IMPACT OF 5G TECHNOLOGY IN BLENDED LEARNING

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Abstract

In this paper, an understanding of Blended learning is defined, concerning with a study about whether the facilities and applications offered to learners might improve with 5G wireless communication technology. To this objective, the characteristics of 5G revolution on education that takes 4G LTE (Long Term Evolution) does and make it better, faster and more reliable. In 5G technology the network transmission speed of mobile communication has improved while reducing data latency and increasing the reliability. Also it brings more in-depth learning materials collection, provide further use of AR-VR technology for teaching use. This paper reviews the impacts of fifth generation wireless communication on education in blended mode that creates a more stimulating learning environment than previous generation of communication.

Keywords : Blended Learning, 5G, AR-VR technology, Wireless

1. Introduction

Online teaching–learning methods have been followed by many universities/colleges for more than a decade to satisfy the needs of students who stay far away from universities/colleges. But during the COVID-19 pandemic period, online teaching–learning helped almost all universities, colleges, and their students. Now post COVID-19, it has been a common conclusion and experience by lots of researchers and academic institutions that hybrid or blended mode of teaching-learning methods would be feasible in the present time for the students and teachers.

Blended learning (BL) is a different learning model that proposed on the introduction of technology into traditional teaching. It combines the advantages of online and offline instructions, to enjoy the online learning as a traditional face-to-face classroom teaching. Especially the development of 5G technology brought predictable advances in blended learning. For example, easy use of Argumented Reality (AR)/Virtual Reality (VR) application and can be learning data uploaded and downloaded faster. This makes it easier to do varieties of blended learning that were hard to do before in a 4G network environment, like real-time connections between multiple locations in real-time with various online educational tools. [1]

Technology advancements in education have greatly benefited from changes in communication and information technology in the twenty-first century. Fifth generation (5G) networks are capable of handling large amounts of wireless connections and data traffic. Different types of data traffic provides different levels of Quality of Services in terms of bandwidth and daily internet data limits. The 5G mobile network seeks to address the shortcomings of earlier cellular technologies (such as 2G, 3G, and 4G) and serve as a potential key enabler for the Internet of Things (IoT). Several applications are supported by 5G networks, including smart homes, autonomous vehicles, drone operations, mission-critical health applications, entertainment, multimedia and in the area of education [2-3].

The use of 5G technology opens up new possibilities for resolving issues with earlier intelligent teaching models backed by earlier communication trends. Hence, this paper examines the difficulties of blended learning and describes how 5G will affect that process's optimization. It is anticipated that ideas for enhancing blended teaching and learning would emerge as a result of the broad deployment of 5G. [4,5]

2. Objective

The objectives in this paper are:

    i.   To identify the impact of 5G technology on Blended Learning.
    ii.   To identify issues and challenges of Blended Learning while using 5G technology.
    iii.   To identify the findings and scope for future research.

3. Background of 5G and Blended Learning

3.1 5G Technology

In wireless communication, Fifth Generation (5G) Technology is a recent generation of mobile networks.

Unused network system 5G has unquestionably higher data rates, is reliable, and has lower latency than previous generations. The technologies that will be employed in 5G, which is the fifth generation of technology built on the foundation laid down by 4G, are still being developed. The OFDM (Orthogonal frequency-division multiplexing) encoding type is used by fifth generation networks. The air interface has been designed with significantly less latency and higher adaptability. The "millimetre wave" frequency used by 5G networks may operate at low and high frequencies, and it can transmit large amounts of data in a few blocks at a time. In order to increase network coverage, 5G networks are more likely to be networks of tiny cells the size of a home router. The goal is to offer tremendous speed at a low latency that is greater than 4G. While 5G reduces latency to approximately onhe millisecond, 4G still remains around the 50 millisecond mark. The purpose of 5G is to achieve transmission speed to 20-30Gbps, which is 50 times speedy than 4G networks. Up to one million connections per square kilometre are expected to be available on the fifth generation of networks. It also involves very high data rates and the interconnectedness of the entire wireless universe [6].

The widespread uses of IoT, mission-critical communications, and enhanced mobile broadband are the three primary connected service types that use 5G which are describe below:

- Enhanced mobile broadband - Along with improving our devices, 5G mobile technology can bring about new, immersive experiences like VR and AR with faster, more consistent data rates, lower latency, and cheaper cost-per-bit.
- Mission-critical communications - 5G can enable new services that can transform industries with ultra-reliable, available, low-latency links like remote control of critical infrastructure, vehicles, and medical procedures.
- Massive IoT - 5G's ability to scale down in data rates, power, and mobility will provide extremely lean and low-cost connectivity solutions, allowing it to connect a vast number of embedded sensors in virtually everything without disrupting their operation. [7]

3.2 Blended Learning

During the COVID-19 epidemic, remote work and remote learning were widespread activities all over the world, and the word "remote learning" became increasingly popular. Self-paced eLearning and virtual classrooms are already commonplace in education and training programmes. Even when education resumes in traditional classroom settings after COVID-19, blended learning will remain popular.

Blended learning is a cutting-edge teaching method that combines the use of both physical and digital materials at once to maximise learning opportunities for students, match their individual needs, and better utilise class time[8]. The goal of blended learning is to provide the most efficient and effective instruction experience by combining delivery modalities. Blended learning is a solution that integrates multiple various distribution techniques, including as collaborative software, Web-based courses, Web Conferencing, and knowledge management procedures. The term "blended learning" is also used to

represent learning that combines several event-based activities, such as in-person instruction, live online learning, and self-paced study. The use of these technologies has expanded the ways in which students can connect with one another, teachers, and course material both within and outside of the classroom. [9] The main problem with e-learning was that it was too much machine-focused, making it impossible for students to interact socially with one another but social connection between students and teachers is a major component of blended learning.

The term 'Flipped Classroom' is a form of blended learning and assumed to have a broad definition connecting itself to different leaning activities and platforms, including both inside and outside classroom learning modes. Flipped classroom teaching is a pedagogical technique and learning type, which is different from the traditional classroom and learning. The main goal of the Flipped Classroom is to focus on learners. Typically, a traditional classroom is teacher-centered; while, the Flipped Classroom learning is student-centered.

4. Discussion on Findings

4.1 Challenges of Blended Learning

The best features of both online and classroom-based education are combined in blended learning, a method of teaching. It meets the need for intimate physical interaction between teachers and students as well as for a vast array of additional learning resources and technological tools to support the traditional learning environment. The merits of mixed learning are now widely acknowledged by institutions. However, as the field of blended learning research grows, so do identify and overcome of its drawbacks.

There are basically two types of limitation in blended mode of education

(A) Network speed: The blended learning model makes use of digital technologies to improve the effectiveness of instruction in conventional classroom settings. There are some blended learning models exist such that combine the students, the teachers, and the learning activities etc.

When students are "mixed," it means that they are being taught online as well as in a traditional classroom. The term "mixing of instructors" refers to pairing up teachers from a distance online learning environment with students in a typical face-to-face classroom. The term "mixing of learning activities" refers to the blending of students' online learning activities and their traditional offline classroom activities.

The speed of network transmission affects all types of blended learning, even though their exact modes vary. In this interactive setting, the real-time communication between the two sides is prioritised much more and the network speed must be stable and secure. The use of several blended teaching and learning methods is frequently affected by the high network latency, poor image transfer during video conferencing, and other real-time image processing. One of the primary influencing variables that now causes this blended learning to hit the constraint is the network speed factor[12, 14]

(B) Application of the technology: The blended learning strategy relies heavily on online technology tools. The traditional classroom can benefit from a variety of digital resources in various ways. In the blended mode of classroom, improved teacher-student communication is made possible through cutting-edge classroom interaction tools. Examples include social media software with text-based communication features and LMS (Learning Management Systems). Teachers can quickly access current student Question & Answers and enable simultaneous cross-screen dialogue by utilising a built-in mobile app, such as moodle, which is based on a learning management system.

Online course tools, such as MOOC platforms, improve learning resources that are gathered on one platform. By recommending free online learning resources like MOOCs, teachers assist students in learning at their own speed outside of the classroom. Numerous LMS solutions are used to assess student learning outcomes based on information about their classroom learning experiences. In blended learning, the use of technological tools in the conventional classroom is highly considered. However, the digital tools used by teachers in the blended learning model are

usually simple. The majority of digital technologies still face difficulties when used in blended learning approaches.

(C) Low supervision: In the blended learning, the majority of college and university students who take courses online schedule their own class time. It is impossible for the teacher to directly get the student's learning environment due to their separation. The Internet's perception of distance has an impact on how students and students communicate with one another and with their teachers. Online instruction does not have the same learning environment as traditional classrooms and is not subject to the same learning restrictions. Additionally, one of the difficulties that has to be addressed is the use of online tests. In comparison to the standard test format, the online test platform has additional issues. Without an invigilator, cheating by candidates is more likely, and the test's fairness is impossible to ensure[10].

4.2 Impact of 5G in Blended Learning

Like never before, 5G will facilitate the creation of a "digital university". It will increase interaction in distance learning, especially in rural areas. One of the sectors that 5G would most likely benefit is education. The concept of "Blended Learning" will be made possible by 5G since it will make it possible for millions of unconnected learners to instantly access online education, significantly enhancing learning outcomes. In a blended learning approach using 5G, learners could finish their education anywhere, anytime. Blended mode of Education will become much more student-friendly and accessible to 5G. Instant content access will be possible with digital textbooks. Students will be able to learn at their own pace to the use of more sophisticated way of e-learning tools and services made possible by 5G [11].

Institutions must have recognised the importance of online learning and its effects during the COVID-19 pandemic. Institutions who chose to use various online teaching / learning technologies like Moodle, Google Class rooms, Microsoft Team etc. now have a more effective option along with these. In order to do this, Institutions must realise that they will require a high potential network that can link and communicate with high intensity, low latency and bandwidth. In this approach, 5G can develop into a magnificent solution that can raise standards of quality and more dependability than 4G.The quality, speed, and connectivity of video conferences are all enhanced by fast connections. Additionally, a 5G network enables general connectivity between academic staff and students.

4.3 Blended learning model advancement with support for 5G technology

The adoption of 5G, speeds up development in other sectors, like healthcare and intelligent transportation. Education is a field that is quite sensitive to these changes. As a result, this study will examine how 5G can benefit blended learning that is supported by other technologies.

(A) 5G-enabled Augmented Reality (AR) and Virtual Reality (VR) in the education.
With the popularization of 5G technology and the development of VR/AR technology, 5G + VR/AR will surely bring a new teaching experience. Mixed-reality content and video require high bandwidth and low latency to perform optimally. 5G is aimed to reduce latency to a few milliseconds (ms) than 4G that latency interval is recorded as 50 to 80 milliseconds (ms). Thus with 5G, experiences will be seamless[12].
VR can be transportable, it can overcome geographic restrictions, and it can expand the reach of the classroom. Students can use touch, pinching, and zooming in AR to explore concepts. By using powerful AR and VR technologies, this technology could enhance the concept of interactive classrooms. Any type of 3D design can be seen and touched by them. Students can make virtual operations in the intelligent experimental system through the VR/AR platform to build an experimental environment, eliminating the safety dangers of high-risk experiments. Students can better understand the reasons for the experiment's failure and increase the effectiveness of training as the 5G+VR/AR technology restores the scene in accordance with it.

(B) 5G-enabled IoT Smart Classroom, Saves Teachers Time
Even if everything works perfectly, setting up devices in class and gathering feedback takes time. 5G Internet of Things (IoT) enables teachers to automatically log in as soon as they enter the classroom. Menu management tasks are automated and students can provide feedback digitally.

Higher bandwidth of 5G keeps the signal strong throughout a lecture or presentation, preventing accidental disconnects and distractions.

(C)   Higher Internet Speed

The experience of teachers and students interacting online is enhanced by fast internet speed. One key element that directly influences whether online instruction can be carried out normally is an uninterrupted communication network. A high-definition video may be downloaded in less than ten seconds as the 5G network rate can achieve Gbit per second. Information transmission time is significantly reduced by the high rate of the 5G network, which may effectively address the issues of live broadcast jams and online real-time interaction delays. Large-scale educational applications, including lectures by well-known educators, online learning, augmented reality (AR) virtual experiments, and other specialized remote interactive teaching application scenarios, are supported by the appearance of 5G networks with high traffic[13].

(D)   5G-enabled Flexible Learning

Every student has a unique learning style and aptitude. With the same data rates and responsiveness as in the classroom, 5G will enable students to continue their education outside of the classroom on their phone or laptop. Students now have access to the same material and exercises as their peers, regardless of distance or location.

(E)   Realistic Image quality

High-definition video massive data transmission is compatible with the peak rate of 5G information transmission. Students can easily view every detail in the teaching video screen as 5G technology uses 4K/8K ultra-high definition quality. The realistic and 3D image experience brought by vision can improve student's learning interest and learning initiative. The instructor may simultaneously respond in real time to the high-definition videos, images, charts, and other queries raised by the students in the classroom while also setting their teaching techniques with tools like replay and clear zooming.

Conclusion

This article examined the blended learning approach, which has faced several difficulties in integrating cutting-edge technologies like AR/VR and IoTs. Additionally, Network Speed has been noted. In the blended learning mode, low supervision and restricted use of online educational tools and applications have an impact on actual teaching and learning environments. Although 5G technology, a new generation of communication technology developed recently, appears to offer a breakthrough to break the bottleneck of blended learning mode due to its high speed, low latency, and accuracy as the development of blended learning progresses. The number of linked devices has increased significantly from 4G to 5G, enabling proper IoT application. IoT usage in education is beginning to rise. 5G-enabled IoT, which connects anything to anything at anytime and anywhere, is swiftly becoming a reality. Therefore, this study analyzes the bottlenecks of current blended learning models and examines whether 5G technology has a positive impact on overcoming these bottlenecks.

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