SSRG International Journal of Electrical and Electronics Engineering
ISSN: 2348-8379/ https://doi.org/10.14445/23488379/IJEEE-V11I6P117

Volume 11 Issue 6, 150-155, June 2024

Review Article

A Review: The Effectiveness of Cloud-Computing Infrastructure Services on Educational Domain

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Received: 08 April 2024 Revised: 11 May 2024 Accepted: 08 June 2024 Published: 29 June 2024

Abstract *- For nations with expanding economies, in particular, education plays a critical role in guaranteeing sustained progress. cloud-computing has sophisticated scalability and access to the internet because of resource virtualization. Regardless of the minimal resources available, public and private education institutional authorities should influence the feasible benefits of cloud setup to provide superior services. Because of its many benefits, cloud-computing is gaining popularity in academics. The objective of such a study is to ascertain the paybacks of cloud-computing for educational purposes. Cloud-computing solutions raise the standard of instruction and learning in the educational institutional environment by increasing the efficacy and sustainability of both teaching as well as research and development environments. The main objective of this survey is to resolve the payback of using cloud-computing in the classroom. The competitiveness and effectiveness of research and development, as well as instruction, are increased by cloud-computing solutions, which benefit education quality and its services.*

Keywords *- Cloud, Cloud computing, Education, SaaS, PaaS.*

1. Introduction

Since education gives us the skills this research needs to accomplish the research goals, it is essential to the wellbeing. Using cloud-computing is a potent paradigm for education. A type of internet-based computing known as cloud-computing uses pooled resources and data to provide payback to its users. The cloud represents a novel method of utilizing computing resources that can be symbolically partitioned and exchanged across service providers for the first time in computing history. Resources can be derived from network servers, apps, platforms, infrastructure components, and services.

Self-serving in nature, cloud-computing offers appropriate network connectivity, a data resource environment, and flexible scalability in addition to on-demand services. This innovation centralizes memory, storage, and processing power on PCs and servers, increasing computing effectiveness and lowering costs. With all the benefits that cloud-computing provides, this work anticipates that it will have a significant influence on education. Cloud-computing technologies enable higher education institutions to be more flexible. The cloud platform on campus offers an effective infrastructure and deployment architecture for organizations with fluctuating demands, which is a good thing.

Cloud-computing in educational infrastructure can come up with problems that frequently arise in educational institutions, such as re-functioning in cost, rapidity, efficiency, security, confidentiality, and compliance. This work has the following contributions:

- The purpose of this report's writers was to identify the benefits of cloud-computing for Saudi Arabia's educational system.
- This study examines the potential financial, operational, and qualitative benefits of cloud-computing for academic institutions, including security and mobility.
- This work also gave insights into issues in academia pertaining to cloud computing.

This research assesses the problem statement as well as the state of education in Part 2. This research discusses the educational cloud-computing environment and provides a quick introduction to cloud computing. The research methodology used to carry out this study is covered in part 3. Results and discussions are outlined in part 4. The paper is finally concluded [1].

2. Literature Review

The idea of combining technical means of assets in the simulated biosphere through the infrastructure of the internet is known as cloud computing. Cloud-based software. Google first used this expression in 2006, and in today's technologically advanced world, it has become widely used. Through a pay-as-you-go model, organizations and individuals can easily access and utilize a variety of services

that meet their specific needs by pooling online resources such as networks, servers, storage, and applications. Many benefits, including cost-effectiveness, scalability, dependability, service focus, and flexibility, are associated with cloud computing. Pay-per-use cloud models allow users to access shared online resources across a network on desktops, laptops, and smartphones, getting what they need whenever and wherever they need it. These are the hardware and software platforms that users can access and use on-demand over the internet to run different applications, as shown in Figure 1. [1-6] Cloud Deployment Models: functional and compatible with all kinds of gadgets, including PDAs and desktop PCs, making researchers and students more effective and productive [11, 12].

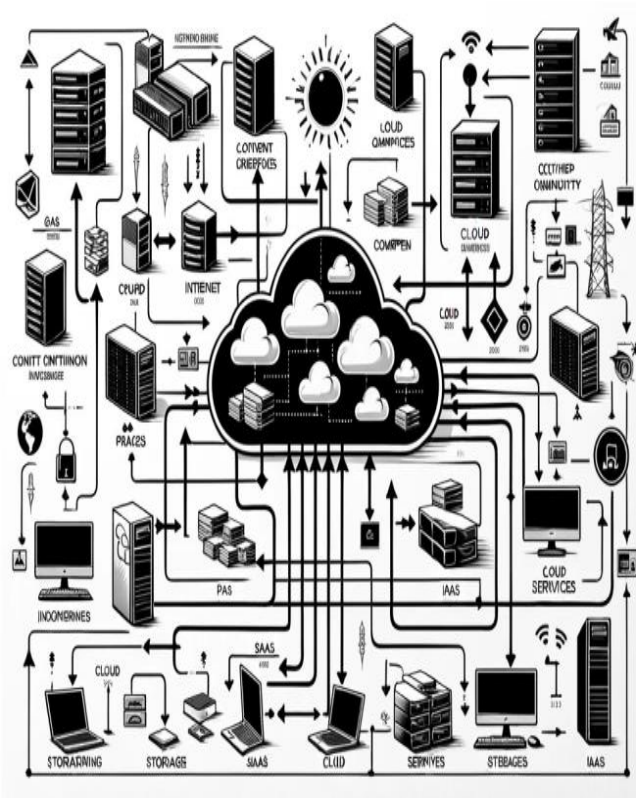

Fig. 1 Cloud-computing infrastructure

There may be four different types of deployment models that can be considered for cloud infrastructure which are as follows [7, 8].

1. Public-based cloud.
2. Private-based cloud.
3. Hybrid-based cloud.
4. Community-based cloud.

2.1. Cloud-Computing Services Infrastructures

Regardless of so many paybacks as well as the feasible applicability of cloud-computing, there are many hazards and security issues to be aware of, including the possibility of data loss or leakage, hacker attacks, and hostile insider attacks. Three categories have been identified by the "National-Institute-of-Standards & Technology (NIST)" for subsequent service simulations [9, 10]:

1. Infrastructure-as-a-Service (IaaS): It focuses on end-user networks or virtual machine provisioning and operation.
2. Software-as-a-service (SaaS): In such a condition, the user solely makes use of vendor-provided applications, which are hosted on cloud-based-services.
3. Platform-as-a-Service (PaaS): Through this, users can use certain related programming languages and libraries to configure the application they want.

2.2. The Uses and Impact of Cloud-Computing-Based-Services Infrastructures in Educational Domain

The foundation of cloud-computing has been the internet, which provides a range of services for learning. Rather than transforming the way that education is thought of and delivered. Direct access to an extensive array of educational resources, such as research applications, ready-to-use platforms, cloud-based academic resources, etc., is made possible by the cloud-computing application ecosystem. Major cloud service providers for educational institutions include Microsoft, Amazon, Google, and so on.

Microsoft's efforts to make learning more engaging and dynamic have made it possible for services like Microsoft Windows Azure and its other services. The primary consideration. Additionally, all services provide education and institutions with greater financial flexibility, resulting in lower development, scaling, operating, and migration costs for pre-existing systems that are split among the cloud and database houses. Microsoft is interim to improve workplace safety [11, 12]. Some services can play a vital role in cloud infrastructure, and they have a potential impact on it. This includes the exchange of files, storing files, exchange of resources, scheduling of resources, deployment of voice over internet protocol-based applications, such as files and desktops, Development or establishment of web resources, etc. Some of these services can also be pillars of cloud infrastructure.

2.2.1. Google-Educational-Cloud

Google-Apps educational cloud is one a cloud-computing platform that focuses primarily on group-specific assignments for higher education institutions. For its subscribers to use these services, google charges a fee [13]. The applications listed below are part of google apps in education.

Google Mail

Known as Gmail, it is the most popular email program used by businesses and individuals, including students and researchers. Enterprise IT administrators use it at companies and universities to manage their emails. For storage, it offers 7 GB for every user.

Google Talk

Commonly referred to as Gtalk, it is the Instant Messaging (IM)-related part of google apps. People who are dispersed across various remote locations can effectively connect through this instant messaging platform.

Google Webpages

This tool is primarily designed to help students develop their technical skills through web publishing in a more creative and hassle-free manner. With the help of this user-friendly web publishing tool, students can more easily refine their technical capacities by posting content and media resources.

Google Calendar

It is the tool that helps university staff members manage their schedules by getting everyone "on the same page." The following features are frequently used in google educational applications [14].

Customizable

Google apps is an intuitive platform that allows users to configure various account permissions, features, and security settings. Google apps help institutions' needs by keeping an eye on students' behaviour, like turning off their email for four first graders' ability to email classmates.

2.2.2. Useful on All Devices

Google apps are state-of-the-art and ought to work seamlessly across a variety of platforms, such as PCs, iPads, laptops, and android-powered tablets. Moreover, for free, google provides a range of free educational resources to support educational institutions. Applications, such as a phone and video tutorial-equipped teacher training center. Collaboratively, google developed applications to facilitate smooth teamwork. They offer a strong basis for sharing, real-time editing, cooperation, interoperability, and controls.

2.2.3. Data Security

The utmost crucial element of any organization or entity is information security. Cloud-computing hacking can affect data stored in the cloud, particularly sensitive data and cloud information in general.

2.2.4. Dependability

When a system fails in a business, it can seriously harm the services that are provided to clients. S3 had yet another notable outage that occurred in July 2008 for eight hours on this occasion. Midway through 2009, for three hours, 113 million Google Gmail users were unable to access their online documents and emails kept as "Google Docs."

3. Recommendations for Cloud-Computing in Educational Domain

Some issues are to be considered as a part of the recommendations to be followed while handling or applying the cloud infrastructure in the educational domain. It would be advantageous to businesses looking to purchase cloud-based services for various uses [20-22] to compile a group of selected measures and submit them to rival suppliers for a response [23-25].

3.1. Framework-Based Issues

The framework that the applications are provided on must be identified. Although it would be ideal, it is unlikely that the software will function identically across all device operating systems and web browsers. A user's advice to use specific channels may be crucial. For many students, having an approach to mobility communication devices is becoming more significant.

3.2. Technological-Based Issues

As part of their technological integration efforts, institutions may need to automate tasks like creating a cloud-based user-account related information saved in student-information-based systems or enabling a one-time signing from one system to another. Additionally, monitoring usage, deleting accounts, or carrying out other management-related system tasks might be appropriate.

3.3. Application-Based Issues

The features that users require should be included in the list. For email, for example, this can entail using instead of out-of-office notifications or web-based POP client applications. Concerns about record storage include the total amount allotted to each user and the types of files that can be allocated and preserved.

4. Methodology

Following studies on the function and impact of cloud computing, particularly in education, published from 2015 to 2020 in a number of prestigious digital libraries, including IEEE Xplore, Semantic Researcher, and Springer Link. By utilizing various phrases and keywords, such as Saudi Arabia, educational, and cloud-based-computing. Which concentrated on the propositions of previous outcomes via an acute estimation of the literature review, which is mentioned in Table 1.

5. Findings and Conversation

Cloud-computing is undoubtedly helpful to educational institutions in a variety of ways. Some benefits are displayed below [17-19]:

a) By providing all necessary IT services to businesses at no cost, cloud-computing and education combine to increase efficiency greatly. This relieves the strain on institutional budgets by obviating the requirement for frequent upgrades to hardware and software.
b) Cloud services are available to everyone, including teachers and students, with year-round maximum availability.

c) The learning environment gets more sophisticated and productive as students are exposed to a wider range of instrument software as well as associated cloud-based tools.
d) Because cloud-computing saves data centers' processing power on the client side, it gives institutions the ability to use resources as sparingly as possible. As such, it reduces carbon emissions.
e) No consideration of difficulty is necessary.
f) It is simple to use and quick to understand.
g) Would someone like to modify a lesson and then modify it once more? No issues. Cloud storage allows the storage of numerous revisions and iterations of a document, making it possible to track an item's development over time.
h) In the traditional approach, the supply of computing resources is usually insufficient to meet the demand for those resources.

Table 1. Literature review

Purpose	Adopted Tool	Methodology	Outcome
About [10]: The authors of this work proposed a hybrid-cloud prototype to allot intellectual property from all Saudi Arabian educational institutions. The suggested hybrid approach is feasible and has been approved by Saudi institutions. Various sections of the model have been examined, and its effectiveness has been proven.	Hybrid Cloud Model	The suggested model is helpful for disseminating the research and knowledge-generating efforts of Saudi Arabian universities. A hybrid cloud architecture helps KSA-(MOHE) look at it efficiently and manage the nations at the higher educational level. The ministry's public cloud, MOHE cloud, houses data produced by universities in the area of intellectual capital.	Suppose it is implemented in KSA-(MOHE). In that case, it will provide the required statistical data that will support MOHE in monitoring and coordinating all affiliated institutes regarding the norms and guidelines it establishes. By removing the need to buy hardware, software, networking, and communication equipment for research and higher education institutions this idea will result in significant financial savings for the government.
For future researchers, this area could be a point of interest. This article examined the ongoing situation of CC acceptance in the higher-educational industry, according to [12]. Current empirical studies establish current shortcomings and knowledge gaps. The proposed domain for future research will also be emphasized. These studies back up the use of cloud-computing in educational environments, especially at higher educational levels.	Cloud Computing	Looking into a few articles published in several credible digital databases, such as Springer-Link, Science-Direct, and, IEEE-Xplore during 2014 and 2017.	Even though cloud-computing is becoming more common in universities, there are still a few problems that need to be resolved. Several contradictions and omissions are found in the critical, thorough examination of the empirical studies that have already been conducted. These gaps introduce fresh limitations and issues that need more research.
Regarding [13], researchers looked at how well Saudi-Arabian's cloud-computing worked in the educational domain, particularly with regard to eLearning. Examining a study that was conducted in Saudi Arabia's capital, Riyadh, will help achieve this.	Cloud-Computing and E-Learning	Multiple studies have been carried out and made available for teachers and educators of IT learners in the capital of KSA, Riyadh, with the help of a questionnaire. Secondary data regarding the background of cloud-computing has been gathered from multiple previous research studies. Primary data was gathered through the use of questionnaires from educational institutions and the IT sector.	This thorough examination of primary and secondary data sources as well as Cloud-computing After reviewing the responses, the researcher can make the following final observations.

6. Conclusion

In Saudi Arabia, the education sector is gradually utilizing cloud computing. This paper presents the results of an investigation into education in the Kingdom of Saudi Arabia. This work also talked about the difficulties associated with cloud computing, particularly as it relates to education. Lastly, this work developed policies to accelerate the sluggish adoption of cloud computing.

References

[1] Ashraf Ali, "Cloud Computing Adoption at Higher Educational Institutions in the KSA for Sustainable Development," *International Journal of Advanced Computer Science and Applications*, vol. 11, no. 3, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[2] Lubna A. Hussein, and Mohd Faiz Hilmi, "Cloud Computing Based E-Learning in Malaysian Universities," *International Journal of Emerging Technologies in Learning*, vol. 15, no. 8, pp. 4-21, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[3] Bader Methqal AlFawwaz, "Effect of Cloud Based Educational Applications in E-Learning: Evidence from Jordan," *International Journal of Interactive Mobile Technologies*, vol. 11, no. 4, pp. 30-42, 2017. [CrossRef] [Google Scholar] [Publisher Link]

[4] Sukosol Wanotayapitak, Kobkiat Saraubon, and Prachyanun Nilsook, "Process Design of Cooperative Education Management System by Cloud-Based Blockchain E-Portfolio," *International Journal of Online & Biomedical Engineering*, vol. 15, no. 8, pp. 4-17, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[5] Mohammad Tabrez Quasim, "An Efficient Approach for Concurrency Control in Distributed Database System," *Indian Streams Research Journal*, vol. 3, no. 9, 2013. [Google Scholar]

[6] Muhammad Suhaib, "Usage of Cloud Computing Technology and Challenges in Japanese Higher Educational Institutes," *International Journal of Scientific and Technology Research*, vol. 9, no. 4, pp. 2727-2733, 2020. [Google Scholar] [Publisher Link]

[7] Sarita Narwal et al., "Cloud-Computing in Education," *4th National Conference on E-Learning and E- Learning Technologies (ELETECH India 2013)*, 2013. [Google Scholar]

[8] Z.K. Tavbulatova et al., "Types of Cloud Deployment," *Journal of Physics: Conference Series*, vol. 1582, pp. 1-6, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[9] Iqbal Ahmed, "A Brief Review: Security Issues in Cloud Computing and Their Solutions," *Telkomnika (Telecommunication Computing Electronics and Control)*, vol. 17, no. 6, pp. 2812-2817, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[10] Aaqib Rashid, and Amit Chaturvedi, "Cloud Computing Characteristics and Services: A Brief Review," *International Journal of Computer Sciences and Engineering*, vol. 7, no. 2, pp. 421-426, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[11] Mohsen Attaran, Sharmin Attaran, and Bilge Gokhan Celik, "Promises and Challenges of Cloud Computing in Higher Education: A Practical Guide for Implementation," *Journal of Higher Education Theory and Practice*, vol. 17, no. 6, pp. 21-38, 2017. [Google Scholar] [Publisher Link]

[12] F.J. Olaloye et al., "Cloud Computing in Education Sector: An Extensive Review," *International Journal of Civil Engineering and Technology (IJCIET)*, vol. 10, no. 3, pp. 3158-3171, 2019. [Google Scholar] [Publisher Link]

[13] Khaloud A. AlKhaled, "Using Google Cloud in Education," *International Journal of Advanced Engineering and Nano Technology (IJAENT)*, vol. 3, no. 12, pp. 1-9, 2018. [Google Scholar] [Publisher Link]

[14] AlAlaa N. Tashkandi, and Ibrahim M. Al-Jabri, "Cloud Computing Adoption by Higher Education Institutions in Saudi Arabia: An Exploratory Study," *Cluster Computing*, vol. 18, pp. 1527-1537, 2015. [CrossRef] [Google Scholar] [Publisher Link]

[15] Upendra Singh, and Prashant Kumar Baheti, "Role and Service of Cloud Computing for Higher Education System," *International Research Journal of Engineering and Technology*, vol. 4, vol. 11, pp. 708-711, 2017. [Google Scholar] [Publisher Link]

[16] Abusfian Elgelany, and Weam Gaoud Alghabban, "Cloud Computing: Empirical Studies in Higher Education," *International Journal of Advanced Computer Science and Applications*, vol. 8, no. 10, pp. 1-12, 2017. [CrossRef] [Google Scholar] [Publisher Link]

[17] Mishaal Mofleh Almutairi, "A Review of Cloud Computing in Education in Saudi Arabia," *International Journal of Information Technology*, vol. 12, no. 4, pp. 1385-1391, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[18] Lovedeep Saini, Jyoti, and Harpreet kaur, "Role of Cloud Computing in Education System," *International Journal of Advanced Research in Computer Science*, vol. 8, no. 4, pp. 345-347, 2017. [Google Scholar] [Publisher Link]

[19] Mohammad Al Rawajbeh, Issam Al Hadid, and Hassan Al-Zoubi, "Adoption of Cloud Computing in Higher Education Sector: An Overview," *International Journal of Technology & Engineering Studies*, vol. 5, no. 1, pp. 23-29, 2019. [Google Scholar] [Publisher Link]

[20] Edeh Michael Onyema et al., "Cloud Security Challenges: Implication on Education," *International Journal of Computer Science and Mobile Computing*, vol. 9, no. 2, pp. 56-73, 2020. [Google Scholar] [Publisher Link]

[21] Abdulhafeez Muhammad et al., "Factors Affecting Academic Integrity in E-Learning of Saudi Arabian Universities - An Investigation Using Delphi and AHP," *IEEE Access*, vol. 8, pp. 16259-16268, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[22] Muhammad Junaid et al., "Smart Agriculture Cloud Using AI Based Techniques," *Energies*, vol. 14, no. 16, pp. 1-15, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[23] Chetan Bulla, Basavaraj Hunshal, and Sankalp Mehta, "Adoption of Cloud Computing in Education System: A Survey," *International Journal of Engineering Science*, vol. 6, no. 6, pp. 6375-6380, 2016. [Google Scholar]

[24] Rania Almajalid, "A Survey on the Adoption of Cloud Computing in Education Sector," *arXiv*, pp. 1-12, 2017. [CrossRef] [Google Scholar] [Publisher Link]

[25] Quadri Noorulhasan Naveed et al., "Evaluating Critical Success Factors in Implementing E-Learning System Using Multi-Criteria Decision-Making," *Plos One*, vol. 15, no. 5, pp. 1-25, 2020. [CrossRef] [Google Scholar] [Publisher Link]