

Use of Cloud Computing Implementation with Education System and its Security Concern

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Abstract: Cloud computing is a type of technology that provides remote services on the internet to manage, access, and store data rather than storing it on Servers or local drives. This technology is known as Serverless technology. Here the data can be anything like Image, Audio, video, documents, file, etc.

Education plays an important role in maintaining the economic growth of a country, especially a growing country like India. Nowadays students are more advanced than before, learning and teaching is changing day by day. Information and communication Technologies are powerful enabling tools for educational change and reform introducing new methods of teaching and conducting research as well as provisioning of educational facilities for online learning, teaching and research collaboration. The smart classroom, labs are introduced with automation in maintenance and management of all academic activities. Cloud computing is opening new horizons for various sectors of business as well as education institutes which is likely to have a significant impact on the new teaching and learning environment.

Usually cloud computing services are delivered by a third party provider who owns the infrastructure. There are advantages to mention but a few include scalability, resilience, flexibility, efficiency and outsourcing non-core activities. Cloud computing offers an innovative business model for organizations to adopt IT services without upfront investment. Despite the potential gains achieved from cloud computing, the organizations are slow in accepting it due to security issues and challenges associated with it. Security is one of the major issues which hamper the growth of the cloud. The idea of handing over important data to another company is worrisome; such that the consumers need to be vigilant in understanding the risks of data breaches in this new environment. This paper introduces a detailed analysis of cloud computing in educational aspect and challenges focusing on the cloud computing types and the service delivery types.

Cloud computing has become another buzzword after Web 2.0. Cloud computing is not a completely new concept; it has an intricate connection to the grid computing paradigm, and other relevant technologies such as utility computing, cluster computing, and distributed systems in general. With the development of cloud computing, a set of security problems appears. Security issues present a strong barrier for users to adapt into cloud computing systems. Several surveys of potential cloud adopters indicate that security is the primary concern hindering its adoption. This paper introduces a detailed analysis of the cloud computing with education and challenges focusing on the cloud computing types, the service delivery types and the background and service model of cloud computing. Along with this, a few security issues and challenges are also considered as loop holes in it.

Aim: The aim of this research is to **improve physical and digital access to resources**. It makes it easier for students to access the same materials and learning resources, regardless of the devices or internet browsers they use and also to find some challenges, risks that institutes can face after implementation and how to handle it.

Research methodology : To study the impact of cloud computing security and challenges on educational usage, a multi-method research approach can be used, combining both qualitative and quantitative research methods . Quantitative methods can include surveys and statistical analysis of data collected from educators, administrators, and students to measure the extent to which cloud computing is being used in education and the impact of security issues on its usage. This can provide a numerical representation of the findings, which can be used to make generalizations about the larger population. Qualitative methods can include in-depth interviews , focus groups and case studies to gain a deeper understanding of the experiences and perspective of those using cloud computing in education. This can provide insight into the security challenges faced by educators and students, and how they perceive the impact of these challenges on their ability to use cloud computing effectively .

Both methods can be used to triangulate data and build a strong evidence base to support conclusions and recommendations . Additionally, a systematic review of existing literature on cloud computing security and challenges in the educational sector can be conducted to provide an overview of the current state of research in the field.

Findings: collected data from 55 respondents from which 22 respondents are IT professionals and rest of the 33 respondents are from educational institutes.

- 1) 93 percent of educational institutes are aware of cloud computing.
- 2) As per the educational institute's opinion, the cost to implement cloud computing lies mainly between Rs.30,000- 40,000 only.
- 3) It is seen that the percentage of PaaS & SaaS requires high implementation cost (Rs. 90000/-) as compared to IaaS.
- 4) 90 percent educational institutes agreed that cloud computing is cheaper than traditional ERP system and they are satisfied with cloud computing
- 5) Study reveals that cloud computing services are more reliable with average value 4.0 followed by accessibility with average value 3.90, security is high with average value 3.78. Further resources flexibility with average value is 3.69 and resource availability with average value is 3.68.
- 6) Most of the educational institutes used the Hybrid Deployment model as compared to other models.
- 7) As per IT and Educational sectors point of view, security of cloud computing is very high

According to them, cloud computing is the latest development that provides easy access to high performance computing resources and storage infrastructure through web services. Cloud computing delivers the potential for efficiency, cost savings and improved performance to governments, organizations, private and individual users. It also offers a unique opportunity to developing countries to get closer to developed countries. Developing countries like India can take the benefits of cloud computing by implementing it in its e-government projects. The paper addresses the issues that can arise during the deployment of cloud services. After identifying these problems some steps are explained to mitigate these challenges and solutions to solve the problems.

Keyword : Cloud computing, Network, Educational Sector, Implementation ,Security ,flexibility and scalability etc

Introduction : Cloud computing has become an increasingly popular option for organizations , including educational institutions , due to its cost savings , increased collaboration and accessibility , and improved disaster recovery .However , the usage of cloud computing also represents a number of security challenges , including the risk of the data breaches and unauthorized access ,compliance and regulatory issues , technical failures and outages , and multi-tenancy issues.

Given the critical importance of protecting sensitive information and maintaining the security of cloud based systems , it is essential to understand the extent to which these challenges are affecting the educational sector and how they

are being addressed . Research in this area can provide valuable insights into the impact of cloud computing security and challenges on educational usage and inform the development of effective strategies for ensuring the secure use of cloud computing in education .

1.2 Review of Literature

The concept of a massive computer network was first introduced by J. C. R. Licklider in 1969 who had an obligation to initiate training to improve the Advanced Research Projects Agency Network (ARPANET). The perspective was to unite all people on the Web with the aim that information could be reached always and anywhere. Chang et al. says that, as a needed accumulation of data, it is a key factor to securely store the information of the personal computer (PC). The client's main motive for storing data in the cloud is to save costs and have 24/7 information access. The cloud computing service allows users to securely store any type of data in the cloud and then access it from anywhere in the world with Internet access. The basic element of this service is the storage capacity. Also, organizations that provide information to their clients face various issues relevant to cloud security. The Cloud Security Alliance (CSA) is working on cloud security issues, and its members are concerned that their central issues be resolved. The central issues that have dominated the field for many years are privacy, respectability and accessibility.

Daniel D. Sunil (2022): According to him, the cloud can be insecure due to some issues like attacks from unauthorized users. The attack can be of two type's viz. targeting the whole cloud or targeting a single service. In both cases, the security issues need to be handled. This can be done with the help of Access Control List (ACL). ACL (Access Control List). It contains a set of access rules, which can be assigned to the authorized user. The ACL works along with the Security manager in order to avoid unauthorized access to the Cloud.

F A. Alvi, B.S Choudary, N. Jaferry : This section includes a survey conducted by international data corporation (IDC). It shows the strength of cloud computing to be implemented in the IT industry and gives the potential inspiration to CSP. The section contains the survey related to the growth of clouds.

Cloud Growth Year	2022	2023	Growth
Cloud IT data center Spending	\$3537 million	\$3477 million	-1.4
Total IT spending	\$110.3 billion	\$109 billion	2.6%

According to them, cloud computing is the latest development that provides easy access to high performance computing resources and storage infrastructure through web services. Cloud computing delivers the potential for efficiency, cost savings and improved performance to governments, organizations, private and individual users. It also offers a unique opportunity to developing countries to get closer to developed countries. Developing countries like India and others too can take the benefits of cloud computing by implementing it in its e-government projects. The paper addresses the issues that can arise during the deployment of cloud services. After identifying these problems some steps are explained to mitigate these challenges and solutions to solve the problems.

1.2.1 Virtualization

The capacity to create a virtual and shared resource between different apps in order to optimize server utilization is a benefit of cloud technology. In non-cloud computing, there appear to be three distinct platforms for three distinct programs that run on their own servers. The number of servers required for applications and operating systems can be decreased by sharing or using virtual machines on the internet (in specific- two servers). Virtual Machine (VM) technologies like VMware and Xen, as well as virtual networks like VPN, are illustrations of virtual machines. Virtual machines allow people to enter cloud services through a customized distributed system, whereas virtual networks offer on-demand virtualized IT infrastructure.

Cloud delivery models:

- 1) **Infrastructure as a service (IaaS):** IaaS is a cloud delivery model in which the cloud provider offers virtualized computing resources such as servers, storage and networking. This model allows users to build and manage their own applications and services, giving them greater control and flexibility.
- 2) **Platform as a service (PaaS):** PaaS is a cloud delivery model in which the cloud provider offers a platform for developing, testing and deploying applications. This model provides users with a pre-configured environment for building and deploying applications, without the need for managing underlying infrastructure.
- 3) **Software as a Service (SaaS):** SaaS is a cloud delivery model in which the cloud provider offers software applications that are hosted and maintained by the provider. This model allows users to access software applications over the internet, without the need for installing or maintaining software on their own devices.

Each cloud delivery model has its own advantages and disadvantages, and choosing the right model depends on the specific needs and requirements of the user. For example, IaaS is suitable for organizations that require greater control and flexibility over their computing resources, while SaaS is more suitable for organizations that need access to software applications without the burden of maintenance and support.

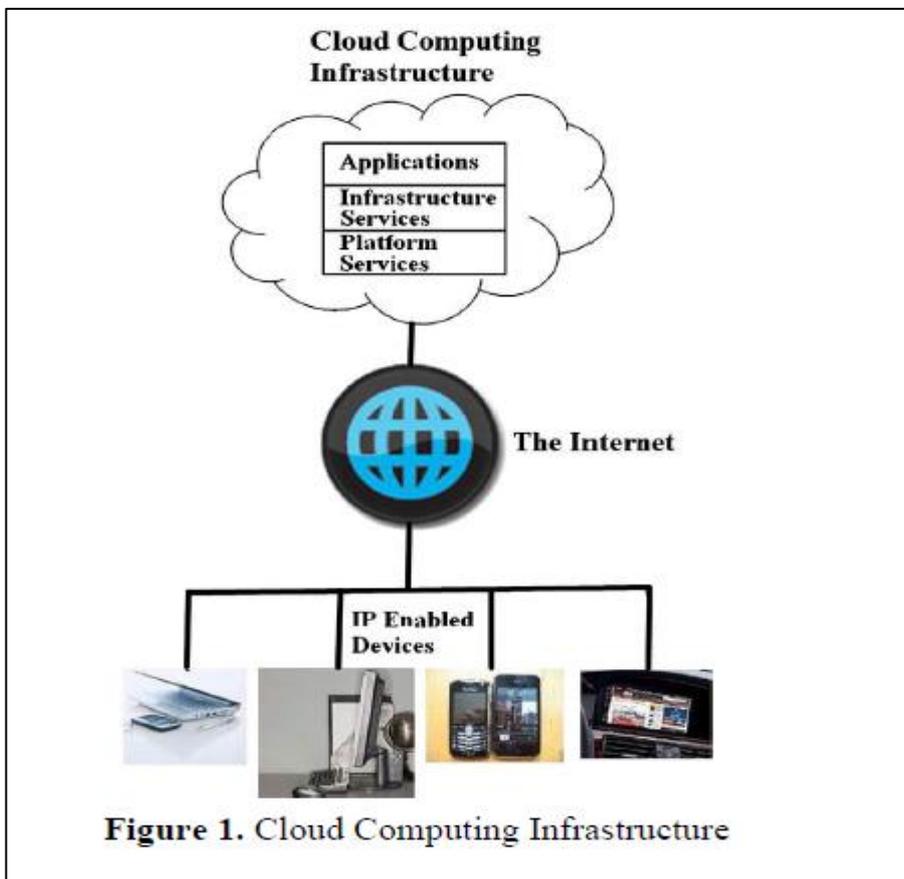


Figure 1. Cloud Computing Infrastructure

1.3 Statement of the problem

Cloud computing in the education system has gained popularity due to its cost-effective and flexible solution to IT infrastructure needs. However, security concerns such as data breaches, unauthorized access, and data loss are major challenges faced by educational institutions when using cloud services. These security risks stem from the shared responsibility model, complex network infrastructure, and limited control over cloud infrastructure by educational institutions. Addressing these challenges is crucial to ensuring the privacy and confidentiality of student information, research data and other sensitive information stored in the cloud.

1.4 Social relevance:

The use of cloud computing in education is not only relevant to the IT infrastructure and operations of educational institutions, but it also has significant social implications. The security of student and research data is of utmost importance, as it can affect individuals' privacy, educational opportunities, and future career prospects. A data breach or unauthorized access to sensitive information can result in identity theft, financial loss and loss of trust in the educational institution.

Moreover, the security of cloud computing in education has broader societal implications as well. The storage and processing of vast amounts of data in the cloud has the potential to support and advance research in various fields, such as medicine, science, and engineering. However, if the data is not properly secured, it can be misused for unethical purposes, such as creating biased algorithms or selling personal information. In conclusion, addressing cloud computing security challenges in education is not only critical for the smooth operation of educational institutions, but it also has significant social implications for students, researchers, and society as a whole.

1.5 Objectives of the Study

The Principal Objective of this study is:

Objectives are carried by this study are given below:

- To study students and teachers activities and their performance in schools.
- To study the current status of learning and teaching in education upto Secondary and Senior Secondary level.
- To highlight impacts and role of cloud computing in education.
- To measure the level of education with or without adopting cloud technology.
- To analyze the effectiveness of cloud computing in regard to technology.

1.6 Hypothesis of the study

A hypothesis is a prediction that shows the relationship between two variables. It is a testable prediction about what a researcher expects to happen in the research. There are different ways to obtain the results of research to gain evidence to support a hypothesis. Many researchers draw the hypothesis from a specific theory; some draw it from previous research. For example, consider the relationship between stress and the immune system. One hypothesis could be that stress can have a negative impact on the immune system. If a person is stressed, that person's immune system can be affected. This demonstrates a causal relationship, where one thing can be seen to cause another. Similarly, some hypotheses state that what is relevant to cloud computing security also affects the security system.

1) To study about the awareness of cloud computing in the Educational Sector.

Table 1 : Awareness of cloud computing in the educational sector .

Awareness	No. of Respondents (In Percent)
Yes	31(93.9)
No	2 (6.10)
Total	33 (100)

2) To study the implementation cost of cloud computing and their various service models.

Table No: 2: Cost incurred for implementing cloud computing

Implementation Cost (In Thousands)	No. of Respondents (In Percent)
Not implemented	8 (24.2)
Below 30	6 (18.2)
30-40	9 (27.3)
40-50	3 (9.1)
50-60	4 (12.1)
60 and more	3 (9.1)
Total	33 (100.0)
Mean	1.94
Standard Deviation	1.619

Table 3

Model	IaaS	PaaS	SaaS
Cost in Thousand	Number of Respondents (In Percent)	Number of Respondents (In Percent)	Number of Respondents (In Percent)
Not implemented	14(63.6)	16 (72.7)	17(77.3)
below 30	3(13.6)	1 (4.5)	0 (0)
30-60	5 (22.7)	1(4.5)	1(4.5)
60-90	0 (0)	1 (4.5)	0(0)
90 above	0(0)	3 (13.6)	4(18.20)
Total	22 (100)	22 (100)	22 (100)

Value present in brackets indicates percentage.

3) To do the comparisons of cloud computing vs. Traditional ERP(Enterprise resources planning) and measure the effectiveness of cloud computing in the educational sector.

Table 4

Cloud computing cheaper than ERP	No. of Respondent (In Percent)
Yes	30 (90.90)
No	3 (9.10)
Total	33 (100)

Figures in bracket indicates Percentages

From above Table no. 4, it is clear that 90 percent of educational institutes agreed that cloud computing is cheaper than traditional ERP system and they are satisfied with cloud computing. For measuring the effectiveness of cloud computing various factors are used along with a five point scale and their average value has been calculated.

Following Table No.5 shows the effectiveness of cloud computing.

Effectiveness Factors	Very Dissatisfactory	Dissatisfactory	Average	Satisfactory	Highly Satisfactory	Average
Resource Availability	3 (9.10)	1 (3.00)	6 (18.20)	17 (51.50)	6 (18.18)	3.66
Security	1 (3.00)	2 (6.10)	12(36.4)	6 (18.20)	12 (36.36)	3.78
Accessibility	1 (3.00)	2 (6.10)	6 (18.20)	14 (42.20)	10 (30.30)	3.90
Reliability	1 (3.00)	2 (6.10)	5 (15.20)	13 (39.40)	12 (36.36)	4.00
Resource Flexibility	2 (6.10)	2 (6.10)	10(30.4)	9 (27.30)	10 (30.30)	3.69

Figures in brackets indicate Percentages From Table No.5, it clears that effectiveness of cloud computing services is very high because average value of each factor is more than 3.5. Study reveals that cloud computing services are more reliable with average value 4.0 followed by accessibility with average value 3.90, security is high with average value 3.78. Further resources flexibility with average value is 3.69 and resource availability with average value is 3.68.

Table No.6 Effectiveness of cloud computing in educational sector with respect to S.D

Effectiveness Factors	Resource Availability for cloud computing	security for cloud computing	Accessibility for cloud computing	Reliability for cloud computing	Resource Flexibility for cloud computing
Mean	3.36	3.48	3.61	3.70	3.39
Std. Deviation	1.365	1.395	1.345	1.380	1.413

calculated mean and standard deviation of all factors and which are satisfactory.

As per Table No.6, it clears that effectiveness of cloud computing is very high and which satisfies educational institutes.

4) To study the role of cloud computing model selection with respect to the educational sector.

Table No.7: Deployment models in educational sector

Deployment Models	Number of Respondents
None	19 (57.6)
Private	4 (12.10)
Public	2 (6.10)
Hybrid	6 (18.20)
Community	2 (6.10)
Total	33 (100.0)

It reveals that most of the educational institutes used the Hybrid Deployment model as compared to other models .

5) To measure the security of cloud computing with respect to the IT sector and Educational Institutes.

Table 8 : Security of cloud computing

Security	IT Sector	Education Institutes
Yes	18 (81.80)	18 (55.54)
No	4 (18.20)	15 (45.51)
Total	22(100)	33(100)

Figures in bracket indicates Percentages

1.7 Research and design

Two methods were used to collect the data from the respondents. The first questionnaire, made by using SurveyMonkey, consists of ten questions. After creating the questionnaire, we distributed it to university students .

This questionnaire is for students who have. Some of these are also part of organizations who do use cloud computing storage in their businesses. Data were gathered from multiple sources at various points in time. Over 100 people answered the questionnaire and sent their replies. The total number of respondents is ,107 of which 101 attempted to answer all the questions. This means that the 90% response rate makes this a valid sample size. This research is based on cloud computing security and data storage issues so that many of the questions are relevant to security. The questionnaire is the main part of the research, and it is very important to find the respondents’ points of view about people or consumers who stop using the cloud computing facility. A total of 93% of the respondents said that security concerns stop people from using cloud computing.

Secondary Data collection : The secondary data was collected from various publications and data available from open sources on the internet.

1.8 Testing of Hypotheses

Various statistical tools used to test the hypotheses. If the replies of a majority of the respondents support a hypothesis then that hypothesis will be considered as confirmed. Otherwise it will be considered as rejected. The data connected with the hypothesis and obtained from respondents has been used for this purpose

Hypothesis 1: The first hypothesis of the study is “Cloud computing services are cheaper than the existing ERP system.” For testing this hypothesis, null and alternative hypothesis are set and which are as follows

H0: There is no difference between the cost of Cloud computing services and ERP systems.

H1: Cloud computing services are cheaper than the existing ERP system.

As the sample sizes are <30 therefore normal approximations are satisfied. In this case Z-test and as one proportion is involved. As alternative hypothesis is in terms “than” hence rejection area is towards only one side hence it is one tail test (t-test).

Table 9 :

One-Sample Test				
T	df	Sig. (2-tailed)	95% Confidence Interval of the Difference	
			Lower	Upper
12.990	21 .000	0.00	1.15	1.58

P value is **0.00** is < 0.05 hence reject H0 (Null hypothesis) and accept H1 that is the hypothesis of the study. Hence it proves that “Cloud computing services are cheaper than the existing ERP system”

Hypothesis 2: Use of Cloud computing increases the resource flexibility level in the educational sector. According to data collected from 33 people, 17 people agree that cloud computing increases resource flexibility. For testing this hypothesis, null and alternative hypothesis are set and which are as follows

H0: Cloud computing doesn't affect the resource flexibility level in the educational sector.

H1: Use of Cloud computing increases the resource flexibility level in the educational sector.

Table No. 10: ANOVA for Resource Flexibility for cloud computing

Groups	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	24.524	1	24.524	19.318	.000
Within Groups	39.355	31	1.270		

As per above table, P value is 0.000 which is less than $\alpha=0.05$, the level of significance. Therefore, it is enough evidence to reject the Null hypothesis and accept H1 that is the hypothesis of the study. Hence it proves that "Use of Cloud computing increases the resource flexibility level in educational sector"

Hypothesis 3: Cloud Computing services are more secure. Null and alternative hypothesis are

H0: Cloud Computing services are not secure.

H1: Cloud Computing services are more secure.

For testing this hypothesis, one sample t test has been applied. T- Statistics for the same have been shown in the following table.

Table No. 11: One Sample Test Statistics

T	Do	Sig. (2-tailed)	95% Confidence Interval of the Difference	
			Lower	Upper
17.140	50	.0000	1.16	1.47

P value is 0.000 which is less than $\alpha=0.05$, the level of significance. Therefore, it is enough evidence to reject the Null hypothesis and accept the alternative hypothesis that, “Cloud Computing services are more secure.”

Hypothesis 4: Cloud Computing is applicable in all IT and educational sectors. As per primary data, 93.9% respondents agreed that cloud computing is applicable in the IT and educational sector.

H0: Cloud computing is not applicable in the educational sector.

H1: Cloud Computing is applicable in all IT and educational sectors.

Table No. 12: One Sample Test Statistics

T	df	Sig. (2-tailed)	95% Confidence Interval of the Difference	
			Upper	Lower
19.072	54	0.000	1.32	1.63

As per above table, P value is 0.000 which is less than $\alpha=0.05$, the level of significance. Therefore, there is enough evidence to reject the Null hypothesis and accept the alternative hypothesis that, “Cloud Computing is applicable in all IT and educational sectors”.

As per IT and Educational sectors point of view, security of cloud computing is very high.

Conclusion

In today's fast moving life people want all the facilities at their maximum convenience which is provided by cloud computing over the internet, this is one of the reasons for the growing popularity of cloud computing. Still a large proportion of people today refrain themselves from using these facilities due to the security reasons or reliability with cloud computing. This means that the IT professionals usually go for just internet services or intranet within the organization without implementing the cloud computing which results in increased cost.

The awareness of cloud computing in the educational sector is very high as compared to the unawareness.

Effectiveness of cloud computing services is very high .

Educational sector can decrease the paper work by implementing the cloud computing services. The cost incurred for the software licensing can be reduced by sharing software with the help of SaaS.

Suggestions

- 1) The use of cloud computing should be promoted by organizations. Service charges for cloud computing should be minimized.
- 2) All the different cloud computing models should be available at low implementation cost.
- 3) Cloud computing should be promoted for personal use.
- 4) The technology should be made simpler, user- friendly and easily accessible.
- 5) Cloud computing should not only be available to faculties or management in institutions but also should be available to students.
- 6) Efforts should be made to decrease the technical problems and security issues regarding cloud computing. Different security measures should be applied in order to provide security for data and services provided by cloud computing.

Limitation of study

While cloud computing has many potentials and benefits for the educational sector , there are also several limitations to its use . here are some of the limitations of cloud computing in education :

- 1 . Reliance on internet connectivity: Cloud computing requires a reliable internet connection , which may not be available in all areas . This can limit access to cloud based resources , especially for students in rural or remote areas
2. Security and privacy concerns : Cloud computing requires storing data on third -party servers , which raises concerns about the security and privacy of sensitive data such as student records , grades , and personal information . institutions must carefully select cloud survival providers that meet their security and privacy standards .
- 3 . Costs and budgeting : While cloud computing can potentially save costs on hardware and software , it can also be costly to maintain and upgrade cloud infrastructure , especially for small institutions with limited budgets .
4. Technical expertise : Cloud computing requires technical expertise to set up , maintain , and troubleshoot cloud -based resources . Institutions may need to invest in training staff or hiring outside consultants to manage cloud resources .

5. Limited customization : cloud computing resources may not be customizable to meet the specific needs of an institution or program , limiting their usefulness in certain educational contexts .

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