalized learning experiences, improve teacher-student interactions, and enhance student engagement [4].
5. *"The impact of IoT on education and learning environments"* by Shilpa et al. (2020) This study presents a conceptual framework for understanding the impact of IoT on education and learning environments. The authors argue that IoT can enhance the quality of education, improve access to educational resources, and promote lifelong learning [5].
6. *Smart Classrooms: IoT can be used to create smart classrooms that enhance learning experiences for students.* In a study conducted by Chauhan et al. (2020), they proposed an IoT-based smart classroom system that utilizes sensors and data analytics to enhance the learning experience. The system was found to improve student engagement, performance, and satisfaction [6].
7. *Personalized Learning: IoT can be used to create personalized learning experiences for students.* In a study conducted by Carmona-Murillo et al. (2019), they proposed an IoT-based system for adaptive learning that uses data analytics and machine learning to personalize the learning experience for each student. The system was found to improve student motivation and engagement [7].
8. *Campus Management: IoT can be used to create efficient campus management systems.* In a study conducted by Hameed et al. (2020), they proposed an IoT-based campus management system that uses sensors and data analytics to monitor and manage various aspects of campus operations. The system was found to improve efficiency and reduce costs [8].
9. *The article "IoT applications in education: A systematic review"* by J.C. Sancho-Gómez et al. provides an overview of the use of Internet of Things (IoT) technologies in the field of education. The authors conducted a systematic review of literature published between 2010 and 2016, identifying and analyzing 64 articles that met their inclusion criteria [9].
10. *The paper "IoT in education: Opportunities and challenges"* discusses the potential of Internet of Things (IoT) technology in transforming the education sector. The authors, H. Alhazmi, F. Alharthi, and S. Alqahtani, highlight the benefits of IoT in education, including improved learning outcomes, personalized learning experiences, and enhanced student engagement [10].
11. The paper titled *"IoT-based smart classroom for enhancing education"* by M.R. Alharthi, M.A. Khan, and M. Alnuem was published in the 2019 International Conference on Computer Applications & Information Security (ICCAIS). The paper proposes a smart classroom system based on Internet of Things (IoT) technology to enhance the education process [11].
12. The paper titled *"Internet of things (IoT) applications in education: A review"* by F. Anwar, A. H. Al-Amri, and H. Al-Badi, published in the proceedings of the 2017 International Conference on Electrical and Computing Technologies and Applications (ICECTA), provides an overview

of the potential applications of IoT in the field of education. The authors begin by introducing the concept of IoT and its impact on various fields, including education. They highlight the advantages of IoT in education, such as the ability to provide real-time feedback and personalized learning experiences. The authors then provide an overview of the different areas in education where IoT can be applied, such as student monitoring, smart classrooms, and campus management [12].

13. The article titled "*Internet of Things (IoT) in Education: A Comprehensive Review*" by S.S. Saeed, A. Almazyad, and A. Almazyad, gives an introduction to IoT and its potential to revolutionize the education sector. The authors then proceed to provide a comprehensive overview of the existing literature on the use of IoT in education. They categorize the applications of IoT in education into three broad areas: learning analytics, smart campus, and personalized learning [13].
14. The paper titled "IoT-based learning environment for secondary school science" by D.N. Chiu and J.M.H Ng, proposes the development of an IoT-based learning environment for secondary school science. The authors highlight the importance of technology in enhancing the learning experience of students, especially in the field of science. They propose the use of the Internet of Things (IoT) as a tool for creating an immersive and interactive learning environment that can help students better understand scientific concepts [14].
15. The article titled "*Internet of Things in Education: A Review*" by K.L.K. Teh, K.T. Chong, and K.Y. Lim provides a detailed overview of the current state of IoT in education and highlights its potential for improving student learning experiences and educational outcomes. It is a useful resource for educators and researchers who are interested in exploring the applications of IoT in education [15].
16. The paper "*A smart classroom for effective education: An IoT approach*" presents a novel approach to enhancing the classroom environment using Internet of Things (IoT) technology. The authors propose an interesting and innovative idea for leveraging IoT technology in education. The paper also provides a comprehensive overview of the proposed smart classroom system, including the hardware and software components, and explains how the system can be used to enhance the teaching and learning process. The authors also discuss the potential benefits of using IoT technology in education, such as improved student engagement and better learning outcomes [16].
17. The paper "*Internet of Things in Education: A Review*" by P.T. Nguyen, V. Tran, and D.D. Nguyen provides an overview of the current state of IoT in education. The authors present a comprehensive analysis of IoT applications in education and the benefits and challenges associated with their implementation. The paper begins with an introduction to IoT and its potential to revolutionize education. The authors then review the current state of IoT in education, including its applications in various areas such as classroom management, smart campuses, personalized learning, and assessment. The authors also discuss the challenges associated with IoT implementation in education, including data privacy and security concerns, cost, and technical issues [17].
18. The paper titled "Smart campus using IoT for enhancing education" by M.A. Khan, M.R. Alharthi, and M. Alnuem presents an innovative approach to enhance education by using the Internet of Things (IoT) technology on a university campus. The paper discusses how IoT can be used to create a smart campus that will provide a better learning environment for students and faculty. The authors present a case study of a smart campus implemented at a university in Saudi Arabia. They explain how the campus was equipped with various IoT devices, such as sensors, cameras, and microcontrollers, to collect data on student behavior, classroom usage, and energy consumption. The data collected was then analyzed to identify areas of improvement and optimize the learning experience for students and faculty [18].
19. The article "*IoT in education: A survey*" published in the Journal of Educational Technology & Society in 2018, provides an overview of the potential of the Internet of Things (IoT) in education. The authors, T. Dimitrakopoulos, N. Fragoulis, and I. Papadopoulos, conducted a

systematic literature review to identify the current state of research on the use of IoT in education [19].

20. The article titled *"IoT-Based Educational Environment: An Interactive and Engaging Approach to Teach Science"* published in the Journal of Educational Computing Research in 2018, authored by Halabi, Abdallah, and Al-Shamali, describes an innovative approach to teaching science using the Internet of Things (IoT) technology. The authors argue that traditional methods of teaching science, which rely on textbooks and lectures, can be dry and unengaging for students. To address this issue, they propose an IoT-based educational environment that uses sensors and devices to provide students with hands-on learning experiences [20].
21. In their 2019 article *"Internet of things in education: A review,"* J.J. Sanz, J.B. Montalvá, and E. Jiménez provide the overview of the use of Internet of Things (IoT) technology in education. The authors introduce IoT and its potential benefits for education, such as improving personalized learning experiences, enhancing communication and collaboration, and providing real-time feedback. They also discuss the various applications of IoT in education, including smart classrooms, smart campuses, and remote learning. The authors provide examples of IoT devices and systems that can be used in each of these contexts, such as smart boards, smart lighting, and environmental sensors. They also discuss the benefits and challenges of implementing IoT in education, such as cost, privacy concerns, and the need for teacher training [21].
22. The article *"IoT-based educational applications: Opportunities, challenges, and future directions"* by H. Arshad and A. R. Khan, explores the potential benefits and challenges of integrating Internet of Things (IoT) technologies into educational applications. The article discusses various opportunities offered by IoT-based educational applications, such as personalized learning, real-time feedback, and the ability to collect and analyze large amounts of data. Additionally, the authors highlight the potential benefits of using IoT in distance learning and remote education [22].
23. The paper titled *"IoT Based Smart Classroom for Effective Learning"* by M.P. Shaji and N.K. Kumar, discusses the limitations of traditional classroom settings and how technology can be used to overcome them. The paper also introduces their proposed smart classroom system, which includes several IoT devices such as sensors, actuators, and cameras, to collect and process data in real-time. The collected data is used to improve various aspects of the classroom environment, such as lighting, temperature, and air quality, to ensure a comfortable and conducive learning environment [23].
24. The article titled *"Internet of Things (IoT) in Education: Challenges and Opportunities"* by A. Alawadhi explores the potential of IoT in education, highlighting both the challenges and opportunities presented by this technology. The article discusses the potential of IoT in education, including its ability to facilitate personalized learning, increase efficiency, and enhance collaboration among students and teachers [24].
25. The article *"IoT-based educational platform for smart classrooms: A case study"* by Barbancho et al. (2019) presents a case study of an IoT-based educational platform for smart classrooms. The authors argue that the integration of IoT technology into education can enhance teaching and learning processes, and they provide an example of how this can be achieved [25].

METHODOLOGY

The study involves both primary and secondary data. Primary data was collected with the help of a questionnaire. This questionnaire was administered in a random stratified sample of 106 engineering college students spread across all four years of engineering from various branches. Secondary data was collected from print and electronic sources of information, journals and articles.

Sample Size

A random stratified sample of 106 engineering college students spread across all four years of engineering from various branches like computer science, information technology, mechanical, civil, electrical, electronics and communications and chemical.

Primary Survey

As part of the study on IoT in the Education Sector, a small survey was conducted with 106 responses. The respondents were students of an engineering college. These students have experienced changes in the teaching–learning methodologies during the pandemic. The following are the inferences that can be drawn from primary survey.

Series: On a scale of 10, how much do you think the utilization of IoT in education sector has increased after the COVID Pandemic

106 responses

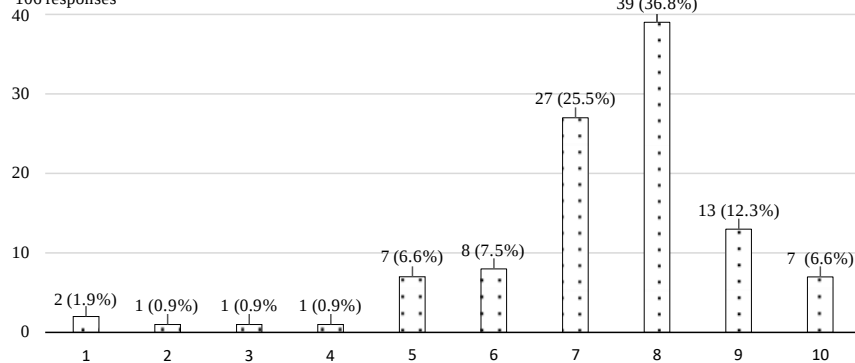


Figure 1. increase in the Utilisation of IoT in the Education Sector.

Figure 1 The majority of respondents (39) believe that the utilization of IoT in the education sector has increased moderately after the COVID pandemic, while 27 respondents voted 7. The data suggests a significant increase in IoT utilization, with a long tail on the higher end of the scale, indicating that relatively few respondents voted low values.

What specific IoT technologies have been used in the education section to facilitate remote learning during the COVID-19 pandemic?

106 responses

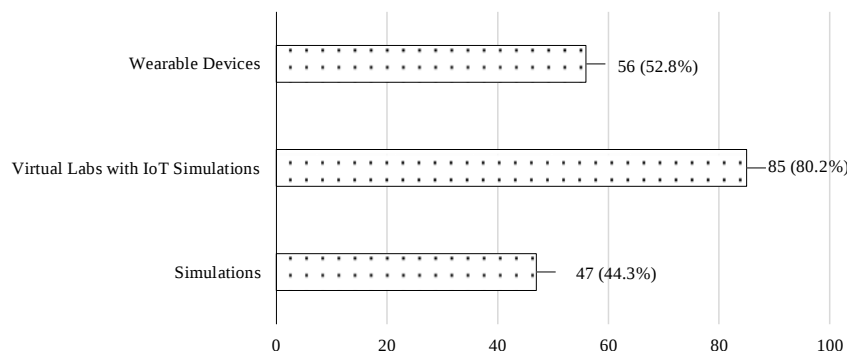


Figure 2. Technologies used in the Education Sector.

Figure 2 The data plotted on the graph shows that "Virtual Labs with IoT Simulations" received the highest number of votes (85), followed by "Wearable Devices" (56) and "Simulations" (47). This suggests that Virtual Labs with IoT Simulations were the most popular IoT technology used to facilitate remote learning during the COVID-19 pandemic.

How have school and universities ensured the security and privacy of students' data while using IoT technology for remote learning during the covid-19 pandemic?
106 responses

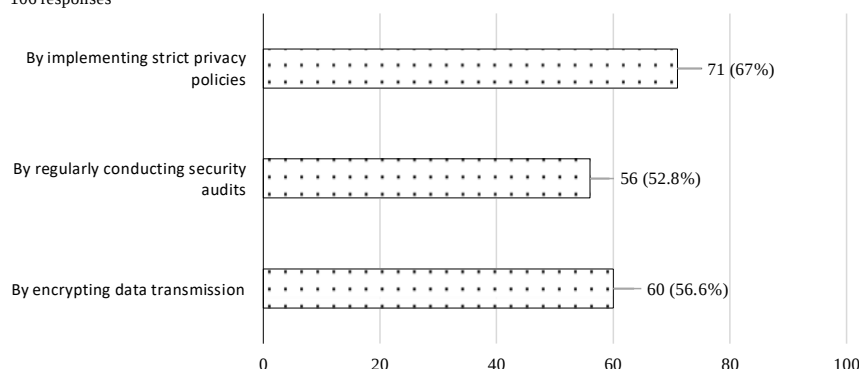


Figure 3. Ensuring Security and Privacy of Student Data.

Figure 3 The data reveals that the most popular method used by schools and universities to ensure students' data privacy and security during remote learning with IoT technology was by implementing strict privacy policies, with 71 votes. The second most popular method was encrypting data transmission with 60 votes, while regularly conducting security audits was the least popular with 56 votes. Overall, the data indicates that measures were taken to ensure data security and privacy during the COVID-19 pandemic.

Have there been any noticeable improvements in the quality of remote learning after the implementation of IoT technology in the education sector?
106 responses

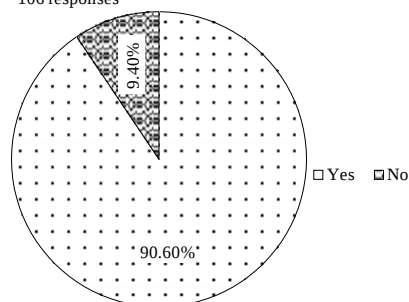


Figure 4. Improvements in the Quality of Learning.

Figure 4 The data indicates that the majority of respondents (96) believe there have been noticeable improvements in the quality of remote learning after the implementation of IoT technology in the education sector, with only 10 respondents voting "No." The data suggests that IoT technology has had a positive impact on the quality of remote learning during the COVID-19 pandemic.

Figure 5 The data indicates that the majority of the respondents (63) had a positive response to the use of IoT technology in the education sector for remote learning during the COVID-19 pandemic, while only a small number of respondents voted "Negative" (6). The "Neutral" option received 37 votes. This suggests that IoT technology was generally well-received by students, teachers, and parents during the pandemic.

What has been the response from students, teachers, and parents regarding the use of IoT technology in the education sector for remote learning during the COVID-19 pandemic?
106 responses

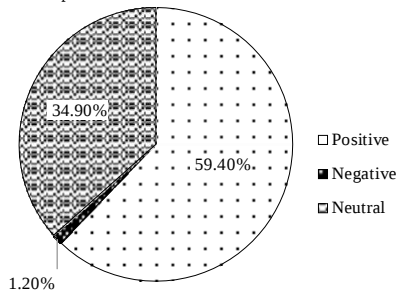


Figure 5. Response of Students, Teachers and Parents to the use of IoT in the Education Sector

How have school and universities ensured the security and privacy of students' data while using IoT technology for remote learning during the COVID-19 pandemic?
106 responses

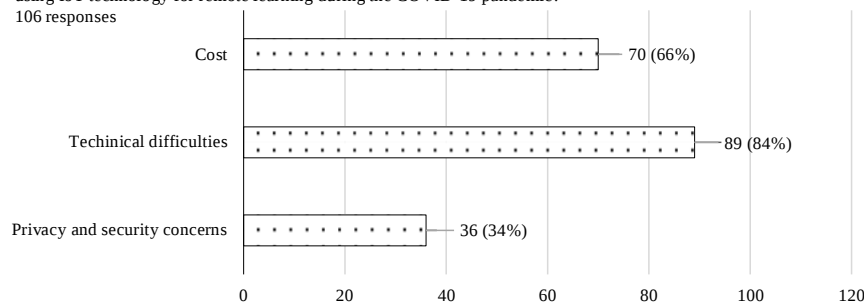


Figure 6. Challenges faced by Educational Institutions in the Implementation of IoT.

The data indicates that the most significant challenge faced by schools and universities in the implementation of IoT technology for remote learning during the COVID-19 pandemic was technical difficulties, as indicated by 89 votes. The second most common challenge was cost, with 70 votes, followed by privacy and security concerns, with 36 votes. The results underscore the importance of addressing technical challenges in implementing IoT technology in the education sector and highlight the need for cost-effective solutions to facilitate remote learning Figure 6.

How has the use of IoT technology in the education sector for remote learning during the COVID-19 pandemic affected the cost of education?
106 responses

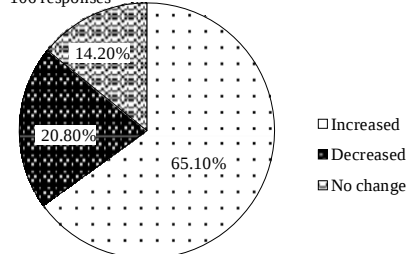


Figure 7. Impact of IoT on the Cost of Education.

Figure 7 The data shows that a majority of the respondents (69) perceived an increase in the utilization of IoT technology in the education sector for remote learning during the COVID-19 pandemic, while a small number of respondents voted for "Decreased" (22) and "No change" (15). This suggests that IoT technology played a significant role in facilitating remote learning during the pandemic, and its utilization increased in the education sector. The data highlights the importance of IoT technology in the education sector and its potential to improve remote learning.

How can school and university ensure the long-term sustainability and scalability of IoT technologies in the education sector for remote learning?
106 responses

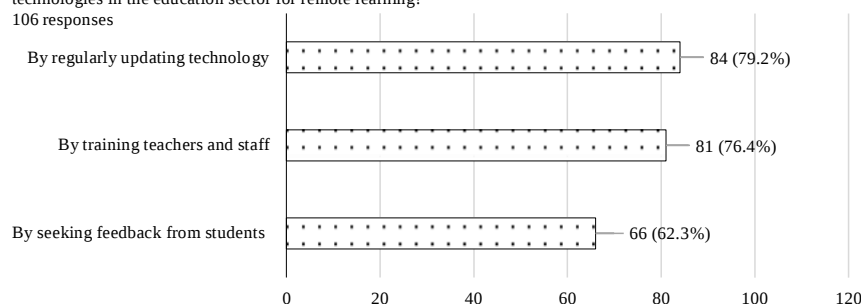


Figure 8. Sustainability and Scalability of IoT in the Educational Sector.

Figure 8 The data indicates that the majority of respondents voted for "regularly updating technology" and "training teachers and staff" to ensure the long-term sustainability and scalability of IoT technology in the education sector for remote learning during the COVID-19 pandemic. "Seeking feedback from students and parents" received the least number of votes. These results suggest that continuous updating of technology and providing adequate training to teachers and staff are the most critical factors in ensuring the successful implementation of IoT technology for remote learning. Additionally, seeking feedback from students and parents can help improve the effectiveness of IoT technology in the education sector.

Have there been any initiative or programs aimed at increasing the adoption of IoT technologies in the education sector for remote learning?
106 responses

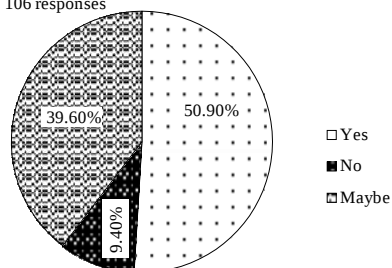


Figure 9. Initiatives aimed at increasing the adoption of IoT in the Education Sector.

Figure 9 The given data shows that there is some uncertainty among respondents regarding the existence of initiatives or programs aimed at increasing the adoption of IoT technology in the education sector for remote learning. However, a significant number of respondents (54) voted "yes", suggesting that some initiatives or programs may exist. On the other hand, a smaller number of respondents voted "no" (10), indicating that there is a possibility that there are no such initiatives or programs. Further investigation is needed to determine the types and effectiveness of these initiatives or programs.

What impact has the use of IoT technology in the education sector for remote learning had on quality of education and student outcomes?
106 responses

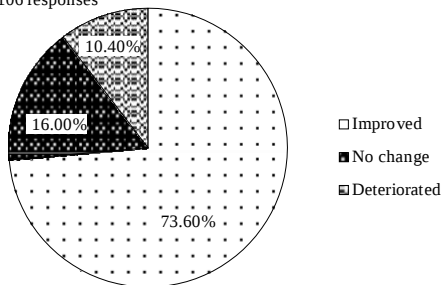


Figure 10. Impact of IoT on Quality of Education and Student Outcomes

Figure 10 The results suggest that most of the respondents (78) believe that the use of IoT technology in the education sector for remote learning has positively impacted the quality of education and student outcomes. However, a small number of respondents (11) believe that it has had a negative impact. Meanwhile, 17 respondents did not observe any significant change. It would be beneficial to examine the reasons behind these perceptions and the factors that affect the impact of IoT technology on remote learning outcomes further.

How has the use of IoT technology in the education sector for remote learning impacted the role of teachers and the teaching professions?
106 responses

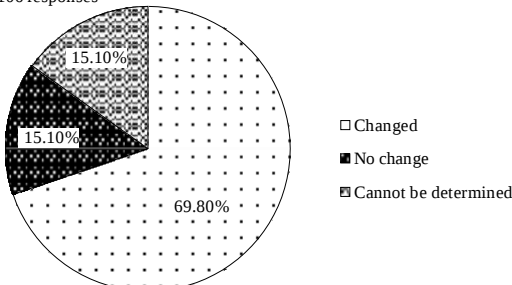


Figure 11. Impact of IoT on Remote Learning

Figure 11 Out of 106 responses, 74 participants believed that the use of IoT technology in education sector for remote learning has changed the role of teachers and the teaching profession, while 16 participants believed that there was no change, and 16 responses could not determine the impact. These results suggest that the implementation of IoT technology has had a notable impact on the teaching profession, although there is still some uncertainty surrounding its effects.

The COVID-19 pandemic has dramatically changed the way the world operates, including the education sector. The rapid shift to remote learning has led to an increased adoption of IoT technology in education. The use of IoT devices such as laptops, tablets, and smartphones has made it possible for students to continue their education from anywhere, at any time. This has been particularly beneficial for students who were unable to attend physical classes due to the pandemic.

Additionally, IoT technologies such as augmented and virtual reality have made learning more interactive and engaging. Students can now visualize complex concepts and ideas, making learning

more interesting and effective. The use of IoT devices equipped with sensors has also enabled personalized learning by collecting data on a student's learning habits and preferences. This data can then be used to personalize the learning experience, making it more effective and engaging.

Automated grading and assessment has also become possible through the use of IoT technologies such as AI and machine learning. This has freed up teachers' time to focus on more important tasks such as providing personalized attention to students. Collaboration among students and teachers has also improved through the use of IoT technologies such as video conferencing and online collaboration tools.

Focussed Group Discussion with some Teachers and Students

A focussed group discussion was conducted with some teachers and students of an engineering college in Visakhapatnam. For the purpose of the study, several people from the education sector who have been in this field for over 5-10 years were interviewed regarding how they found the Utilization of IoT into education sector post COVID pandemic. Information was also gathered from the industry oriented people and accurate inferences were drawn from the information thus gathered. The results are presented as under:

The COVID-19 pandemic has dramatically changed the way the world operates, including the education sector. The rapid shift to remote learning has led to an increased adoption of IoT technology in education. The use of IoT devices such as laptops, tablets, and smartphones has made it possible for students to continue their education from anywhere, at any time. This has been particularly beneficial for students who were unable to attend physical classes due to the pandemic.

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- E-resources and e-learning have become a part of regular teaching.
- Quizzes, tests, and evaluations have become easier online.
- YouTube, Google Meet, and Zoom have become more popular among teachers and students.
- EdTech companies have recruited many people based on their skill sets.
- Audio-visual tools, animations, and videos have become more popular for virtual classrooms.
- The rate of usage of these tools has increased due to the pandemic and continues even in the post-pandemic era.
- Content delivery has become more effective and efficient, but the lack of focus on students during online classes affects the learning outcomes.
- IoT is not yet available in schools and colleges for efficient teaching-learning.
- The evaluation of descriptive type questions is still difficult.
- Gadgets/software tools are yet to be developed for the education sector.
- Easy availability and access to digital tools has brought development to every person in the education sector.
- A blended mode of teaching may be a better option than exclusively offline or online methods.
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Analysis

- IoT has enabled virtual classrooms for remote learning during COVID-19.
- It has opened up education opportunities for students in rural or remote areas.
- IoT allows for personalized learning experiences.

- Smartboards and educational games track student progress and adjust learning.
- IoT generates vast amounts of data to improve teaching methods.
- It facilitates remote learning and personalizes education.
- IoT helps improve the use of data and analytics in education.
- The COVID-19 pandemic has accelerated the need for technology-driven solutions in education.
- IoT is a key enabler in the transformation of education.
- IoT is poised to play an important role in shaping the future of education.

Challenges of IoT in Education

1. *Cost*: The adoption of IoT devices and applications can be expensive, which can be a barrier to their widespread adoption in the education sector.
2. *Security*: IoT devices are vulnerable to cyber-attacks, which can compromise the privacy and security of student and teacher data.
3. *Privacy*: The use of IoT devices in classrooms raises concerns about student privacy, as these devices can collect sensitive data about student behavior and performance.

CONCLUSION

IoT is transforming the education sector by offering new and innovative ways to improve teaching and learning experiences. While there are challenges associated with its adoption, the benefits of IoT in education outweigh the costs. As IoT continues to evolve, it has the potential to revolutionize the way we teach and learn, making education more accessible, engaging, and personalized.

After the COVID-19 pandemic, the rapid shift to remote learning has emphasized the importance of technology in education and has accelerated the adoption of IoT in the sector. The use of IoT technologies has made remote learning possible, enabling students to continue their education from anywhere, at any time. Furthermore, the integration of IoT technologies such as augmented and virtual reality has made learning more interactive and engaging, leading to a better understanding of complex concepts.

The use of IoT devices equipped with sensors has also made personalized learning a reality. Data collected from these devices can be used to tailor the learning experience to each student, making it more effective and engaging. The automation of grading and assessment through AI and machine learning has also improved the education sector by freeing up teachers' time to focus on more important tasks such as providing personalized attention to students.

In addition, the use of IoT technologies such as video conferencing and online collaboration tools has improved collaboration among students and teachers, leading to more effective learning. The impact of IoT on the education sector has been substantial and will continue to be so in the future. As technology advances, it is certain that IoT will continue to play a critical role in shaping the future of education.

Overall, the impact of IoT on the education sector after the COVID-19 pandemic has been positive, enabling the sector to adapt and evolve to meet the changing needs of society. It has made remote learning possible, improved the quality of education, and has made learning more interactive, personalized, and collaborative.

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