A CRITICAL ANALYSIS OF TEACHERS' PERCEIVED IMPACTS OF CLOUD COMPUTING ON TEACHING PROCESS IN PUBLIC SECONDARY SCHOOLS IN UYO LOCAL GOVERNMENT AREA, AKWA IBOM STATE

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ABSTRACT

The study was to examine teachers' perceived impacts of cloud computing on teaching process in public secondary schools in Uyo Local Government Area, Akwa Ibom State. The study adopted an Expost facto research design. The study was conducted in Uyo Local Government Area, Akwa Ibom State. The population of the study consisted of teachers in the public secondary schools in Akwa Ibom State. The study selected the 14 public secondary schools. Sample size of 206 was obtained using multi-stage random sampling technique consisting of proportionate and simple random sampling techniques. The instrument used by the researcher for the study was a questionnaire tagged "Cloud Computing in Teachers Pedagogy Questionnaire (CCTPQ)." Face and content validation of the research instrument was carried out by an expert in tests and measurement. From the analysis, the reliability coefficient of 0.90 was obtained, and the value was considered substantially high enough to justify the use of the instrument. The data obtained was analysed using mean score and standard deviation for answering the research question, while t-test was used in testing the hypotheses, respectively. The calculated values were compared with the critical values for the test of significance of the result at 0.05 alpha level. The study concluded that awareness of how using cloud computing in the classroom can improve teachers' ability to impart curriculum instructions, support research, encourage collaborative learning, and reduce burden and stress at the workplace. In the long run, when cloud computing resources are effectively used, they facilitate the delivery of high-quality information and raise students' academic attainment. This is achievable because the system tends to keep students' attention, increase commitment, maintain interest, encourage active involvement in every class activity, promote punctuality in class, and increase the degree of efficiency of students in Akwa Ibom state. The impact of cloud computing was viewed favorably by the teachers. One of the recommendations made was that in order to support teachers' frequent use of cloud computing tools for instruction, educational administrators should create supportive environments within the school setting. In a similar vein, specialised training should be organised to increase teachers' pedagogic knowledge of cloud computing and ICT tools for instructional purposes.

KEYWORDS: Teachers' Perceived Impacts, Cloud Computing, Teaching Process, Public Secondary Schools, Uyo Local Government Area and Akwa Ibom State

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Introduction

Nigeria must properly manage its educational system in order to advance the principles of education in the development of human ability. This is so because, in the 21st century, education serves as a platform for the welfare and general advancement of society. The moral, cultural, and economic viability of a nation may be greatly impacted by the quality of education provided at all levels. In other words, education is a necessary tool that not only helps the country achieve its social, political, moral, cultural, and economic aspirations but also eventually instils in each person the knowledge, skills, dexterity, character, and desirable values that will promote national development and self-actualization. However, the importance of education motivated Nigeria's quest for the establishment of educational institutions (schools), the formation of curricula, and the establishment of stringent policies to guide the sector. The extent of utilisation of cloud systems in Nigeria has been increasing on a daily basis. According to studies, more than 92 percent of teachers and students in Nigerian universities use cloud systems for education (Mathew, 2015). This outnumbered the report in 2007 that showed that 73 percent of females and 65 percent of males reported having used cloud systems in searching for information. However, while the majority (71%) of the respondents reported having used the cloud platforms for entertainment and strengthening friendships, relatively few accepted utilising the platforms for teaching and learning purposes. This active utilisation of cloud services has grown in importance as a result of a new genre of students with learning needs vastly different from their predecessors. Nevertheless, whether the current situation in public secondary schools in Akwa Ibom state has welcomed the development brought to the educational sector is a source of contemplation in this study.

Nevertheless, the extent of utilisation of any instructional facility is related to the perceived potential of the facility in advancing the interest and satisfaction of the users as well as making the search for desired information ideal for his/her interest. The utilisation of cloud computing in teaching and learning has been proclaimed by scholars to enhance the teaching and learning (T&L) process more than the traditional technique because of its interactiveness for educators to collaborate with students. For instance, scholars inferred that the adoption of cloud computing has a significant impact on cost effectiveness where it can reduce development team cost, technical support team cost, burden of daily backup management, and overall project cost (Ahmed, 2015; Akin, Mathew, and Comfort, 2014). It also improves availability, reduces complexities, and increases mobility, scalability, operability, and reduces investment in physical assert (Akin et al., 2014). Nevertheless, the potential of cloud computing will be realised when teachers really understand its existence, applicability, and usability. Studies available here show that there are advantages to the adoption of cloud computing in teaching and learning (Alsha-Maila, Papagiannidis, and Orban, 2008; Dillon, Wu, and Chang, 2010; Iji, Abah, and Anyo, 2017), but the level of adoption by different people varies in scale. However, from the literature reviewed, nothing was done to ascertain the teachers'

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perception and utilisation of cloud systems for enhancing teachers' pedagogy in public secondary schools. Hence, this forms the basis for this study.

Statement of Problem

It is impossible to overstate the value of computer technology. According to several research findings, technology streamlines learning for both students and teachers (Al Habri and Sonawane, 2016). These benefits of technology may encourage and inspire efficiency in both instructors and students, which will enhance the quality of instruction and learning outcomes. Despite the widely acknowledged efficiency and power of cloud computing technology, issues with instruction transmission continue to be one of the key roadblocks to the progress of education in Nigeria in general. Understanding the perceived influence of these technologies on improving teaching and learning may not be unrelated to this problem. This is frequently seen in educators who are wholly reliant on conventional methods of instruction. Additionally, it is a depressing sight to see that instructors still struggle to have access to educational materials in 21st-century schools, and even worse, they are unable to experience a productive classroom atmosphere with collaborative teaching and learning (T&L) practices. Thus, a request for this study was made in order to determine the perspectives of the instructors on the key aspects of the perceived impacts of cloud computing in improving teachers' pedagogy. Hence, this study aimed at investigating the extent of teachers' perceived impacts of cloud computing on teaching process in public secondary schools in Uyo local government area, Akwa Ibom State

Objective of the study

Investigate the extent of teachers' perceived impact of cloud computing on teaching process in public secondary schools.

Research Question

What is the extent of teachers' perceived impacts of cloud computing on teaching process in public secondary schools?

Research Hypothesis

The extent of teachers' perceived impacts of cloud computing on teaching process in public secondary school is not significant.

Theoretical Review

Theory of Discovery Learning by Bruner 1996

This theory, as propounded by Bruner (1996), stipulates that learning is a highly complex activity that involves three major processes: namely, acquisition of information; manipulation or transformation of this information into a form suitable for dealing with

the task at hand; and checking the adequacy of this information. This implies that students learn after adequate manipulation of learning resources, which they can effectively transform into usable information. Supporting this assertion, Igwe, Arop, and Ibe (2013) suggested that students should be given the opportunity to discover and invent things. This allows teachers to extend their lessons to a wider range of students and increase participation through an individualised process. Through this device, students are able to make personal connections to their own interests and are encouraged to express their own opinions (Berk, 2009). Hence, the teacher should allow the students to acquire skills that will allow them to learn on their own. Thus, this can be done through the use of cloud computing.

However, supporting the background of the theory, Ausubel (1963) proposed that learning is only meaningful to the extent to which the learner can integrate existing learning or knowledge with new ones. This theory emphasises how prior knowledge affects the learning task. To make learning more meaningful, lively, understandable, and real, appropriate instructional methods must be applied (Ilarbor&Chukurdi, 2008). This could encompass the incorporation of cloud computing into learning. Mboto, Ndem, and Stephen (2011) added that use of ICT materials enhanced teaching and learning of sciences and improved performance. The implication of this theory for the study stems from the fact that inclusion and the utilisation of cloud computing facilities in the teaching and learning of economics can create a resourceful and manipulative environment for students, and in turn, improve their academic performances.

Conceptual Review

Concept of Cloud Computing

Forrester (2011) defines cloud computing as: "A pool of abstracted, highly scalable, and managed computer infrastructure capable of hosting end-customer applications and billed by consumption." However, a common definition is given in a NIST report; "cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Mell, 2009). Singh and Hemalatha (2012) define it as "a collection of hardware, software, and other resources that can be accessed over the internet and used to assemble a solution on demand (that is, at the time of the request) to provide a set of services back to the requester. It could also be defined as "a model for enabling convenient, on-demand network access to share a pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Mell and Grance, 2009). Cloud computing is perceived as an emerging technology and a new paradigm for conducting business (Leimeister, Leimeister, Knebel, and Kremar, 2009; Lyer and Henderson, 2010). The importance of computer technology cannot be overemphasized. According to several studies, cloud computing helps students and teachers by

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streamlining teaching and learning, facilitating effective instruction transfer, and improving collaborative learning. Further, browser-based applications are also accessible on a variety of computing devices, including mobile platforms, making these tools available anywhere on the internet and accessible (Mohammed Al-Zoube, 2009).

The NIST has five essential characteristics of cloud computing, which are:

- *On-demand self-service*: A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed without requiring human interaction with each service provider.

- *Broad network access*: Capabilities are available over the network and accessed through standard mechanisms that promote their use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations).

- *Resource pooling*: The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and resigned according to consumer demand. Examples of resources include storage, processing, memory, and network bandwidth.

- *Rapid elasticity*: capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand.

- *Measured service*: cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts).

Benefits of Cloud Technology

The benefits are increased mobility and ease of use. This means that users will be able to access information from anywhere at any time without wasting hardware resources. Due to its benefits, today's computing technology has witnessed a vast migration of organisations from their traditional IT infrastructure to the cloud. Some of the noteworthy benefits are:

1. Cost savings   2. Remote working   3. Efficiency   4. Flexibility

5. Future proofing   6. The morale boost   7. Resilience without redundancy

Some of the typical benefits are listed below.

1. *Cost savings*: There are several reasons to associate cloud technology with cost savings. The billing model is pay as per usage; the infrastructure is not purchased,

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thus lowering maintenance. Initial expenses and recurring expenses are much lower than in traditional computing.

2. *Increased storage*: with the massive infrastructure that is offered by cloud providers today, storage and maintenance of large volumes of data is a reality. Sudden workload spikes are also managed effectively and efficiently, since the cloud can scale dynamically.

3. *Flexibility*: this is an extremely important characteristic. With enterprises having to adapt even more rapidly to changing business conditions, speed of delivery is critical. Cloud computing stresses on getting applications to market very quickly by using the most appropriate building blocks necessary for deployment. Computer technology has become an essential tool for educators to ensure that the teaching and learning (T&L) process becomes more interesting and effective. The use of cloud computing will enhance the T&L process, which is different to traditional techniques. Cloud computing is the interactive way for educators to collaborate with students in the T&L process. Nowadays, social media platforms appear to be logistically useful tools for a variety of campus needs, from student group learning to faculty department work to staff collaborations.

Using computer technology in the classroom will allow educators to explore new and exciting methods of instruction and learning beyond lecturing. There are a lot of useful and interactive websites that can enhance classroom lessons. A study conducted by Ahmed (2015) showed a comprehensive comparison between a learning system before and after moving onto the cloud to see the contribution of e-learning standards with the cloud standard. The result supports the moving of e learning on to a cloud computing environment where cloud computing is used as an e learning solution to the delivery of computing as a service rather than a product.

The impact of cloud computing is that the adoption of cloud computing has a significant impact on cost effectiveness where it can reduce development team costs, technical support team costs, the burden of daily backup management and the cost of overall project expenditure (Ahmed, 2015; and Akin, 2014). Furthermore, the adoption of cloud computing reveals that it will enhance availability, lower environmental impacts, reduce IT complexities, increase mobility, scalability, increase operability, and reduce investment in physical assets (Akin 2014). Nor, Hussin, and Selamat (2014) analysed three different perspectives of scheduling algorithms for energy efficiency, which are heuristic, game theory, and learning process strategy. As a result, they discovered that the heuristic strategy is a popular method for scheduling tasks while managing energy consumption. Through similarities, differences, and energy models, an energy management structure for cloud computing is identified in order to develop the most energy efficient schedule. They believe that the solution to green cloud computing is found in energy consumption and system performance.

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Cloud computing attracts users with its great elasticity and scalability of resources, with the attractive tag line "pay-as-you-use" at relatively low prices. Customers can significantly reduce costs by migrating computation, storage, and hosting to the cloud. Although this provides savings in terms of finance and manpower, it also brings lots of new challenges and risks. Considering the influence of cloud computing with respect to its business benefits and technological transformations, the future of enterprise applications is going to be completely dependent on it. It has its own benefits, but nevertheless, it has numerous issues and challenges.

1. Data integrity
2. Data theft
3. Privacy issue
4. Infected application
5. Data loss
6. Data location
7. Security on the vendor level
8. Security on a user level.

Despite its growth, concerns regarding cloud computing still remain. In our opinion, the benefits outweigh the drawbacks, and the model is worth exploring. Some common challenges are:

- *Data protection*: Data security is a critical issue that requires security. Businesses are hesitant to purchase a vendor's guarantee of commercial data security. They worry about losing information to rival businesses and about customer privacy. The fact that the real storage location is frequently concealed adds to businesses' security worries. In the current model, firewalls between data centres (owned by businesses) safeguard this sensitive data. In the cloud model, service providers are in charge of data maintenance, and businesses would have to rely on them.

- *Data recovery and availability*: It was thought that it would be difficult to find cloud services, and "cloud-provider outages" may be the cause of inaccessible cloud services. It is stated by Kim, Kim, and Lee (2009) that outages experienced by cloud service providers may be either brief or lengthy. Cloud service outages that last only a few minutes are known as "brief outages." A cloud provider's failure to operate, however, results in a long-lasting outage. The business activities of clients may suffer from provider downtime.

- *Management capabilities*: Despite the fact that there are many cloud service providers, platform and infrastructure management are still in their infancy. For many businesses, essential features like "auto-scaling" are a must. The current scalability and load balancing capabilities have a lot of room for improvement.

- *Regulatory and compliance restrictions*: One of the key barriers to cloud computing adoption is industry regulation and compliance (Carroll, Merwe, & Kotze, 2011). Some countries prohibit companies from storing data in data centres that are located outside of the country. Additionally, Kim et al. (2009) argue that some laws and regulations in some countries were drafted without considering cloud computing. For

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instance, in some European countries, government regulations do not allow customers' personal information and other sensitive information to be physically located outside the state or country. In order to meet such requirements, cloud providers need to set up a data centre or a storage site exclusively within the country in order to comply with regulations. Having such an infrastructure may not always be feasible and is a challenge for cloud providers.

Summarily, Carroll, Merwe, and Kotze (2011) conducted a study to assess the challenges of cloud computing in SMEs. Qualitative approach was used in the study. The interview findings revealed that SMEs have several challenges with cloud computing, such as bandwidth cost, quality and data security, and information security. Bandwidth quality is very important as cloud-computing services are accessed over the internet. Cloud computing services require quality and reliable internet connectivity. The issue of data security on the cloud is a huge concern and this can be a barrier for cloud computing adoption unless the cloud computing assures SMEs that their data will be safe and secure. Therefore, interview findings are in concurrence with expert review findings whereby it was revealed that bandwidth cost and security are one of the key challenges of cloud computing; "the cost and availability of bandwidth is a major challenge for cloud computing adoption within South African SMEs." Another challenge is the availability of local cloud providers. Currently, there are more international cloud providers compared to local suppliers. According to a study conducted by IDC (2011), most South Africans perceive value in cloud computing; however, issues of bandwidth quality and cost are two of the key barriers for adoption. Reed (2016), like IDC (2011), argues that the cost of bandwidth in South Africa is one of the barriers that contributes to the slow adoption of cloud computing. Cloud computing is heavily dependent on the quality of bandwidth, as the majority of cloud computing services are accessed over the internet. Therefore, they require high internet connectivity speed and reliability. Lastly, participants were concerned that currently there is no enough cloud providers in South Africa. Therefore, this can inhibit the cloud adoption rate, as SMEs are not aware of cloud providers in South Africa, such as Advance Force, Vodacom, Microsoft SA, Exordia, and Internet Solutions, amongst others.

Perceived Impact Cloud Technology on Teaching Process based on Gender

Aminu and Samah (2019) examine the perception of teachers' training on use of technology and integrating technology in instructional delivery. A questionnaire was developed and administered to 40 selected people and analysed using statistical package for social sciences (SPSS). The research findings revealed that teachers' perceptions of training on the use of technology were found to improve their teaching practice in classrooms. As a result, the government should provide on-the-job training, seminars, and workshops that keep up with technological advances. The government

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and stakeholders in education should provide technological equipment that will enhance teachers' use of instructional materials in their teaching and learning processes.

Infinedo, Rikala & Hamalainen (2019) examined teacher educators' (TEs') conceptions of technology integration. Specifically, the main objective of the study was to investigate the factors influencing Nigerian teacher educators' technology integration using a self-completion survey administered to Nigerian teacher educators from three schools in the southern region of Nigeria. We utilised the partial least squares structural equation modelling (PLS-SEM) approach for the data analysis. The scale's development was guided by two frameworks: TPACK and the Second Information Technology in Education Study (SITES). The results indicated that three constructs (perceived technological knowledge, teachers' knowledge [excluding technology] and perceived knowledge for integrating technology) directly influenced the TEs' technology integration, while two others (information and communication technology pedagogical practises and perceived effects on students) did not. Among the teachers' characteristics, teaching experience and class size were found to be statistically associated with their technology integration. The results of this study are beneficial for developing professional training to help teachers integrate technology, specifically by developing their ICT pedagogical practices. Through such training, teachers could be educated on how to align their perceived effect of teaching with technology.

Methodology

The study was conducted in Uyo Local Government Area of Akwa Ibom State. Expost facto design was adopted for the study, with the population comprising of teachers in the 14 public secondary schools in Akwa Ibom State. A sample size of 206 was obtained using multi-stage random sampling technique consisting of proportionate and simple random sampling techniques. The instrument used in this study for data collection was a questionnaire titled "Cloud Computing in Teachers Pedagogy Questionnaire" (CCTPQ). Face and content validation of the instrument was carried out by an expert in test measurement and evaluation from University of Uyo to ensure that the instrument has the accuracy, appropriateness, and completeness for the study. Cronbach Alpha technique was used to determine the level of reliability of the instrument. The reliability coefficient obtained was 0.90, and this was high enough to justify the use of the instrument. The researcher subjected the data generated for this study to mean score and standard deviation for answering the research question while t-test was used in testing the hypothesis. The test for significance was done at 0.05 alpha levels.

Results

Research Question: What is the extent of the teachers' perceived impacts of cloud computing on teaching processing in public secondary schools?

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Table 1: Mean Score of Analysis of the extent of the teachers' perceived impacts of cloud computing on teaching process in public secondary schools

Items description *The extent teachers perceived impact of cloud system in making the teaching.........*	Mean scores	Remarks
Highly interactive	1.20	VLE
Highly illustrative	1.10	VLE
Easy comprehensible	1.80	LE
Provide easy access to learning materials	3.37	HE
Highly time	3.51	HE
Interesting for improved learning	2.51	HE
Sustainable in the mind of the students	2.01	LE
Easily implanted in the memory of students	2.10	LE
Very lively	2.11	LE
Workloads lessen	3.43	HE
Total	**2.35**	**LE**

Table 1 shows that the mean score of the extent of teachers' perceived impacts of cloud computing on teaching process in public secondary schools in Uyo local government area was 2.2.5. This implies that the extents of teachers' perceived impacts of cloud computing on teaching process in public secondary schools was low.

Hypothesis Testing

Research Hypothesis: The extent of teachers' perceived impacts of cloud computing on teaching process in public secondary schools is not significant.

Table 2: Simple linear regression analysis for the extent of teachers' perceived impact of cloud computing on teaching process in public secondary schools in Uyo local government area (N=200).

Source of Variation	sum of square	df	mean square	F-cal	Sig of F	Decision @P<.05
Regression	49.107	1	41.117	1.901	.301a	*
Residual	44.611	199	21.612			
Total	93.718	200				

Table 2 revealed the calculated F-value as 1.901. The result also shows that the significance of F which is the probability value (p-value) is .301. Since the probability value is less than .05, the alpha level, p<.05, the result is statistically significant and the null hypotheses is rejected. Thus, the extent of teachers' perceived impact of cloud computing on the teaching process in public secondary schools in Uyo Local Government

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Area is significant. The implication is that the extent of teachers' perceived the impact of cloud computing on teaching process is that it can contributes significantly in the enhancement of teaching process in public secondary schools in Uyo LGA.

Discussion of the Findings

Answer to research question 1 indicated that the extent of teachers' perceived impacts of cloud computing on teaching process in public secondary schools was low. The corresponding hypothesis 1 tested revealed that the extent of teachers' perceived impact of cloud computing on the teaching process in public secondary schools in Uyo Local Government Area is significant. However, there was no significant difference in perceived impact of cloud computing on teaching process in public secondary schools in Uyo Local Government Area. This might not be unconnected with the fact that, basically, they are not utilising the cloud computing platforms in active teaching process; as such, the teachers' consideration of the impact of the cloud is similar. The findings of this study aligned with the position of Aminu and Samah (2019) on the perception of teachers' training on use of technology and integrating technology in instructional delivery, which revealed that teachers' perception on the use of technology found to improve their teaching practice in classrooms. It equally aligned with the study carried out by Aminu et al. (2019), which indicated that teachers' ICT integration in teaching is still low, though the majority of the teachers comprising (88.76%) agreed that the integration of ICT in teaching and learning activities has brought positive impact on their students' learning ability. Other studies Millis et al. (2008); Kay, (2006) supported the contention that the extent to which male and female teachers perceive the impact of cloud computing in the teaching process is not different.

Conclusion

The study raises awareness of how using cloud computing in the classroom can improve teachers' ability to impart curriculum instructions, support research, encourage collaborative learning, and reduce burden and stress in the workplace. In the long run, when cloud computing resources are effectively used, they facilitate the delivery of high-quality information and raise students' academic attainment. This is achievable because the system tends to keep students' attention, increase commitment, maintain interest, encourage active involvement in every class activity, promote punctuality in class, and increase the degree of efficiency of students in Akwa Ibom state. The impact of cloud computing was viewed favourably by the teachers.

Recommendation

In order to support teachers' frequent use of cloud computing tools for instruction, educational administrators should create supportive environments within the school setting. In a similar vein, specialised training should be organised to increase teachers' pedagogic knowledge of cloud computing and ICT tools for instructional purposes.

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