APPLICATION OF 5G TECHNOLOGY IN E-LEARNING: AN EMPIRICAL STUDY

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Abstract

5G technology is the next generation of wireless communication, after 4G. It promises faster speeds for mobile phones and other connected devices, but it also has applications for e-learning. One of the most exciting uses of 5G technology in e-learning is its potential to offer higher resolution video streaming on mobile devices. Because 5G offers faster speeds, it can be used to stream higher quality videos with less buffering or stuttering than 4G networks are able to offer.

The use of 5G has also made it possible to deliver content to students through a variety of devices, such as smart phones, tablets and laptops. This enables students to access learning material anytime and anywhere they want. It will have a great influence on the development

of e-learning. Moreover, it can be used as one of the main technologies to improve the efficiency and effectiveness of e-learning. This paper focuses on the application of 5G technology in e-learning. The objectives of this study were to identify the use of 5G technology in e-learning, determine the effect of 5G technology on e-learning, and determine whether 5G technology can be used in e-learning. Sample of 190 respondents that includes teachers and students were surveyed to know different applications and impact of 5G Technology in E-Learning. The study concludes that 5G technology is significantly helpful in E-Learning.

Keywords-5G Technology, E-learning, E- education, Video Classes.

Introduction

As artificial intelligence and communication technology continue to advance, the rapid development of teaching media technology and tools has had a great impact on e-learning. With the development of 5G network technology, E-learning will be more integrated into our daily life. 5G is the fifth generation of mobile communications technology.

The first generation was 1G analog voice calls, 2G digital voice calls, 3G high-speed Internet access and video transmission, 4G high-speed wireless connections and video streaming. The fifth generation is exected to provide ultra-high-definition video streaming in real time. It can also support a variety of applications such as cloud computing and smart cities. The current 4G network has experienced congestion problems due to increasing network demand (Yang, X. 2022).

The 5G era will bring a new era of intelligent networks and smart society, which will have an even greater impact on e-learning. The development of the 5G network is expected to make huge changes in various industries and fields, especially in the education sector. The application of 5G technology in e-learning is widely used in different areas such as information retrieval, learning management system (LMS), online tutoring system, online training platform and so on. In addition, 5G will also make it possible to build large-scale virtual reality systems that simulate real-life environments by using VR headsets (Gui, Q. 2021)

Such an environment can be used in e-learning to help students practice skills or take exams in a safe environment without risking their own lives or those of others around them. On mid-

2018, the 5G standard was approved, and the first deployed trials started to provide valuable information on the services that can be offered to 5G users. The application of 5G technology in e-learning will help us to improve the quality of education and increase its efficiency. The latest 5G standard has been created in order to meet the requirements of users and operators.

It is expected that this new technology will have a significant impact on our lives by providing faster Internet access and better connectivity, which will result in improved performance for many applications. The use of these technologies in e-learning could help improve learning outcomes by providing students with more opportunities for interaction with their teachers or other students in real time. This would allow them to collaborate more effectively during lessons and solve problems together more quickly when working on group assignments or projects (Raja, R., & Nagasubramani, P. C. 2018).

The Covid 19 pandemic changed e-learning and it showed the importance of technology in education. In the past, there have been many technological advances that have changed the way people learn, In fact, many students today are still using older forms of technology for their e-learning courses. However, as we continue to move forward into the 21st century, technology is becoming more accessible and more affordable for everyone—including students.

Literature Review

The advent of 5G technology has been a major boon for education. In the past, school kids were forced to learn and study in a traditional way that was not only time-consuming but also stressful. However, with the introduction of 5G technology, things have changed drastically and students now have access to various e-learning courses that are not just easy to understand but also convenient.

The Covid 19 pandemic changed e learning in many ways. First, it made parents realize that their children needed a more interactive form of education, which would enable them to learn more efficiently. Second, it showed how important technology is in education. Finally, it made teachers realize their role as facilitators rather than just providers.

As the development of information and Internet technology promotes content dissemination and fast learning online teaching models, leading the development trend of today's education. E-learning has become a popular way for students to learn. However, due to the limited

bandwidth and stability of the network, e-learning is difficult to apply in real time. 5G technology can solve these problems by improving the quality of mobile networks and expanding the coverage area (Baratè, A., Haus, G., Ludovico, L. A., Pagani, E., & Scarabottolo, N. 2019, July). The emerging technology has made it possible to give feedback on various platforms, which is called Electronic Word of Mouth (Kudeshia & Mittal, 2016).

The use of e-learning is growing rapidly in recent years, and this has led to the increase in demand for 5G technology. However, due to the sudden increase in demand during the pandemic, it has gradually exposed several problems in the e-learning sector. In the past, e-learning was mainly used for educational purposes, but now it has become a tool for companies to develop their products and services.

The application of 5G technology in e-learning will help solve many problems that have arisen from its use during the pandemic. The core problem with e-learning is that there is a lack of supervision, especially in colleges and universities.

At present, online teaching in colleges and universities is basically arranged by the students themselves. Most of the time, the classroom time is arranged by students themselves. This makes it difficult to ensure that students have sufficient learning time due to various factors such as their own schedule, personal interests and other reasons. In addition, online teaching tends to be fragmented and single-form teaching content (Conde-Zhingre, L. E., Quezada-Sarmiento, P. A., & Labanda, M. 2018)

 During the epidemic, colleges and universities did not have a solution for how to reasonably use online resources and fully guarantee the quality of students' learning. However, due to the small number of teachers, large classroom size and poor quality, online teaching has become more and more popular among students since the outbreak of the epidemic. On one hand, some teachers have been forced to give up teaching because of their own health problems; on the other hand, there are many students who are unable to attend classes because they are too busy with work or other activities.With 5G, E-learning Education is going to be amazing. The problem is going to be solved. The 5g technology will benefit in the field of education by providing an amazing service in a crowd and allowing everyone to communicate with each other. It will also provide ubiquitous things communicating with each other and make sure that the best experience follows you wherever you go (Paudel, P. 2021).

With 5G technology, learners will be able to access their data anywhere and at any time. They will also be able to use their devices in a variety of places and situations. The 5G network will provide an amazing connection speed which makes it possible for people to learn from anywhere.

The great service provided by 5G can easily be used in crowded places as well as in remote areas where there is no internet connection. The 5G network also allows for ubiquitous things that can communicate with each other without any human intervention. This means that everything has the potential to connect directly with one another, which will make life easier for everyone involved. Korea was the first country in the world to commercially launch 5G services and is capable of transmitting data at speeds of up to 20GB per second. This means that users will be able to download a full HD movie in just one second using 5G, which is a much faster rate than 4G LTE technology (Fuks et al., 2002)

As it stands, there are many benefits associated with 5G technology for e-learning. For example, there will be much lower latency rates as compared to 4G LTE technology, which means that anyone can access content more quickly and easily. With these benefits in mind—and many others besides—it's clear that 5G technology has huge potential for improving online learning experiences around the world.

5G's technical features will bring about changes that were not possible in the traditional mobile learning. The ability to transmit data on a single device at speeds of up to 20 gigabits per second, combined with low latency and high reliability, will make it possible for students to access content from anywhere (Xue & Mao, 2021). The combination of these features will allow students to watch live streaming of lectures on their phones and tablets, as well as access interactive digital textbooks. Moreover, 5G networks will be able to support high-quality video conferencing between teachers and students. In a live class, the teacher must be able to address lots of students. This makes it impossible for teachers to pay attention to the needs of each student in the room, so the use of adaptive learning algorithms is essential for individualized learning. Adaptive learning algorithms are helpful in e-learning because they can help students learn at their own pace and according to their needs.

They also help teachers identify each student's strengths and weaknesses so that they can provide better instruction. Students who have different learning styles may find it difficult to follow along with a lecture or even keep up with their classmates during class time. These

students may benefit from adaptive learning algorithms because they allow them to learn at their own pace while still being held accountable for their progress (Zhongmei et al., 2019).

Adaptive learning algorithms are built on data about each student and can predict how well they will learn from different types of content. The algorithm then selects content based on what it predicts will best fit each student's needs. These algorithms can also provide tailored feedback to students based on their performance. For example, if a student has answered an exam question incorrectly, they may receive extra practice questions related to that topic before moving on to another topic or exam question. The use of adaptive learning algorithms can help teachers save time by reducing the amount of time spent preparing lessons and assessments, while also improving student performance by selecting appropriate content at just the right time during each lesson

The 5G technology will be applied in online learning platforms and e-learning systems. The first application of 5G technology in online learning platforms is the real-time transmission of audio and video signals between students and teachers. The second application is real-time transmission of data files between students and teachers. The third application is real-time transmission of text messages between students and teachers. In order to make this possible, need to use real-time data from students' mobile phones (such as location and activities). This will allow track each student's current situation and provide feedback at any time. The next step is to collect information from students' wearable devices (wristband or smart watch), which can record heart rate, body temperature and other physiological parameters. The collected data can then be used for personalization purposes by teachers in order to understand each learner's needs more effectively.

The advent of 5G makes it possible for the teacher to "clone" to preach and solve puzzles and student to learn quicker and easier way. The technology will be used for e-learning, where students can interact with teachers in real time. This means that a virtual classroom can be created using holographic technology, where the teacher can attend classes from any part of the world and share his/her knowledge with students sitting in their classrooms simultaneously. Students would no longer have to travel far distances just to attend classes at a distance education school. The technology will also enable students who cannot afford travelling costs or have most of their time taken up by work or other commitments to attend classes at distant locations without having to worry about travelling costs or missing out on work hours.

In this new paradigm, students will learn faster and more effectively because of their ability to focus on the task at hand without having to worry about distractions like mobile phones or other forms of social media (Kudeshia, Sikdar & Mittal, 2016; Kudeshia and Mittal, 2015). They will also be able to access information more quickly because of faster internet speeds that allow them quick access to information via search engines like Google or Bing (or whatever search engine is in use at that time).

Objective

1. To explore different applications of 5G Technology in E-Learning.
2. To know the importance of 5G Technology in E-Learning.

Methodology

Sample of 190 respondents that includes teachers and students in higher education were surveyed to know different applications and impact of 5G Technology in E-Learning. Survey was conducted with the help of a questionnaire particularly designed for this study. Convenient sampling method was chosen by the researchers to collect the primary data. The data of the present study was analysed and evaluated by mean and t-test.

Findings

Table below is presenting respondent's basic details in which it is found that males are 57.4% and females are 42.6 percent. 36.3% of them are below 28 years of age, 37.4% of the respondents are 28-34 years and rest 26.3% of the respondents are above 34 years of age. 50% of the respondents are teachers and 50% are students.

Table 1 Basic Details

Variables	Respondents	Percentage
Gender		
Male	109	57.4
Female	81	42.6
Total	**190**	**100**
Age (years)		
Below 28	69	36.3
28-34	71	37.4

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Above 34	50	26.3
Total	**190**	**100**
Occupation		
Teacher	95	50
Student	95	50
Total	**190**	**100**

Table 2 Applications of 5g Technology in E-Learning

S. No.	Statements	Mean Value	t value	Sig.
1.	5G technology allow students to watch live streaming of lectures on their phones, tablets and access interactive digital textbooks	3.12	1.683	0.047
2.	5G can easily be used in crowded places as well as in remote areas for e-learning	3.20	2.823	0.003
3.	5G improves learning outcomes by providing more opportunities for interaction with teachers or other students in real time	3.19	2.725	0.004
4.	Collaboration is more effective during lessons and group assignments with 5G technology	3.22	3.091	0.001
5.	5G helps to improve the quality of education and increase its efficiency	3.29	4.142	0.000
6.	It builds large-scale virtual reality systems and simulate real-life environments by using VR headsets	3.17	2.387	0.009
7.	5G has the potential to offer higher resolution video streaming on mobile devices	3.21	2.976	0.002
8.	It promises faster speeds for mobile phones and other connected devices	3.18	2.563	0.006
9.	5G enables students to access learning material anytime and anywhere	3.13	1.828	0.035
10.	Enable students to attend classes at distant locations without	3.16	2.290	0.012

	having to worry about travelling costs or missing out on work hours			

Table above is showing different applications of 5G Technology in E-Learning. It is observed that 5G helps to improve the quality of education and increase its efficiency with mean value 3.29 and Collaboration is more effective during lessons and group assignments with 5G technology with mean value 3.22. 5G has the potential to offer higher resolution video streaming on mobile devices with mean value 3.21, 5G can easily be used in crowded places as well as in remote areas for e-learning with mean value 3.20 and 5G improves learning outcomes by providing more opportunities for interaction with teachers or other students in real time with mean value 3.19. The respondent says that 5G promises faster speeds for mobile phones and other connected devices with mean value 3.18, It builds large-scale virtual reality systems and simulate real-life environments by using VR headsets with mean value 3.17 and Enable students to attend classes at distant locations without having to worry about travelling costs or missing out on work hours with mean value 3.16. The respondent also says that 5G enables students to access learning material anytime and anywhere with mean value 3.13 and 5G technology allow students to watch live streaming of lectures on their phones, tablets and access interactive digital textbooks with mean value 3.12. Further t-test shows that all the statements are significant with the value below 0.05.

Conclusion

5G technology is definitely going to make elearning more fun, easy and comfotable for students. it will provide better facilities like faster data speed, no buffering problem etc with 5G technology learn new things and it will also help in making learning process an interesting one. Using a variety of emerging technologies and communication devices, the students will be able to learn more effectively. In the future 5G world, it would be easier for them to access the e-learning content that is being shared by many sources in real time with fewer errors. The 5g technology is definitely going to change elearning it sis going to impact teaching and as well as student experinces.For over half a decade now, millions of users have been accostumed to watch live lectures in e-learning platforms, however the application of 5g technology offered by 5G networks can help universities and educational institutions to develop interactive learning systems in much improved ways. In addition, with the onset of Internet Of Everything (Io E), not just video lectures but also internet based programs would

be able to connect with IoE gadgets like smart dining tables and interactive whiteboards remotely, while making real time lecture notes available online for students.

The study explore different applications of 5G Technology in E-Learning and found that 5G helps to improve the quality of education and increase its efficiency, Collaboration is more effective during lessons and group assignments with 5G technology, it has the potential to offer higher resolution video streaming on mobile devices easily be used in crowded places as well as in remote areas for e-learning and 5G improves learning outcomes by providing more opportunities for interaction with teachers or other students in real time. The study concludes that 5G technology is significantly helpful in E-Learning.

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