CLOUD COMPUTING AND EFFECTIVE TEACHING OF CHILDREN: THE PROSPECT AND CHALLENGES

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ABSTRACT

One of the most crucial aspects of educational growth and activity is cloud computing. With cloud computing, children can access learning materials from virtually anywhere with an internet connection. The study reveals that cloud computing has emerged as a game changing technology in the field of education, offering numerous prospects and addressing various challenges in the effective teaching of children. The study assessed the concept of cloud computing, cloud computing and its effectiveness in teaching children, the prospect of cloud computing, and the challenges of cloud computing in teaching children. The study concluded that cloud technology has a promising future in the effective teaching of children, offering accessibility, collaboration, scalability, and data-driven personalization. As technology continues to evolve, the prospects for enhancing the educational experience of children through the cloud are likely to grow even more. One of the recommendations made was that educational institutions and policymakers should work to improve internet access, invest in teacher training, establish strong data protection policies, and ensure that cloud-based resources are equitable and inclusive for all students.

KEYWORDS: Cloud Computing, Effective teaching, Children, Prospects and Challenges

INTRODUCTION

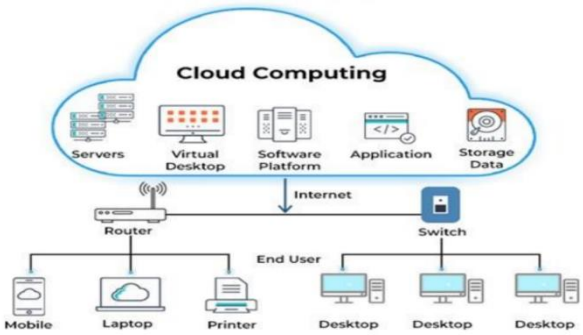
Cloud computing has emerged as a transformative technology in the field of education, offering numerous prospects and addressing various challenges in the effective teaching of children. Cloud-based learning systems and applications make it possible to access educational materials from any location, encouraging flexible and individualized learning. Children especially require this accessibility so they may study at their own speed and meet their own demands. Additionally, collaborative learning is made possible by cloud computing, which encourages peer interaction and raises interest in academic pursuits. Additionally, by gathering and processing data on student performance, cloud computing in education makes it easier to make decisions based on that data. Teachers may use this data to personalize learning for each student and deliver timely interventions (Anderson & Dron, 2011). Cloud-based solutions can also reduce the digital divide by making educational resources available to students who lack access to expensive hardware and software, thus promoting inclusivity.

Through cloud-based platforms and tools, children can access learning materials from virtually anywhere with an internet connection. This accessibility is particularly valuable for ensuring continuous learning, whether a child is at home, school, or any other location. It empowers educators to create more personalized learning experiences, adapting to individual students' needs and preferences. Additionally, cloud computing fosters collaboration and communication among students, enabling them to work on group projects and share ideas seamlessly, enhancing their learning experience (Voogt, & Knezek, 2018). However, challenges accompany the integration of cloud computing in children's education. Privacy and security concerns are paramount, as children's data must be protected rigorously (Kebritchi, Lipschuetz, & Santiague, 2017). Moreover, not all educational institutions have the resources or infrastructure to fully adopt cloud-based solutions, leading to disparities in access to technology and learning opportunities (Rienties, Brouwer, & Lygo-Baker, 2013). The potential overreliance on technology could also raise concerns about screen time and its impact on children's physical and mental health. Cloud computing offers immense prospects for the effective teaching of children, from enhancing accessibility and personalization to enabling data-driven decision-making and collaborative learning However, these advantages must be balanced with the challenges of privacy, security, and equitable access to technology. Educators and policymakers must work collaboratively to harness the potential of cloud computing while safeguarding children's well-being and ensuring a fair and inclusive educational environment.

CONCEPT OF CLOUD COMPUTING

Cloud computing is the delivery of computing services including servers, storage, databases, networking, software, analytics, and intelligence over the Internet ("the cloud") to offer faster innovation, flexible resources, and economies of scale.

Cloud Computing is defined as the storing and accessing of data and computing services over the internet. It doesn't store any data on your personal computer. It is the on-demand availability of computer services like servers, data storage, networking, databases, etc. The main purpose of cloud computing is to give access to data centers to many users. Users can also access data from a remote server. Cloud computing has a rich history that extends back to the 1960s, with the initial concepts of time-sharing becoming popularized via Remote Job Entry (RJE). The "data center" model, where users submitted jobs to operators to run on mainframes, was predominantly used during this era. This was a time of exploration and experimentation with ways to make large-scale computing power available to more users through time-sharing, optimizing the infrastructure, platform, and applications, and increasing efficiency for end users.



Basic structure of a cloud computing model (*source: Spiceworks*)

The use of the "cloud" metaphor to denote virtualized services traces back to 1994, when it was used by General Magic to describe the universe of "places" that mobile agents in the Typescript environment could go. This metaphor is credited to David Hoffman, a General Magic communications employee, based on its long-standing use in networking and telecom. The expression cloud computing became more widely known in 1996 when the Compaq Computer Corporation drew up a business plan for future computing and the Internet. The company's ambition was to supercharge sales with "cloud computing-enabled applications". The business plan foresaw that online consumer file storage would most likely be commercially successful. As a result, Compaq decided to sell server hardware to internet service providers. In the 2000s, the application of cloud computing began to take shape with the establishment of Amazon Web Services in 2002, which allowed developers to build applications

independently. In 2006 the beta version of Google Docs was released, Amazon Simple Storage Service, known as Amazon S3, and the Amazon Elastic Compute Cloud (EC2), in 2008 NASA's development of the first open-source software for deploying private and hybrid clouds.

CONCEPT OF EFFECTIVE TEACHING

Effective teaching is the knowledge, strategies, processes, and behaviors that lead to good student outcomes. Effective teachers have a positive impact on their students and use their expertise to improve learning. These good outcomes are often those that can be measured easily, usually through summative assessment. In this chapter, we discuss research on effective teaching. Effective teaching can be defined in many ways, including teacher behavior (warmth, civility, and clarity), teacher knowledge (of subject matter and of students), teacher beliefs, and so forth. Here we define effective teaching as the ability to improve student achievement, as shown by research. As noted, this is only one way to define effectiveness. However, teacher effects on student achievement are the preferred definition of high-quality teaching by American policymakers and those in many other countries as well.

Effective teachers cultivate excellent working relationships with their students in safe and respectful environments. Effective teaching is much more than end-of-year data; it is an ongoing, reflective practice that needs to be refined and amended to suit learners' needs. Effective teachers nurture effective learners who are actively involved in their own learning and personal development. They can manage a classroom to remove or reduce instances of challenging behavior, introduce new information in an engaging and accessible way, and provoke curiosity in the subject matter to promote higher-order thinking. Effective teachers also love their subject and use their experience and pedagogical knowledge in order to create high-quality learning. After discussing what is known about how effective teachers teach, we then turn to an examination of one of the many either-or debates about research on teaching.

TYPES OF CLOUD COMPUTING

There are the following 5 types of cloud that you can deploy according to the organization's needs:

- Public Cloud
- Private Cloud
- Hybrid Cloud
- Community Cloud
- Multi Cloud

- **Public cloud**

  This is open to all to store and access information via the Internet using the pay-per-usage method. In public cloud, computing resources are managed and operated by the Cloud Service Provider (CSP). The CSP looks after the supporting infrastructure and ensures that the resources are accessible to and scalable for the users. Due to its open architecture, anyone with an internet connection may use the public cloud, regardless of location or company size. Users can use the CSP's numerous services, store their data, and run apps. By using a pay-per-usage strategy, customers can be assured that they will only be charged for the resources they actually use, which is a smart financial choice. Examples: Amazon elastic compute cloud (EC2), IBM Smart Cloud Enterprise, Microsoft, Google App Engine, Windows Azure Services Platform.

- **Private Cloud**

  Private cloud is also known as an internal cloud or corporate cloud. It is used by organizations to build and manage their own data centers internally or by the third party. It can be deployed using Open-source tools such as Open stack and Eucalyptus Examples: VMware spheres, Open Stack, Microsoft Azure Stack, Oracle Cloud at Customer, and IBM Cloud Private. Based on the location and management, National Institute of Standards and Technology (NIST) divide private cloud into the following two parts- On-premise private cloud: An on-premise private cloud is situated within the physical infrastructure of the organization (Koch, Assunção, Cardonha, & Netto, 2016). It involves setting up and running a specific data center that offers cloud services just for internal usage by the company.

- **Hybrid Cloud**

  This is a combination of the public cloud and the private cloud. We can say: Hybrid Cloud Hybrid Cloud = Public Cloud + Private Cloud. Hybrid cloud is partially secure because the services which are running on the public cloud can be accessed by anyone, while the services which are running on a private cloud can be accessed only by the organization's users. In a hybrid cloud setup, organizations can leverage the benefits of both public and private clouds to create a flexible and scalable computing environment. The public cloud portion allows using cloud services provided by third-party providers, accessible over the Internet. Example: Google Application Suite (Gmail, Google Apps, and Google Drive), Office 365 (MS Office on the Web and One Drive), Amazon Web Services.

- **Community cloud**

  This allows systems and services to be accessible by a group of several organizations to share the information between the organization and a specific community. It is owned, managed, and operated by one or more organizations in the community, a third party, or a combination of them. In a community cloud setup, the participating organizations, which can be from the same industry, government sector, or any other community; collaborate to establish a shared cloud infrastructure (Kumar, Baranwal, Raza, & Vidyarthi, 2017). This infrastructure allows them to access shared services, applications, and data relevant to their community Example: Health Care community cloud.

- **Multi-cloud**

  This is a strategy in cloud computing where companies utilize more than one cloud service provider or platform to meet their computing needs. It involves distributing workloads, applications, and statistics throughout numerous cloud environments consisting of public, private, and hybrid clouds. Adopting a multi-cloud approach allows businesses to have the ability to select and leverage the most appropriate cloud services from different providers based on their specific necessities. This allows them to harness each provider's distinctive capabilities and services, mitigating the risk of relying solely on one vendor while benefiting from competitive pricing models (Matos, Araujo, Oliveira, Maciel, & Trivedi, 2015). Examples: Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP).

COMPONENT OF CLOUD COMPUTING

Components in a cloud refer to the platforms, like the front end, back end, cloud-based delivery, and the network that is used. All together, they form an architecture for cloud computing. With the main components like SAAS, PAAS, and IAAS, there are 11 more major categories in cloud computing that we will explain here. Cloud computing components correspond to platforms such as the front end, back end, cloud-dependent delivery, and the utilized network. So, the framework of cloud computing is broadly categorized into three parts: clients, distributed servers, and datacenters.

- **Storage-as-a-Service**

  This is the component where we can use or request storage, like as we do it physically using the remote site. It is also called disk space on demand. This is the main component where even other components will have a base component as Storage-as-a-Service.

- **Database-as-a-Service**

  This component acts as a live database from the remote where its functionality and other features work as though a physical db is present in the local machine. Its main objective is to reduce the cost of DB using many software as well as hardware.

- **Information-as-a-Service**

  Information that can be accessed remotely from anywhere is called Information-as-a-Service. Here the information will be fetched remotely. This includes, for example, live stock prices, internet banking, online news, credit card validation, and so on.

- **Process-as-a-Service**

  This component combines various resources such as data and services. This happens either hosted within the same cloud-computing resource or remotely. Mainly this is used for business processes where various key services and information are combined to form a process. This helps deliver on-demand. For example, mobile networks (internet settings are sent as soon as activated).

- **Application-as-a-Service**

  Application-as-a-Service (also known as SAAS) is the complete application built ready for use by the client. This is built to use the internet to the end-users and the end-users normally use browsers and the internet to access this service. This component is the ultimate front-end for end-users. Some of the applications are Sales force, Gmail, Google calendar, and so on.

- **Platform-as-a-Service**

  This is the component where the app is being developed and the database is being created, implemented, stored, and tested. In recent times this component allows the creation of enterprise-level applications easily and is cost-effective

- **Integration-as-a-Service**

  Integration-as-a-Service deals with the components of an application that has been built but must be integrated with other applications. It helps in mediating between the remote servers with the local machines. Stacks from the cloud are fetched and communicated with local machines. For example, sales force has recently integrated Google maps into it.

- **Security-as-a-Service**

  This is the main component many customers require. Whoever goes for a cloud environment needs security features a lot since all the data and operations are handled remotely. There are three-dimensional securities found in cloud platform.

- **Management-as-a-service**

  This is a component that is mainly useful for the management of the clouds, like resource utilization, virtualization, and server up and downtime management. This will be like a small role from an admin point of view. Testing-as-a-Service refers to the testing of the applications that are hosted remotely, whether there is a requirement to design a working database and there is enough security for the applications, and so on. This will be tested even with two or three cross clouds. This will also be a component in the development of cloud products.

- **Infrastructure-as-a-Service**

  This is called as nearly as possible the taking of all the hardware, software, servers, and networking that is completely virtual. This is where all the processes and purchases of resources will take place in the cloud.

CLOUD TECHNOLOGY AND EFFECTIVE TEACHING OF CHILDREN

Cloud technology has transformed the landscape of education, offering numerous advantages in the effective teaching of children. The cloud provides a scalable and accessible platform that allows educators to create, store, and share resources and content with ease. It enables collaborative learning, allowing students and teachers to interact and work together on projects, assignments, and discussions from virtually anywhere (Anderson, 2013). Moreover, cloud-based tools and applications facilitate personalized learning experiences, catering to individual student needs and preferences. One significant benefit of cloud technology in education is its ability to enhance access to educational resources. With cloud-based storage and services, students and teachers can access

learning materials, assignments, and educational software from any device with an internet connection (Tanyel, & Akbulut, 2019). This accessibility is especially crucial in bridging the digital divide, ensuring that all students, regardless of their geographical location or socioeconomic background, have equitable access to quality education. Cloud technology also promotes collaboration and engagement in the classroom. Through cloud-based collaboration tools, students can collaborate on projects, share documents, and provide feedback in real-time, fostering teamwork and communication skills. Additionally, cloud-based learning management systems (LMS) enable teachers to monitor student progress, provide timely feedback, and tailor instruction to individual learning needs, ultimately improving learning outcomes (Wu, & Chen, 2018).

Furthermore, the scalability and cost-effectiveness of cloud technology make it an attractive option for educational institutions. Cloud-based solutions eliminate the need for on-premises hardware and maintenance, reducing IT expenses and allowing schools to allocate resources more efficiently. This scalability also ensures that educational institutions can adapt and grow their technology infrastructure to accommodate changing needs and student populations. Cloud computing can help teachers connect with their students more efficiently and communicate more clearly. Teachers can use tools like online courses to deliver content that pupils can access anytime and anywhere. They can also use management information systems to streamline administrative tasks, stay organized, and gain more time to connect with pupils directly.

CHALLENGES OF CLOUD COMPUTING IN THE EFFECTIVE TEACHING OF CHILDREN

Despite several benefits, cloud adoption in the education sector presents its own set of challenges. Teaching children using cloud computing technologies has become increasingly popular in education. However, it also comes with several challenges, some of which are highlighted:

- **Internet Accessibility and Infrastructure**

Many students may not have reliable access to the internet, especially in underserved or rural areas, which can hinder their ability to use cloud-based educational resources effectively (Vidakis, et al. 2020).

- **Data Security and Privacy**

Protecting students' personal information and educational data is paramount. Cloud platforms must ensure robust security measures to prevent data breaches and unauthorized access.

- **Digital Divide**

Not all students have access to the same devices or digital literacy skills, creating disparities in their ability to effectively use cloud-based tools and resources (Warschauer, 2017).

- **Content Quality and Control**

Ensuring the quality and appropriateness of educational content available on the cloud can be challenging. Educators need to have control over what materials are accessible to their students.

- **Costs and Licensing**

Cloud services often come with licensing costs that can be prohibitive for cash-strapped schools and districts, affecting their ability to implement cloud-based solutions.

- **Teacher Training and Support**

Educators may require training and ongoing support to effectively integrate cloud technologies into their teaching methods (Ching, & Hsu, 2018).

- **Digital Citizenship Education**

Teaching students responsible and safe use of cloud technologies and online resources is essential to address issues like cyberbullying, plagiarism, and digital ethics.

- **Reliability and Downtime**

Dependence on cloud services for educational activities can be disrupted by unexpected downtime or service interruptions from cloud providers.

PROSPECT OF CLOUD TECHNOLOGY IN THE EFFECTIVE TEACHING OF CHILDREN

Cloud technology holds immense promise for transforming the effective teaching of children in contemporary education. One of its most significant advantages is its ability to enhance accessibility and flexibility in learning. Cloud-based educational resources can be accessed from anywhere with an internet connection, allowing students to learn at their own pace and in diverse environments, promoting inclusive learning (EDUCAUSE Review, 2012). This flexibility is especially crucial in accommodating the varied learning needs and preferences of children. Another compelling prospect of cloud technology is its capacity to facilitate collaborative learning. Cloud platforms enable real-time collaboration, encouraging students to work together on assignments and projects seamlessly. This not only fosters a sense of community and teamwork but also enhances critical skills such as communication, problem-solving, and digital literacy (International Journal of Emerging Technologies in Learning, 2013).

Cloud technology can reduce the need for expensive physical infrastructure and maintenance costs in educational institutions. Institutions can allocate resources more effectively, potentially reducing the overall cost of education while maintaining or even improving the quality of teaching and learning. Moreover, cloud technology offers robust data security and backup solutions. Cloud providers invest heavily in data security measures, ensuring that children's educational data remains protected from loss or cyber threats. Automatic backups also safeguard against data loss, crucial for preserving academic progress and materials. The personalization of learning experiences is a compelling prospect of cloud technology. Cloud-based learning platforms can collect and analyze student data, enabling educators to tailor their teaching to individual students' strengths and weaknesses. This adaptive learning approach maximizes student engagement and achievement, further enhancing the effectiveness of teaching (Forbes, 2020). Cloud technology holds immense potential for effective teaching of children by enhancing accessibility, promoting collaboration, offering cost-efficiency, ensuring data security, and enabling personalized learning experiences. These advantages not only benefit students by providing a more tailored and accessible education but also empower educators to create more engaging and effective teaching strategies. The integration of cloud technology into education represents a significant step forward in modernizing and improving the educational experience for children in today's digital age.

CONCLUSION

The study concludes that cloud technology has a promising future in the effective teaching of children, offering accessibility, collaboration, scalability, and data-driven personalization. As technology continues to evolve, the prospects for enhancing the educational experience of children through the cloud are likely to grow even more. Cloud technology has transformed various aspects of education, including the effective teaching of children. It offers numerous benefits that enhance the learning experience for students of all ages.

RECOMMENDATIONS

- Educational institutions and policymakers should work to improve internet access, invest in teacher training, establish strong data protection policies, and ensure that cloud-based resources are equitable and inclusive for all students.
- Digital citizenship education should be integrated into school's curriculum, to educate students about online etiquette, privacy, and security.

REFERENCES

Anderson, T. (2013). Getting the mix right again: An updated and theoretical rationale for interaction. *The International Review of Research in Open and Distributed Learning*, 14(2), 1-23.

Anderson, T., & Dron, J. (2011). Three generations of distance education pedagogy. The International Review of Research in Open and Distributed Learning, 12(3), 80-97.

Ching, Y. H., &Hsu, Y. C. (2018). Factors affecting teachers' adoption of cloud computing in education. *International Journal of Information and Education Technology*, 8(1), 35-40.

EDUCAUSE (2012). Source: https://er.educause.edu/articles/2012/6/the-case-for-cloud-computing-in-education

ELPRO CUS (2013) Available at:www.elprocus.com/cloud-computing-technology/

Forbes, (2020). Source: https: //www.forbes .com / sites /forbestechcouncil/2020/08/12/how-the-cloud-has-revolutionized-education/?sh=5e3132d45f15

International Journal of Emerging Technologies in Learning (2013) Source: https://online-journals.org/index.php/i-jet/article/view/2600

Java point (2021) Cloud Computing. Available at:/www.javatpoint.com/types-of-cloud

Kebritchi, M., Lipschuetz, A., & Santiague, L. (2017). Issues and challenges for teaching successful online courses in higher education: A literature review*. Journal of Educational Technology Systems,* 46(1), 4-29.

Koch, F., Assunção, M. D., Cardonha, C., & Netto, M. A. (2016). Optimising resource costs of cloud computing for education. Future Generation Computer Systems, 55, 473-479. 25.

Kumar, D., Baranwal, G., Raza, Z., & Vidyarthi, D. P. (2017). A systematic study of double auction mechanisms in cloud computing*. Journal of Systems and Software,* 125, 234-255.

Matos, R., Araujo, J., Oliveira, D., Maciel, P., & Trivedi, K. (2015). Sensitivity analysis of a hierarchical model of mobile cloud computing. Simulation Modelling Practice and Theory, 50, 151-164.

Prajakta p. (2022) cloud computing concept, Available at: www.spiceworks.com/tech/cloud/articles/what-is-cloud-computing

Qian, Ling; Lou, Zhigou; Du, Yujian; Gou, Leitao. "Cloud Computing: An Overview". Retrieved (19 April 2021)/Available at: wikipedia.org/wiki/Cloud_computing#cite

Ray, Parthia Pratim (2018). "An Introduction to Dew Computing: Definition, Concept and Implications - IEEE Journals & Magazine". IEEE Access. 6: 723–737. Available at:10.1109/ACCESS.2017.2775042. S2CID 3324933. Archived

Rienties, B., Brouwer, N., & Lygo-Baker, S. (2013). The effects of online professional development on higher education teachers' beliefs and intentions towards learning facilitation and technology. *Teaching and Teacher Education*, 29, 122-131.

Tanyel, F., & Akbulut, Y. (2019). The use of cloud computing in education: A literature review. *Contemporary Engineering Sciences*, 12(31), 1815-1826.

Thomas. L (2023). Effective Teaching Available at: link.springer.com/chapter/10.1007/978-0-387-73317

Vidakis, N., Karakos, A., Koutsopoulos, K. et al. (2020). Cloud-based Education: A state-of-the-art survey. *Computing in Science & Engineering*, 22(2), 54-63.

Voogt, J., & Knezek, G. (2018). *International handbook of information technology in primary and secondary education* (Vol. 20). Springer Science & Business Media.

Warschauer, M. (2017). Computer science for all: Can schools pull it off. *Journal of Information Technology Education:* Research, 16, 43-51.

Wu, D., & Chen, S. (2018). The adoption of cloud computing technology in education: A study of cloud storage service. *Journal of Educational Computing Research*, 56(2), 244-268.