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Review Article

Assessing the Future of Information and Communication Technologies in Education: the Prospects of Cloud Computing Technology

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A B S T R A C T

A profound revolution in numerous facets of life, notably education, has been triggered by information and communication technologies. The significance of online learning has increased especially in light of the advancement in emerging information and communication technology. Thus, the objective of this paper is to explore the experience of integrating and employing IT in the classroom, the digitization of education, the rapid growth of cloud computing technologies, and the increasing acceptance of this method of learning. This IT technology is designed to make it simpler to access services or databases via a secure virtual environment. It is also a productive way to store and retrieve data as needed. The enshrinement of information and communication technology (ICT) use in education correlates with the rise of digital literacy. The study employed synthesis and analysis as scientific methodologies. A number of cloud computing applications in the field of education were chosen for research. The synthesis approach determined the primary shortcomings and the conclusion points out that digital innovation has demonstrated its value in enhancing, altering, and accompanying education. It also has the ability to hasten the objective of sustainable development for education and change access to learning in general. This will support inclusivity, enhance the administration and management of education, and improve the quality and applicability of learning. Distance learning can be utilised to lessen closings and disruptions to schools during emergencies.

Keywords: Information And Communication Technologies, Cloud Computing Technologies, Virtual Environment, Digital Literacy, Scientific Methodologies

Introduction

Cloud computing is an emerging paradigm in enormous scale collaborative computing that utilises current technologies like network computing, virtualization, and service-oriented design. They provide an additional means of obtaining and overseeing extensive IT resources. Cloud computing technologies are being used in education nowadays. This is particularly because of the healthcare crisis, which has increased demand for online education. The covid pandemic made the events of that year crucial for the advancement of information technology. Additionally, the epidemic brought about the biggest catastrophe in schooling. Among the

industries most impacted by the epidemic was education (Alshammari & Aldribi, 2021). In fact, a lot of colleges and institutions have been compelled to make the shift to an online curriculum. Online interactions and remote learning proved to be invaluable in this circumstance. If the school sector was only getting started in the digital sphere, the spread of Covid-19 hastened this development (Ali & Alourani, 2021). In this regard, the need for using cloud computing technologies in education is growing. Due to changes in geopolitics, this method of data management and storage has been able to circumvent a number of medical and geographic restrictions. The usage of the cloud in education has revolutionised the field (Ali, 2021). The virtualization of IT resources and increased accessibility to educational resources have been the two most notable developments of the last three years. To complete their digital transformation project, the majority of education-related institutions have had to modify their cloud computing methods (Darwish et al., 2019). The usage of cloud computing addresses the increasing demands placed on educational subjects during the digital shift. It offers a chance for innovative teaching strategies. On the one hand, it's a means of encouraging more imaginative and participatory learning among pupils. Additionally, teachers may keep a closer eye on their pupils' work—even from a distance—by using cloud computing. Given the numerous advantages of cloud computing, this paper's challenge is to examine how using cloud computing enables access to a range of educational resources. The most widely used educational platforms are chosen, and their benefits and drawbacks are discussed. The research attempts to explore the potential of cloud computing technology as well as the advancement of ICTs in the future of education. The purpose of this essay is to discuss the benefits and drawbacks of utilising cloud computing technology in education. It also discusses the platforms Coursera, EDX, Udacity, NetExplorer, Microsoft Azure for Research, Microsoft Sharepoint, OneNote, Microsoft Teams, and InTune, as well as the user experience with them.

Research Methodology

Instances of how the literature examines the use of cloud computing were given by the study. The key benefits and drawbacks of ICT use in education were noted. This work must be fragmented into stages due of its complexity. Using analysis and synthesis, the most widely used ICT platforms in Europe were determined at the initial phase. Specifically, their primary benefits and drawbacks are noted. The study's second phase included a platform comparison for cloud computing. The platforms that are currently being used in education were compared for their capabilities, and the research findings that are referenced in the scientific literature were examined. The benefits of utilising ICT in education as well as the benefits and drawbacks of the chosen platforms—Coursera, EDX, Udacity, NetExplorer, Microsoft Azure for Research, Microsoft Sharepoint, OneNote, Microsoft Teams, and InTune—were ascertained in the third stage of the study. The benefits and drawbacks of each platform are enumerated in the findings. A substantial amount of data is consistently generated in the field of education. With cloud-based platforms like NetExplorer, which is widely used in French education, all of this digital data is totally safe (Siddiqui et al., 2019). All types of data, including written papers, movies, photos, and more, are stored on servers. This kind of site requires a password and username to access. By doing this, the possibility of information leakage or loss—from exam results to private student data—is eliminated. Compared to physical document archiving, this is a far better alternative. Naturally, the specific supplier will determine how secure the data is. NetExplorer makes sure that the databases of its clients are safe from harm. Additionally, this provider's storage facilities have ISO 27001 certification (Al-Malah et al., 2021).

When it comes to the advantages of cloud computing technology, the first thing to consider is their low cost of ownership. They also demand less IT resources and infrastructure to maintain. Modern hardware is not necessary to operate this kind of system because the software is installed on a distant server. Workstations are only utilised as an Internet-based means of accessing the Cloud. Data protection does not require an expensive antivirus programme (Iatsyshyn et al., 2019). Additionally, the Cloud's managing organisation handles all of the server management and upgrades. Paying solely for what they use is how cloud users pay. Since the cloud can be accessed from any device—a computer, tablet, or even a cell phone—it is an especially good option for facilitating remote learning and providing access to educational materials when people are socially separated (Balyer & Öz, 2018).

Everyone seeking education eventually looks for a range of textbooks and resources for their areas of interest in learning, regardless of their area of specialisation. Physical resources are advantageous, of course, but thanks to cloud computing, these resources are now accessible digitally.

Every cloud has services like data access, managed firewalls, and personal profile information. They also provide transparent accountability for the educational system. Yes, administrators at schools have access to the details of who uses their platform when and how. However, the cloud offers the highest amount of anonymity for an individual (Bond et al., 2018). Furthermore, academic material is stored in the cloud and can be restored in the event of data loss or corruption. Any corruption in the data can be found.

Aside from all the advantages, cloud computing supports a cutting-edge educational framework. The wonderful

thing about the ever-evolving education system is cloud technology. For instance, a large number of Spanish higher education courses are already offered on websites like Coursera, EDX, and Udacity. Here are a few of the most significant advantages. Cloud technology also help with a lot of other things, such as bridging cultural and linguistic obstacles. They are the engine of today's global education system, and they will only get better with ongoing innovation (Table 1).

Learning is no longer limited to the classroom, just as work is no longer associated with the office. In order to support students and teachers wherever they are and whenever they need it, universities are establishing an online learning community. It was discovered that Microsoft technology is mostly used in European education to ensure that learning is accessible to all students. Through Microsoft Sharepoint, web design programmes employ a blended learning environment that allows students to always have access to the information they need. Teachers record every lesson as students watch it using Skype. Students pursuing two degrees, working, or having a family can study at the appropriate time without sacrificing the quality of their education if they have a more flexible schedule.

Students work together virtually on various assignments using the OneNote notebook for class. This implies that even in cases where a student is unable to attend in person, teachers can still access OneNote and give prompt feedback. Microsoft Teams, a new product that lets teachers build a single digital hub for classes, is linked with OneNote's digital collaboration tools. With Teams, teachers may oversee project groups, assign and mark assignments, invite outside speakers, embed videos from the Internet, share materials, and conduct in-the-moment discussions. Education now has easier access to new resources like InTune for Education.

Table 1.Positive characteristics of today's global education system

Positive characteristics	The advantage
Not everyone has access to higher education internationally. The physical payment method is cumbersome and time-consuming. The advent of cloud-based digital payments facilitates the payment of money. Getting a receipt and paying for your tuition only takes a minute.	Cloud training for digital payments
You can immediately share your scholarly work or research with others by using these collaborative options. Cloud computing is beneficial to universities even as it facilitates speedy collaboration between instructors and students. They can quickly set up collaboration platforms to communicate information throughout the institution because they are surrounded by several bodies. This promotes worldwide innovation and saves time for everyone.	Cloud collaboration
It is the foundation of the cloud computing system that drives the education sector.It results in a number of general changes, ranging from the administrators overseeing the institution to the convenience of learning. There are fewer employees now.	Automation
The capacity to use cloud-based systems for online communication shortens the duration of interactions. Everyone who participates in online learning has their own content management system account, where all content is automatically arranged. Overall, task completion is significantly increased by automating and cutting down on communication time.	Efficiency
It's amazing to be able to interact, collaborate, and carry out various duties from any location at any time. These are a few of the key explanations behind the quick adoption of cloud computing in all educational domains. Without cloud technology, the higher education sector would not be able to offer the flexibility that it does.	Cloud application flexibility
It's all quite accessible. You can quickly obtain the resources you require by signing into a university portal. Cloud education reduces the need for physical infrastructure (and maintenance), transportation expenses, and numerous other costly procedures.	Easy access toresources, Save Money

The administration (or management) in charge of the organisation has access to comprehensive data thanks to cloud apps. The dean's office can make better decisions if it understands the causes of operational failures and successes.	Data-driven solutions
It is simpler to scale up cloud infrastructure than to expand physically. The university's expansion may have previously been constrained by physical constraints. The school is able to readily accommodate the growing number of students' needs and available resources. And with a smaller time investment overall.	Scalability
Learning via the cloud is secure. Each instructor, administrator, and student has their own space to complete assignments, address inquiries, handle bills, etc.	Privacy and data protection

Figure 2.Advantages and Disadvantages of the Described Platforms

Platform	Advantages	Disadvantages
Coursera	Interactive platform; largeselection of courses; free learning resources.	Course content is limited toacademic subjects andprofessional skills; large membership contribution; some instructors shy away from the camera.
EDX	Nonprofit, open-ended platform; online education and promotion; new formatsemerging all the time.	Passive learning; long instructional videos; mostly ITsubjects certified.
Udacity	Simple design; project-based, active learning; cutting-edgecontent.	Pioneer in education; quite expensive; no app.
NetExplorer	Runtime - timely garbage collection; asynchronous model;the framework is robust.	Difficult to use; very many apps to the program itself; their quick "death".
Microsoft Azure for Research	Most popular among clouds; increased power and manageability; data security and retains large amounts ofinformation.	Hybrid model, difficult for the average user; many services to support migration; need to takecourses in use beforehand.
Microsoft Sharepoint	Uses fewer IT resources; personal library; low cost.	User resistance; file properties do not migrate; metadata is notstored.
OneNote	Overlaps all possible tasks; quick access to any data of arbitrary nature; has the form of notebooksorganized by visual area.	Rather confusing workspace;operations to create your own notebook are complicated enough for a novice; when editinga document, there is no connection between the original document on disk and its copyin Onenote.
Microsoft Teams	Free app; easy to distribute tasks; no license required andeasy to use.	Lack of notifications; similar and redundant tools; limitednumber of channels.

InTune	Easy to manage mobile apps from the cloud; workforce productivity; protect corporate data and integrate familiar appsinto the cloud.	Unattractive interface; easily attacked by viruses; quiteexpensive.

Source: the table is the author's own development.

Science and ecology make extensive use of cloud programmes in addition to instructional duties. Digital transformation gives research-focused higher education institutions the tools to fund significant studies with the goal of changing the world. Regardless of location, Microsoft Cloud guarantees that researchers can work swiftly and precisely with any combination of data sources in a secure, real-time environment by offering enterprise-class data storage, processing power, collaboration tools, and analytics.

Microsoft provides free Azure storage and processing resources for cutting-edge research initiatives like the REACH project, which is led by the University of Oxford, through Microsoft Azure for Research. The initiative helps increase access to clean drinking water in Asia and Africa by utilising Azure machine learning (Rashid & Chaturvedi, 2019).

With the use of technology, students can design the society of the future. Pupils who graduate from today's educational system with digital skills will go on to have successful professions and create previously unthinkable new technologies. It is the duty of parents, educators, and tech businesses to give youth the finest education possible and the resources they need to realise this future. Technology is essential to fostering our kids' success, encouraging their creativity, and building a better society.

Discussion

After analysing academic sources and identifying the features of the platforms Coursera, EDX, Udacity, NetExplorer, Microsoft Azure for Research, Microsoft Sharepoint, OneNote, Microsoft Teams, and InTune, it is clear that there is a pressing need in academia today to address the question of how technology can change education. Amani et al. (2020) claim that, when applied appropriately, digital transformation can address the democratisation of educational opportunities, one of society's most important issues. Scholars from Europe claim that personalised services, adaptable infrastructure, improved data comprehension, and innovative strategic thinking are all necessary for educational institutions.

Through the use of Coursera cloud computing programmes, educators and students are able to improve student and teacher results from kindergarten through higher education by establishing cognitive campuses (Avidov-Ungar et al., 2022). It is proven that personalised learning is supported by this educational technology, which also boosts research capacity and streamlines operations to make higher education more cost-effective. Regarding this study, keep in mind Cuellar (2002), who points out that in order for colleges and universities to benefit from the digital transformation, they must acknowledge that students now learn in a different way than they did in the past. believes that the Microsoft Azure for Research platform has the most influence in this regard. According to Bonfield et al. (2020), there are drawbacks to employing EDX in particular. Because EDX is so complicated, researchers believe that one of the main obstacles to teachers adopting it to engage students in the classroom is its complexity. Many educators want to avoid embracing cloud computing technology because they believe it to be a time-consuming process, yet their worries are entirely baseless. The utilisation of EDX papers is particularly crucial for remote educators. The average person can easily access cloud technologies. The fundamental idea behind these technologies is that web servers store and process data. Using a browser, the user receives the result. The owner can enter and edit specific information on his computer with the help of unique web page commands. Educational technologies such as Udacity, cloud-based hybrid computing, and data management improve learning environments, expanding learning potential, leading to better outcomes and more rewarding experiences for students (Mishra et al., 2020).

Regarding this task, take note of Shatri's (2020) advice regarding NetExplorer, Microsoft's enterprise-class cloud computing platform that offers analytics tools and processing capacity. However, American scientists advise teaching with Microsoft Teams.

North Carolina State University is able to develop innovative ways to support its students in effectively managing and analysing vast volumes of structured and unstructured data from various sources by utilising Microsoft Teams data and educational technologies. Hawkridge in 2022. The use of additional cloud computing tools like Microsoft Sharepoint, OneNote, and InTune in the European experience mentioned above may be interesting to modern students as a means of improving their understanding of specific subjects using educational videos and visuals. Additionally,

you have the chance to expand your knowledge and study anything via the Internet.

Teachers now need to become more proficient with computers in order to employ various information and communication technologies for children's remote learning, thanks to the development of inclusive education. Conventional email is utilised in its format. The teacher runs the programme, downloads the student's letter, writes it down, and then reads the data. In education, cloud computing technology makes browser-based email possible. On any computer with an Internet connection, the instructor can read emails and download attachments, including student assessments. Cloud computing technology has been actively used by students in the classroom for a long time. They add computer games and music files, for instance, to the repository. Electronic aids can also be added to the virtual library. There are numerous servers available these days that allow for the transport of data with high-quality images. For instance, a teacher might email a pupil an electronic copy of a textbook that has been posted.

In fact, with digital learning, teachers who are completely aware of every student's circumstances can step in early and give kids the support they require to get over obstacles to learning. The utilisation of computational cloud technology facilitates orientation and enhances comprehension of instructional content. These kinds of technology enable the educational system to provide more engaging and effective instruction to subjects, enhancing student achievement across the board. When cloud technologies are actively used in the classroom, they help teachers do their jobs more efficiently and spark students' enthusiasm in learning. The successful adoption of new standards and a child's opportunity for personal growth depend on the computerization of education.

A teacher can keep an eye on a child's growth and personalised educational path because of ICTs. These technologies aid in overcoming political, social, and geographic barriers. Teachers utilise cloud storage actively now, but many of them are still dubious. Cloud technology is now feasible thanks to the rapid advancement of hardware, which includes improved multi-core architecture, faster computer processors, and larger hard drives. Wider and faster Internet channels are also becoming available.

Conclusion

Although there isn't a single, agreed-upon definition of ICT, it's commonly understood to refer all programmes, systems, networked devices, and networked components that allow individuals and organisations to communicate digitally. The primary drawback of ICT in education is the ineffectiveness with which it is incorporated into the learning process or the outright absence of fundamental abilities needed to operate it. The drawbacks of cloud computing platforms have been sufficiently emphasised. The following are general drawbacks for each of the platforms mentioned above: rather costly; certain platforms lack apps; they are hard to use; they quickly "die"; hybrid models are challenging for the typical user; the workspace is complicated; and viruses can target them easily. However, because cloud computing technologies make teaching and learning easier, they go beyond just making technology available. Since they permeate every aspect of contemporary life and are essential to the structure of society and culture, it is no surprise that as digital technologies have advanced, so too have educational systems around the world, requiring numerous adjustments because of their incorporation. The following are some of the generalised benefits that are worth mentioning: they are interactive platforms that offer a wide range of courses; project-based, active learning; advanced content; increased power and ease of management; large amounts of information are securely stored; corporate data is protected; and familiar applications can be integrated into the cloud.

Curriculum at all levels must be reconfigured for modern schooling. The curriculum in which digital tools are introduced determines their meaning and pedagogical life as learning tools. Teachers must represent the innovative aspect of education since they are a crucial component of this shift. Since the current understanding of technological accessibility is far less than what is needed to apply it in the classroom, a great deal of work goes into creating innovative and efficient pedagogic models that leverage information and communication technologies. We see the role of contemporary education as serving as a conduit for knowledge discovery via information and communication technologies. We include the following among the many benefits: ease of use, control, automation, cost-effectiveness, and lessened administrative load.

Additionally, cloud computing technologies offer numerous ways for students to comprehend and absorb information, to clarify specific concepts, and to convey the knowledge they have learned, whether they are working or pursuing multiple courses at the same time. Most of the children learn best while using tactile and visual aids, therefore information and communication technologies (ICTs) can support independent learning beyond reading and hearing alone.

Additionally, applications (apps) for mobile devices provide features like streamlined instructions and screens, a logical menu structure and control features, textual and illustrated content, aural feedback, speed and difficulty level adjustments, easily comprehensible information, and error correction that makes it easier for students with special needs to learn. At this point, developing the appropriate

use of ICT and cloud computing technology is a powerful tool for designing the education of the future.

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