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THE IMPACT ON EDUCATION OF THE CHALLENGES PRESENTED BY CLOUD SECURITY

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Abstract: Most ETs represent serious security risks. Security issues sometimes prevent widespread acceptance of new technologies, yet they can increase system and human performance. The cloud has changed how companies and consumers store data. The cloud has the same security issues as earlier versions despite its flexibility in data storage, recovery, and accessibility. Cybersecurity concerns surround cloud data and customer personal information. Cloud-outsourced data can be accessed, tampered with, leaked, and attacked by DoS attacks. Both internal and external parties can launch cloud storage security attacks. Most educational institutions are digitizing and moving their data to a third-party cloud platform. Given the importance of school records, this study examines how cloud security issues affect education. The findings underscore the relevance of security in academic cloud computing adoption and transition. It also shows how cloud computing security problems are deterring academic institutions from using it. Cloud vendors must regularly update their systems to protect against new and existing cloud risks. This would greatly improve cloud computing security and privacy.

Keywords: Cloud computing, Security, Education, Data leakage, Privacy.

1. INTRODUCTION

Classroom ETs are growing in popularity. New technologies are transforming classroom design, teaching materials, and student evaluation and learning. Blockchain, wearable technology, cloud computing, mobile computing, distributed computing, AI, the Internet of Things, big data, and wearables have changed worldwide education. These technologies are useful educational aids due to their unique features. The introduction of scalable, flexible, and easily available cloud-based computing services has transformed the outsourcing paradigm from on-premises data centers.

Modern businesses, particularly education institutions, choose cloud data storage. The cloud simplifies data management by reducing storage costs and easing restoration. Cloud computing has impacted education. Many academic institutions use cloud computing to improve data storage, operations, and communication. Millions of people worldwide are adopting cloud computing for schooling. Cloud computing can enhance classroom learning in several ways (Behrend, Wiebe, London, & Johnson, 2011). Companies are studying cloud computing technologies to cut expenses and boost profitability (Brandl, 2010). Companies use the cloud to reduce their server hardware and software costs. It promotes innovative instruction while saving schools money on data management. Yahoo, Amazon, Google, Microsoft, and others offer SaaS, PaaS, IaaS, and SaaS storage. Each service type has security pros and cons. Educational research, practice, and theory benefit from each.

Cloud computing may improve or hurt customer data security. Navneet and Rekha (2014) define cloud computing as Internet-hosted computing that gives devices on-demand access to software, shared resources, and data. Security remains a big concern for Chuleeporn et al. (2014), despite the cloud model's growing popularity due to its benefits. Cloud computing in the classroom reduces IT infrastructure costs and gives students easy online access to assignments and course materials, according to Aminur et al. (2017). As a cost-effective way to provide all students with a variety of high-quality learning resources and support services, Kiryakova (2017) reports that academic institutions are increasingly using cloud services. Critical Cloud Hosting (2014) reports 110 million students, educators, and staff use

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Microsoft Office 365 Education—a cloud-based communication and collaboration service.

Data security becomes challenging when cloud customers must rely on their suppliers—a challenge in all technologies (Rittinghouse and Ransome, 2009). The organization's lack of expertise and control over international cloud service providers makes cloud data more vulnerable to security vulnerabilities (Kevin, Hamlen, & Bhavani, 2013). Data security falls on cloud service providers (Ju, Wang, Fu, Wu, & Lin, 2010). Data backup is essential for disaster recovery but poses security issues, according to Subashini and Kavitha (2011). Businesses that use cloud security services are not fully protected from vulnerabilities. Thousands of Facebook apps were disabled for privacy and security reasons. Some attacks have targeted Google, a popular cloud provider. The impact of cloud security issues on learning is examined in this study to optimize the educational benefits of cloud technology. It also highlights cloud technology's educational capabilities and emphasizes proactive cloud security.

2. REVIEW OF RELATED WORK

Cloud computing provides several venues to improve education. It may be used effectively in any technology-based educational setting due to its ubiquitous use. Cloud computing has educational benefits, but more research is needed to secure user data. Jonathan (2018) states that higher education is adopting SaaS due to its speed, agility, adaptability, and elasticity. SaaS apps focus on communication, information sharing, collaboration, and education. Mitchell (2008) comprehensively studied existing learning systems and cloud computing in education. He also presented a persuasive case for the challenges of indexing digital content for teacher and student discovery. Praveena and Betsy (2009) explain academic cloud computing in detail. Tuncay (2010) examines cloud computing's educational benefits. His talk focused on cloud services' educational uses and how they may provide reliable and secure support for virtual services.

Thomas studied distributed systems and cloud computing. The individual claimed that cloud computing gives higher education more than just a new computer option; it provides a robust platform that can improve teacher engagement by helping them assess and improve classroom methods, boosting productivity. Aminur et al. (2017) examine the pros and cons of cloud computing in Bangladeshi schools. They asserted the 2011–12 National University Bangladesh admission exam results for over 400,000 students were efficiently stored on cloud infrastructure.

Khalil et al. (2017) examined school cloud computing security risks. He found that data security threats and cloud users' security worries continue to prevent colleges from adopting cloud computing. Arsalan and Hina (2014) examined cloud server data integrity. Modern consumers fear cloud server data security. In 2017, Kiryakova studied cloud service educational applications. The findings show that cloud computing provides the infrastructure, platform, and instructional services needed to establish a cost-effective learning environment that improves education and promotes inter-institutional collaboration.

Rania (nd) surveyed academic cloud computing. He concluded that cloud computing's many benefits are driving its appeal in academia, and that many colleges are now using cloud-based apps to help professors and students. Kiran (2014) examined cloud computing's impact on education. Cloud storage gives instructors, parents, personnel, and students access to essential data anytime, anywhere, according to his research. Despite a lot of research on cloud computing, little is known about how cloud security affects classroom learning. This study addresses this need.

3. ADVANTAGES OF CLOUD COMPUTING

Telecommunications businesses, academic institutions, corporations, government agencies, and startups value cloud computing. User benefits include cost savings on data management infrastructures and services from this idea. Cloud-based systems like Thinkfree Online, Amazon Workdocs, Google Drives, One Drive, and

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Microsoft Skydrive have permanently changed data storage and access. One of the main benefits of cloud computing is the ability to outsource data management and storage to independent cloud service providers with the infrastructure to create connections and make data available 24/7.

Fig.1: CloudTweeks (2010), quoted by Anthony and Syed (2011), describes cloud computing resources.

Cloud computing can be used for many human jobs, however Figure 1 shows only a small piece of its potential.

Cloud computing enhances classrooms, according to Weaver (2014) and Aminur et al. (2017).

- The Cloud's automated data storage makes crucial data unlikely to be lost. Cloud-stored files and data are available even if the user's machine fails.
- Cloud storage can hold documents, photos, audio, novels, and programs.
- All platforms—PCs and mobile devices—can access cloud data.
- Ideas may be communicated easily, like how many users can edit a cloud document at once. This innovation will improve instructor-student collaboration on lecture ideas and group tasks.
- Digital materials are easily accessible online, so instructors no longer need to duplicate or print large documents or lesson plans. Online platforms allow students to access projects, class notes, and assignments.
- I love that instructors may assign assignments online using the Cloud. Students can read, complete, and save these tasks in a folder for evaluation. This method saves time by avoiding pre-class assignments (Aminur et al., 2017).

Another benefit of cloud computing is file sharing. All students can access course materials through file sharing. Teacher resource sharing promotes overuse and duplication (Kiryakova, 2017). Cloud computing is vital in modern classrooms. It will improve teachers' communication and collaboration and students' classroom technology use. The cloud improves classroom flexibility and engagement. It expands education beyond the classroom. In the coming years, cloud computing will have a major impact on academia.

4. CLOUD COMPUTING AND EDUCATION

Introducing new pedagogies and technologies into classrooms is difficult, which is why the global educational landscape is always changing (Thomas, 2011). Education is going paperless in enrollment, applications, classroom instruction, and student data. The cloud can increase academic output in several fields. Thomas (2011) says cloud computing aids professors and students. Aminur et al. (2017) classified prospective educational cloud system end-users as instructors, learners, administrators, assessment administrators, and admissions officials in Figure 2.

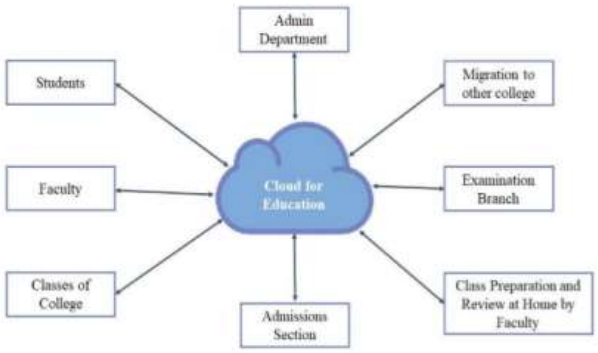

Fig. 2: In 2017, Aminur et al. examine cloud computing in education.

Poonam and Sarika (2014) say cloud technology lets professors create course lectures, presentations, conferences, papers, and more remotely and on their own devices. Cloud computing could revolutionize schooling worldwide. Universities must adopt cloud computing to meet creative technical education demand. Chuleeporn et al. (2014) say learning drives cloud computing advancement. Education

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can benefit from IaaS, PaaS, and SaaS. Microsoft and Google cloud services offer free calendars, email, contact lists, document storage, document creation and sharing, and website construction to educational institutions and students (Sclater, 2009). Cloud computing can make using new technologies in the classroom easier when utilized properly. Cloud computing infrastructures helped colleges integrate new technologies and access their expertise and resources, according to Tuncay (2010). Cloud platforms allow educators to request support with portfolio construction, lecture delivery, and paper submission (Thomas, 2011).

Students and teachers can readily access online teaching resources with cloud-based solutions like Microsoft Office 365. Cloud computing has boosted MOOCs. Teaching professionals can readily expand their subject knowledge with cloud-based solutions. Cloud computing has grown with mobile devices in recent years (Khalil et al., 2017). Cloud computing enables tablet, mobile, remote, and virtual education. Students' cellphones, tablets, and other mobile devices make cloud-based content easier to use (Edeh, 2019b). If educational resources were more accessible, students' grades might improve. Cloud computing also encourages academic institutions to adopt more flexible teaching methods that meet the needs of students from many cultures.

Professors and students can write, update, and test programs in multiple programming languages for free in the cloud. Cloud backups allow users to access their files and data anywhere. Modern education relies on cloud computing for easy and affordable access to internet platforms and resources (Tuncay 2010). Cloud-based management protects student records and outcomes against loss and damage better than the traditional technique. As more teachers and students use the internet, educational institutions can profit from cloud computing. Cloud computing saves schools time and money on maintenance and reduces natural disaster risk.

The following section discusses cloud computing's educational benefits:

Individualized Learning: Cloud services allow students to study whenever and wherever they want. They can find a lot of educational materials with one click.

Affordability: Cloud computing reduces IT infrastructure costs. Complex data management IT solutions no longer cost too much to design and maintain. The cloud allows flexible, pay-as-you-go data delegation.

Increased Accessibility: Instructors and students can use instructional resources anywhere. Everything happens on the cloud now. It eliminates the inconvenient necessity to reference multiple sources. Mobile internet access lets them use cloud-based tools.

Reduced Distractions: Educational institutions can reduce IT infrastructure and facility upkeep with cloud computing. Service delivery improvements may need more time and resources than data infrastructure planning and financing.

Promotion of technology application to education: Cloud services maximize classroom technology utilization for students. It works for online, tablet, virtual, and mobile courses. Mobile education requires many apps, including Microsoft Office 365 (Live@edu).

Creativity: Students can use Python to create and launch PaaS apps. They become more creative and productive learners.

Collaborations: Cloud computing accelerates global academic collaboration. They simplify finding, communicating, and organizing social events for others with similar interests.

Time Saving: This saves time searching for relevant scientific articles, papers, and resources.

Flexibility: Cloud computing allows fast, adaptable data storage and network access.

Robust Backup for Data: Emergency data recovery is assisted by the cloud. If a natural disaster strikes, educators are better equipped to retrieve cloud-based data than filing cabinets. Thus, data loss is reduced.

Office 365 for Education (formerly Microsoft live@edu), Business Productivity Online Suite (BPOS), Exchange Hosted Services, Microsoft Dynamics CRM Online, and Office Web Apps are available to educational institutions from Microsoft's cloud, while Google Apps for

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Education is popular for free web-based email, calendar, and documents for collaborative work.

Despite its many benefits, cloud computing in the classroom raises security concerns due to outages, espionage, hacking, and cracking. Cloud storage outsourcing involves caution due to data compromise, attack, and loss. A physical adversary on the same cloud servers as his target can launch a traditional denial-of-service attack, according to Talbot (2009). Cloud computing for education offers file sharing, collaboration, communication, storage, and data recovery, but its full use depends on cloud security measures.

5. CLOUD SECURITY CHALLENGES

Advanced technology makers and users worldwide worry about security. The majority of IT and technology is flawed. The Cambridge Analytica data theft, which exposed over 86 million Facebook users' personal data, has illuminated several platforms. Security issues are slowing cloud computing's growth. This relates to cloud users' growing privacy and security concerns. Although cloud computing has many benefits, many individuals worry about data security. Many of cloud computing's most appealing features have revealed security vulnerabilities and encouraged new attackers (Navneet and Rekha, 2014). Anthony and Syed (2011) predict that cloud computing adoption will soar. They expect cloud computing will be increasingly vulnerable to hackers, viruses, malware, and attacks. Because hostile nations, terrorist organizations, and organized criminals will perceive cloud computing as another way to disrupt services, steal important data, or damage the firm cloud computing network. Other new technologies have many of the same security problems as cloud computing. Many service and network models subject systems to different risks. Researchers found many cloud computing security issues. Aminur et al. (2017) observed the following cloud issues in their investigation.

Table 1: Cloud data vulnerabilities (Aminur et al., 2017).

Security	The key concern is data privacy: users do not know where their data is being stored and they have no control.
Interoperability	A universal standard about cloud have not yet been defined, resulting in a significant risk of vendor lock-in.
Control	The quantity of control that the cloud user has over the cloud environment varies greatly.
performance	All access to the cloud is done via the internet, introducing latency into each communication between the environment and the user.
Reliability	Many existing cloud infrastructures leverage commodity hardware that is known to fail unexpectedly.
Performance of Language specific	Some cloud environments provide support for specific platforms and languages only.

The Cloud Security Alliance (2010) and Anthony and Syed (2011) say the security vulnerabilities prevent mainstream cloud computing adoption.

- Cloud computing exploitation and crime
- Software development with risky APIs
- Dangerous Espions Inside
- Common Tech Vulnerabilities
- Data loss or leak
- Traffic, service, account theft
- Uncertainty Risk Profile

Cloud security vulnerabilities affect service providers and consumers differently. Salesforce.com went down for six hours in February 2008. In July 2008, Amazon's EC2 and S3 had three-hour and eight-hour outages, respectively. Over 110 million people use Google's webmail in 2009. However, service was interrupted for three hours. Security concerns may dissuade many users, especially educators, from adopting cloud computing. People would not trust a storage system that could not ensure data confidentiality and integrity. For the cloud to benefit users, security and network design must be improved.

6. CLOUD SECURITY ISSUES IN EDUCATION

Cloud computing security vulnerabilities threaten its functionality. Academic users face cloud computing security risks. The client's network medium and cloud infrastructure frequently cause these hazards. Internet is the main way cloud customers connect to infrastructure. Despite this, this connection is vulnerable to phishing, DDoS attacks, malware injection, and eavesdropping. Cloud computing's biggest issue is data compromise during transmission, storage, or processing (Grobauer, Walloschek, & Stocker, 2011). An insecure network or server may render

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cloud services more vulnerable to attacks. Jonathan (2018) lists the security risks for schools using several clouds.

Poor visibility: Different cloud service providers utilize different methods, making cloud security challenging.

No integration or coordination: Precautions are often considered personal preferences.

Reactive security: In the age of zero-day attacks and shrinking infiltration windows, reactive security solutions are unsustainable for schools (Jonathan, 2018).

Educational institutions must address security issues before cloud migration. In this way, they may be prepared for any disaster.

7. SOLVING CLOUD SECURITY CHALLENGES

Before using cloud services, organizations and people must consider risk. Despite researcher attempts to mitigate dangers, new threats make cloud security issues harder to resolve. Cloud service providers must invest more in data protection to retain customers.

Understand the cloud by understanding how cloud systems' amorphous structure compromises data security. To do this, you must grasp cloud computing data transmission and administrative protocols.

Demand Transparency by making sure the cloud service provider's security settings are transparent and auditable. An impartial political group or government agency should do the routine security check.

Reinforce Internal Security Check that the cloud service provider has robust internal security policies and cloud-compatible technology like user access controls and firewalls.

Consider the Legal Implications by being cautious about legal and regulatory restrictions on cloud data.

Pay attention by closely monitoring cloud computing developments that could compromise data security (Edwards, 2009).

Khalil et al. (2017) suggest that the university's IT department host the SaaS application on its own private server or employ infrastructure services from a trusted third-party provider. This would prevent academic data loss.

This report recommends cloud security solutions:

- Protection by isolation
- Digital and hash signatures
- Use of intrusion detection systems.
- Cybercriminals are punished by harsh laws.
- Validation and Acceptance
- Inform end users about cloud security.
- Disaster-Resistant Data Storage
- Implement thorough staff and user screening to prevent insider attacks.
- Networks and servers need visual examination.

Fig. 3: Cloud users and providers in institutions (Khalil et al., 2017).

The organizations in Fig. work to keep the cloud safe for all ages. three previous. Academic institutions are responsible for answering cloud-related questions. Universities, research institutes, and cloud service providers must collaborate more, especially in security.

8. CONCLUSION

Cloud computing has become a great teaching tool, but customers are mostly concerned about security, according to studies. Cloud security concerns compromise user data and impede education from using cloud computing. Research shows that cloud computing improves schools, students, and teachers. Online learning, cost savings, and communication improvement are examples. Many academic institutions have gone online thanks to cloud computing. However, cloud computing security problems may deter academic institutions from embracing it. This means cloud security must be improved to remove hazards. So, clients may completely profit from cloud

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computing. Additionally, it will increase students' digital economy productivity and competitiveness, improving their job prospects. For future classrooms to use cloud computing effectively, stakeholders must solve its security issues.

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