Assessment of Mathematics Students' Knowledge and Attitude towards Cloud Computing

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ABSTRACT

This study was designed to examine students' knowledge and attitude towards cloud computing. Five research questions were raised, and three hypotheses were formulated and tested at 0.05 level of significance. The descriptive research design was adopted for this study, and the population of the study comprised of all three hundred and twenty-three Mathematics Education students in the two tertiary institutions in Ondo State, Nigeria. The research instruments for this study were the Knowledge of Students on Cloud Computing (KSCC) and the Attitude of Students on Cloud Computing (ASCC). The K-R 20 and Cronbach's Alpha statistics were used to determine the level of reliability of KSCC and ASCC to yield reliability coefficients of 0.66 and 0.89 respectively. The results indicated an average level of students' knowledge on cloud computing in tertiary institutions and a positive attitude of Mathematics Education students towards cloud computing in tertiary institutions in Ondo state. Also, the results showed that there is no significant difference in the mean score of the students' knowledge of and attitude towards cloud computing based on their gender, school type, and school academic level.

INTRODUCTION

Cloud computing is the storing and loading of data and programs on the Internet rather of your computer's local or hard drive. When you store data on or run programs from the hard drive, that's called original means of Computing. For it to be named "Cloud Computing." you will need to enter your data or your programs on the Internet, or at least, have that data synced with other information over the Web. The result is like an online connection, Cloud Computing can be done anywhere, anytime (Eric, 2016; Edegbe-Efosa & Ugiagbe, 2025; Martinez & Chen, 2019; Wilson, 2018). Everything you need is physically close to you, which means penetrating your data is fast and easy, for a single computer, or others on the main network.

Education in the 21st century has gone beyond the transfer of knowledge and skills, and its importance is not just one of following and responding to trends (Raja, 2002). It has come to paly a lead role in societal development of the future. With the level of integration of available information and communications technology (ICT) elements, education has risen to be the fulcrum on which the competitiveness of nations in the global community rests (Edegbe-Efosa & Ugiagbe, 2024; Iji et al., 2013; Kumar & Sharma, 2017; Zhao & Lei, 2019). ICT networks are now making it possible for developing countries to participate in the global economy in ways that were simply not possible before (Baez et al., 2010; Friedman, 2011; World Bank, 2016).

Education should seek to inculcate experiences that are aimed at accelerating technological change, fleetly accumulating knowledge, amplifying global competition, and rising manpower capabilities (Edegbe-Efosa & Ugiagbe, 2024; Partnership for 21st Century Skills, 2002; OECD, 2018; Ugiagbe, 2025; UNESCO, 2015). Institutions must equip their students who will eventually spend their adult lives in a multitasking, multifaceted, technology-driven, vibrant world. The reality on ground has made it imperative for the education system to be more strategic and effective in preparing scholars to succeed and prosper. Educational institutions must reevaluate what, but more importantly, how and where we learn (Innovation Unit, 2014).

One of the specific ways technologies is enhancing present day mathematics instruction and learning is through the application of the cloud. The cloud is a set of components, networks, store house, services, and

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platforms which allows the delivery of computing as a service (Hurwitz et al., 2010). Cloud services include the delivery of software, structure and storage of documents over the internet, reducing the cost and allows flexibility and mobility of data (Kovachev et al., 2011). These services are delivered through the internet from high-specification data spots in locating remote from the end user. The educational cloud involves all the learning students performs on mobile phones, smartphones, tablets, palmtops, laptops and PCs while connected to Wi-Fi. It may include download of documents for assignments and research work, studying online and other personalized learning activities done via connectivity to the wireless cloud within the institution or outside. The cloud services of public universities allow mathematics education students have access to infrastructure and content, increased openness to new technologies, and general support for teaching and learning processes. With this support readily available, learners' perspectives of mathematics, which have been generally attested to be skeptical, stand to be changed.

Active usage of cloud services supplied by educational institutions has grown in significance because of a new set of learners with learning expectations totally different from those who learned ahead of them (Thomas, 2011). Present day learners demand increase network access to sustain their attitude of learning, fun and social interaction (Ugiagbe, 2024; Ugiagbe, 2025). The computing power made available by the cloud avails the means to extend learners' mathematics learning beyond the walls of the classroom, thereby offering the learner high participation and control of the learning process he embarks on. Students' attitude towards mathematics is seen as the pattern of beliefs and emotional dispositions associated with mathematics (Ugiagbe, 2024; Ugiagbe, 2025; Zan & Di-Martino, 2007). It is the positive or negative degree of affection towards the subject mathematics. Whitin (2007) maintains that what learners believe about mathematics influences what they are willing to say explicitly, what questions they are likely to come across, what danger they are aspiring to undergo, and what relationship they make to their lives outside the learning environment. How learners feel about mathematics is a result that is highly relying on the local culture and context, age and stage (Pierce et al., 2007). Mathematics confidence is a measure of learners' individual belief in their own capability to handle learning challenges in mathematics properly, overcoming difficulties (Mohamed & Waheed, 2011; Santos & Barmby, 2010). Mathematics boldness affects students' readiness to take on challenging issues and to try and persist in solving them.

Nowadays, it is essential that learners leave class with the mastery of essential abilities and subject matter knowledge like the capability to produce new ideas, critical thinking, and fluent communication about the body of knowledge taught. One way to develop an atmosphere of invention institutions is through cloud computing as it will encourage students to develop new ideas when they are alone learning an aspect in mathematics. Cloud Computing offers openings for invention and benefits in the classroom that are both safe and cost-effective. Just as technology is remolding and changing future endeavors, the 21st-century classroom needs further flexibility in terms of design, ways of presenting and layout. Instructors can also support new and innovative classroom structures using cloud Computing. Innovative classroom formats like blended or flipped classrooms are possible through the cloud (Edegbe-Efosa & Ugiagbe, 2024). Both models allow for further face-to-face time with students in the classroom while they use the cloud to solve exercises and assignments from home. The cloud helps to produce truly up to date content and innovative classrooms.

The following research questions guided the study:

1. What level of knowledge do Mathematics Education students have of cloud computing?
2. What is the attitude of Mathematics Education students towards cloud computing?
3. What is the difference in Mathematics education students' knowledge of cloud computing based on gender, school type and academic level?
4. What is the difference in Mathematics education Students attitude of cloud computing based on gender, school type and academic level?
5. What is the relationship between knowledge and attitude of students on the use of cloud computing?

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The following research hypotheses were formulated and tested at 0.05 level of significance:

H01: There is no significant difference in the mean score of the Mathematics Students' knowledge of cloud computing based on their gender, school type and school academic level.

H02: There is no significant difference in the mean scores of Mathematics student's attitude towards Cloud Computing based gender, school type and school level.

H03: there is no significant relationship between knowledge and attitude of students on the use of cloud computing

Theoretical Framework

The theoretical framework of this study is the Constructivist Theory. Constructivism is a pedagogical approach that emphasizes how learners actively construct or build their own understanding and knowledge of the world through experiences and reflection (Elliott et al., 2000; Piaget, 2013; Vygotsky, 2012). For this study, we focused on social constructivism proffered by Lev Vygotsky. According to Vygotsky (2012), every part of the child's artistic development appears in two forms: first, on the social form and, latterly on the individual form; first, between people in their terrain (inter-psychological) and inside the child (intra-psychological).

Vygotsky proposed that the process of life development is dependent on social relationship and that social learning leads to cognitive development. In other words, all learning processes can be done by learners with the guidance of an adult with peer collaboration. This theory helps to give a background to the establishment of opportunities for students to team up with their instructor and peers in creating knowledge and understanding. Kapur (2018) perceived that social construction of knowledge takes place in different forms and at different terrain. It could be achieved through group discussion, cooperation or any means of instructional relationship in an academic or training institution, social media platforms, religious societies and market environment. As learners relates with people in the surroundings, the material and immaterial surrounding, they achieve understanding and gather applicable knowledge which is useful in living a successful and functional lives in the world in which they are. Social constructivism can also be called collaborative means of learning because it is done through relationships, discussion and sharing between learners. This instructional approach permits for a range of assembling and interactive styles. These may include total class conversations, small group conversations or students working in groups on given projects or assignments (Ugiagbe, 2025). The background factor to the theory is that learners work in groups while sharing ideas, brainstorming trying to discover cause and effect, answers to problems or just creating new thing to add to existing body of knowledge.

In many ways, the characteristics of constructivism and cooperative learning are enhanced with cloud-grounded technologies and infrastructures. For example, constructivism suggests that learners flow from former knowledge to unfamiliar information to produce new learning experience (Brooks & Brooks, 2009; Jonassen, 2011; Richardson, 2003). Cloud applications contain tools that support activities for making use of former knowledge like collecting and sharing of information. In addition, constructivism suggests that concepts are created in group and that the results of these creations are affected by time and place (Jonassen, 2011; Richardson, 2003). Numerous features of cloud-based applications emphasize these features, such as simultaneous typing and Internet publishing of conceptions.

There are other characteristics of constructivism that shows relationship between cloud-based applications. For instance, constructivism involves

- Facilitation of group discussion (Richardson, 2003),
- Reference to formal sphere of knowledge (Richardson, 2003),
- Privileges for learners to select and change level (Richardson, 2003),
- Practice of metacognitive proficiency (Richardson, 2003).

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Although an instructor can make use of these through traditional methods, like paper and pencil assignments and class discussion, organizing them with the help of Cloud Computing is productive and innovative and stress free. For example, students can share files (documents, sketches, spreadsheets, presentations) and simultaneously add information, like definitions of terms, methods and procedures to break through a problem, or data from a math lab. In addition, instructors can openly show files while students are adding content. Rather than being as static displays which cannot be edited, such as pages of a book, socially constructed body of knowledge, facilitation through cloud technologies, is editable by anyone partaking in the creation of the file.

Cooperative Learning (Ugiagbe, 2025) is related to constructivism as it is another approach to instruction readily aligned with cloud technologies. One reason for this is that some tools available in cloud applications, like sharing and internet publishing, match the principle of social interdependence, which means that one must work together to realize an objective (Johnson & Johnson, 1974; Johnson & Hiran, 2014). Huang and Liu (2013) reveal that cloud computing influences the educational sector and that learners' private and immediate atmosphere have been positively impacted through the construction strategy of the collaborative teaching and learning processes. It increases their former knowledge and builds on their new adventures through similar interactions. The nature of services, benefits, and use of Cloud Computing makes it imperative that learners play a more active part than an instructor who aims to act as a facilitator of knowledge sharing and guide the discussion. Numerous researchers also emphasize the impact of Cloud Computing in the provision of training facilities for the development of scientific innovation skills, development of skills and cognitive capacity besides making available an integrated and flexible teaching system. This correlation is best understood from a research work made by Adewole-Odeshi (2014) that there is an effectual relation among Constructivism, Cooperative Learning, and Cloud Computing to enhance the Instruction procedures. It becomes possible through the multiplied tools. It supports and is harmonious with the social constructivism theory's principles in teaching and learning which focuses on the benefits of social interaction in the construction of knowledge, based on the previous experiences of learners. It also supports the importance of education to prove meaningful, as well as the benefits of learner to be active in their concentrated learning, paying attention to the development of cognitive skills.

LITERATURE REVIEW

Wu (2013) embarked on a study to observe the difference between the learning behavior and attitude of students before exposure to IT education atmosphere of Cloud Computing service and after exposure. The study applied a quasi-experimental design on 110 fifth grade students who were taken from Tunglo Elementary School in Miaoli County in Taiwan. 55 of the students were placed on experimental teaching for four weeks, one period per week. Before and after the four weeks experiment teaching, all participants had to fill out the "Scale of Using IT Education Environment of Cloud Computing" (Cronbach's alpha = 0.953). Students were given user accounts to make use of the Cloud Computing hosted inside the institutions. The results showed the means of pretest and posttest of each scale was much more than the reference value. The t-test analysis ($t(92.395) = 5.689$, $p = 0.000$, $MD = (-1.830)$ indicated that after using the cloud service, students had more positive attitude towards using it, even after school. This study by Wu (2013) relates to our research in its direct application of Cloud Computing in instruction. Also, the allocation of users' accounts to students for cloud access is a likeness distributed by both works. Hence, students used for the study are from a lower stratum of education, and the subject of interest was IT education. Our research polled the impact of using Cloud Computing on the attitude of mathematics education students in public universities towards the subject of mathematics.

The work of Johnson and Hiran (2014) presented at the International Conference on Science, Technology, Education, Arts, Management and Social Sciences held at the Afe Babalola University, Ado-Ekiti in May 2014, drew a relative line for universities in Nigeria. The survey was fashioned to get information from a target population comprising IT administrators, faculty, and students from four named tertiary institutions. The sample for the study comprises of 50 respondents randomly drawn from among IT administrators, faculty, and students in the four targeted tertiary institutions. Structured questionnaire containing both open and closed-ended questions were used to get data on the usage, benefits and the constraints of Cloud Computing technology in advanced educational institutions in Ghana. Data analysis for the study was carried out using

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frequencies, percentages, and pie charts. Most of the respondents constituting 76% said that their institutions do not use any cloud service model while the rest of the respondents (24%) said their institutions use at least one of the cloud service models. Out of the respondents whose institutions used at least one (1) cloud service model, their response rate are: SaaS: 40%; PaaS: 30%; IaaS: 22%; and none: 8%.

A study of students from two Nigerian universities by Olibe et al. (2014) emphasized the extent of awareness of available virtual learning mediums in Nigeria. The researchers employed a descriptive survey design on a sample of six hundred and forty (640) 300-level students in two public universities in Anambra State. The study used a researcher-developed checklist named "Students Virtual Learning Awareness Questionnaire" (SVLAQ). The study used frequencies and percentages in breaking data attained with the SVLAQ, and the findings of the study indicate students were conscious of virtual learning channels like educational blogs, online libraries, and other optional learning channels made available via connections to cloud networks. The study also noted a surprising incongruence in gender awareness of what constitutes virtual learning, with female students having greater knowledge of virtual learning than male students. Olibe et al (2014) recommended that instructors need to incorporate virtual skills in curriculum delivery, task design processes and outcomes, pedagogies, and measurements of real learning. The article elaborately revealed aspects of educational content assessed through available network services as covered by our research on cloud usage in public universities. However, the researchers took their sample from across different disciplines, not expounding what the said consciousness of virtual learning holds for individual fields of study like mathematics education.

In the same vein, Oyeleye et al. (2014) carried out a study to find out the impact and challenges of the embracement of Cloud Computing by public universities in the southwestern part of Nigeria. A sample of 100 IT staff, 50 para-IT staff, and 50 students each was named from 10 public universities in the southwest. The researchers made use of descriptive survey for the research. The study employed the use of a well-structured questionnaire titled "The Evaluation of the Impact and Challenges of Cloud adoption and Use on Universities in Southwestern Nigeria." The instrument had a Cronbach Alpha reliability coefficient value of 0.89. Frequency and percentage statistics were used to analyze the collected data. The outcome of the study indicated a mere 10% adoption of Cloud Computing by Nigerian public universities, with the service model distribution represented as PaaS: 20%, IaaS: 10%, and SaaS: 70%. This distribution was in line the report of Johnson and Hiran (2014) whose research stated that the highest numbers of cloud users subscribe to SaaS. Still, this study lacks specificity, not relating how students utilize the services directly in their course of study.

In another study by Adeyeye et al. (2014) craving for enhanced academic levels confirmed that cloud networks are popular in Nigerian tertiary institutions and serves as a good platform for distributing and sharing of instructional resources. The study, which employs a system analysis and implementation design, is a detailed presentation of the development of a virtual campus in Covenant University, Ota, Nigeria. All students at the school's College of Science and Technology (CST) had access to personal computers, with 70% having personal laptop. Students made use of the institution's cloud via wireless hotspot zones. Their research sought to help improve quality of education through online access of learning resources based on Free Open-Source Software (FOSS), wired and wireless allowance to contents, discussion and interaction forum, and mail services.

The researchers made recommendations for efficient propagation of similar systems in tertiary educational institutions in Nigeria to reduce students' time of idleness and get them engaged in productive academic activities. The study, however, left out the use of any program within CST to test the efficacy of the virtual campus. However, while Adeyeye et al. (2014) study sample was from a private university, ours is from public universities, and is subject-area-specific (mathematics education).

Importance of Cloud Computing to Nigeria Tertiary Institutions

The future of every successful society depends largely on the significance it gives to obtaining and delivering effective and qualitative knowledge. In the present information age, ICT plays a vital part in reforming the way knowledge is transferred to learners from traditional face-to-face approach, partly because of the increasing number of students seeking a place in one of the many departments in universities and other tertiary

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institutions. These prospective learners cannot be accommodated in all the universities departments. Current approach to teaching and learning like e-learning platforms therefore becomes necessary, and there is need to redesign the delivery of educational system in response to the changing world as impacted by advancement in ICT (Muhammad & Abdulrahman, 2015). Lately, there has been growing trend regarding the use of electronic-learning methods as e-learning systems are growing in awareness and becoming an undeniable important trend. Factors leading to the spread of e-learning practice include reduced training cost, ease of use and ease of access, convenience and readiness of variety of courses. Hence, e-learning platform requires huge investments in IT structure (hardware & software), which some educational institutions do not have the financial capacity.

Cloud Computing and Students Knowledge

The storing of information is an essential part of knowledge control (Alavi & Leidner, 2001), and Cloud Computing technology is a useful tool for storing and reacquiring information, documents, and files. In education, storing of knowledge is the pivotal as it allows everyone to store unlimited data on the cloud. Hence, when learners get to know many technology benefits, it boosts their perception regarding its importance and availability (Arpaci, 2017). The students' prospects for knowledge storing may impact the perceived importance and perceived ease of use of Cloud Computing technology. Nonaka et al. (2008) stated that knowledge is developed, broadened, enhanced, participated, and validated through the intellectual process of personalities and social processes. One of the main advantages of Cloud Computing services is developing new knowledge and replacing the former knowledge, as it may ameliorate the interaction between implicit and explicit knowledge (Arpaci, 2017). Knowledge is generated when results to problems are developed, and experience is gained.

Alavi and Leidner (2001) concluded that the base of competitive advantage does not lie in the knowledge of a person itself but lies in the effective application of similar knowledge. Knowledge application facilitates learners studying big data to determine individualized preferences (Bian et al., 2020). Cloud Computing services reduce the communication gap; hence, when learners work in a group, it allows them to coordinate effectively. Also, Arpaci (2017) mentioned that Cloud Computing provides effective knowledge control support by allowing its users to modernize files and documents flexibly, timely, and routinely. Thus, it results in high prospects among the users, and this prospect compels users to believe that technology is useful and easy to use. Also, students' expectations for knowledge application have significant and direct effects on Cloud Computing technology (Arpaci, 2017; Bian et al., 2020).

Students Attitude and Cloud Computing

Attitudes means a user's willingness to use or discard the use of technology for the tasks it is designed to support. A crucial believe in the technology acceptance literature is that "Behavioral Intention to Use" (BIU) has a direct and significant relationship with "real operation". It has been observed over times that a lot of learners failed to use the cloud services or develop a good attitude towards its use as a result of complexity and knowledge of the importance of the cloud. Adewole-Odeshi (2014) examined the attitude of students towards e-learning in targeted south-west Nigerian universities. Specifically, the study looked at the relationship between attitude and learning with the application of Technology Acceptance Model (TAM). A questionnaire was used to collect data from a sample of 387 postgraduate and undergraduate learners. Statistical techniques used for the analyses of data were frequency distribution, simple linear regression, One-Way ANOVA, and paired T-test was used to test the hypotheses. Findings showed that students have a positive attitude towards e-learning because they find the system easy to use and useful for their course work.

Cloud Computing and School type

The tertiary institutions in Nigeria can be classified majorly as Universities, Colleges of education, Polytechnics and so on. Universities in Nigeria has been the topmost institution of study in terms of qualifications they offer students where students obtain a degree, masters or doctorate degree. Colleges of education is an institution which specializes in training and retraining of educators in getting the Nigeria Certificate in Education (NCE), while the Polytechnics prepares students in technological courses where they obtain an Ordinary National Diploma (OND) or Higher National Diploma (HND) (Adeyeye et al., 2014).

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Research has shown over time that government of Nigeria spend much of its budget on education in the Universities, which could be as a result of being the topmost institution of learning leaving other institutions like colleges of education and polytechnics on low budgets (Muhammad & Abdulrahman, 2015). Despite the development in Nigeria tertiary institutions, institutions in Nigeria are still lagging in terms of insufficient Cloud infrastructure which will help the staff and learners of the institutions to contend easily with their counterparts internationally (Muhammad & Abdulrahman, 2015). Infrastructures like well-equipped computer laboratory which gives access to students to use and make research, free and active Wi-Fi network within the school system for the staff and students, a well-structured cloud platform where students can get information easily (Muhammad & Abdulrahman, 2015). To achieve global competitiveness, governments in developing countries are evolving and making use information technology programs, to enable their countries partake in the current ICT revolution. One hindrance to attaining the education objectives of the programs is insufficient public ICT infrastructure and services. The absence of ICT architectures leads to brain drain and outsourcing (Muhammad & Abdulrahman, 2015).

METHODOLOGY

Design of the Study

This study adopted the descriptive Survey design method. The survey research design method involves obtaining information concerning the current state of a situation in order to describe what exists with respect to variables or conditions in a situation (Creswell & Creswell, 2018; Key, 2007; Kumar, 2019). The descriptive survey was adopted because of its advantage of getting large volume of data within a short period of time, and also to ascertain how well Mathematics education students of tertiary institutions in Ondo State, Nigeria are exposed to the use of Cloud computing in the teaching and learning of mathematics. The independent variables are Gender, School type, and School level, while the dependent variable are students' knowledge and attitude on cloud computing.

Population of the Study

The population of this study consisted of all Three Hundred and Twenty-three Mathematics Education students in the two-government owned tertiary institutions in Ondo State, Nigeria. The institutions were Adeyemi College of Education and Obafemi Awolowo University.

Table 1: Population of Mathematics Education Students in the government owned Tertiary institutions in Ondo State

S/N	Name of School	Academic Level	Population of Mathematics Students
1.	Adeyemi College of Education, Ondo.	200	72
		300	70
2.	Obafemi Awolowo University Ile Ife	300	98
		400	83
	TOTAL		**323**

Source: Adeyemi College of Education and Obafemi Awolowo Ile-Ife

Sample and Sampling Techniques

The sampling technique adopted for this study was the simple random sampling technique. It was used to select 95% of the total sample to get Three hundred and seven students from the entire Three hundred and twenty-three students in both institutions as shown in the table below.

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Table 2 below shows the number of Mathematics students used for the study from the tertiary institutions selected.

Table 2: Sample of Mathematics students from the tertiary Institutions

S/N	Name of School	Academic Level	Population of Mathematics Students
1.	Adeyemi College of Education, Ondo.	200	68
		300	67
2.	Obafemi Awolowo University Ile Ife	300	93
		400	79
	TOTAL		**307**

Table 3: Distribution of Students by Gender

Gender	Frequency	Percentage
Male	138	44.9
Female	169	55.1
Total	**307**	**100.0**

Table 3 shows the gender distribution of the students. The table shows that 138 (44.9%) of the students were male while the remaining 169 (55.1%) were female. The result from this table implies that higher percentage of the students were female.

Table 4: Distribution of Students by School Type

School Type	Frequency	Percentage
College of Education	135	44.0
University	172	56.0
Total	**307**	**100.0**

Table 4 shows that 135 (44%) of the students were from colleges of education while the remaining 172 (56%) were from university. The result from this table implies that respondents from university were more than those from college of education.

Table 5: Distribution of Students by Level

Level	Frequency	Percentage
200L	68	22.1
300L	160	52.2
400L	79	25.7
Total	**307**	**100.0**

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Table 5 indicates that 68 (22.1%) of the students were selected from 200-level, 160 (52.1%) from 300-level, while the remaining who constitute 79 (25.7%) were 400-level students.

Research Instruments

There were two instruments for this study, the Knowledge of Students on Cloud Computing (KSCC) and the Attitude of Students towards Cloud Computing (ASTCC), which were developed by the researchers. The KSCC was divided into two sections A and B. Section A covered the demographic information of the respondents such as gender, school type, and school academic levels. While section B consisted of 20 items Test on knowledge of students on the use of Cloud Computing. The ASTCC is divided into two sections as A and B. Section A covered the demographic information of the respondents such as gender, school type, and school academic level, while section B consisted of 18 items Test on attitude of students towards the use of Cloud Computing which was structured in a Likert's scale with four options of (SA): Strongly Agree, (A): Agree, (D): Disagree, (SD): Strongly Disagree.

Validity of Instrument

The instrument was validated by two experts in the Department of Curriculum and Instructional Technology, University of Benin, Benin City, Edo State, Nigeria, and one in the Educational Psychology Department, University of Georgia, Athens, USA. The experts assessed the instrument to ensure clarity, relevance, and appropriateness of the items. The corrections and modifications made by the experts were used to update the instrument to produce the final copy.

Reliability of Instrument

In order to establish the reliability of the instruments, the researchers administered the instruments to twenty (20) Mathematics Education who were not part of the sample but part of the population. K-R 20 statistics was used to determine the level of reliability for the KSCC instrument with a reliability coefficient of 0.661 while Cronbach's Alpha Statistics was used to determine the level of reliability for the ASCC instrument with the reliability coefficient of 0.891.

Method of Data Collection

The instruments were administered by the researchers with the assistance of two (2) trained research assistants who distributed and retrieved the instrument from the students. The administration of the instrument was done when the schools were on session. The researchers worked closely with the research assistants in soliciting for the cooperation of the schools and the students chosen for the study. The instruments were retrieved from the students immediately to ensure 100% return rate.

Methods of Data Analysis

Data was analyzed using descriptive statistics such as mean, standard deviation, Analysis of Variance, and Pearson Product Moment Correlation Coefficient. The hypotheses were tested using t-test statistics at 0.05 level of significance. When the probability (p) value is less than or equal to 0.05, hypotheses will be rejected, but when (p) value is greater than 0.05, the null hypotheses will be retained. The decision rule was 2.50 which is the mean criterion. Any mean above 2.5 will be regarded as high and any mean below 2.50 will be regarded as low for students' attitude. For the level of knowledge of students on cloud computing, the decision value at 0.00-39.00 is low, 40.00-49.00 is Average, 50.00-70.00 is High, while 70 and above is Very High.

Presentation of results

Research Question 1: What level of knowledge do Mathematics Education students have of cloud computing?

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Table 6: Level of Students' Knowledge on Cloud Computing

Variable	N	Mean	SD	Decision
University		34.4	9.52	
College of Education	307	14.11	3.16	Low
Grand Mean		48.51		Knowledge

Table 6 shows the level of students' knowledge about cloud computing tertiary institutions in Ondo State, Nigeria. The result from the table shows that the mean score from the University is 34.4 and that College of Education is 14.11 which is a value within the decision range for Low. The overall mean score of the students is 48.51 (a value within the range of decision value for average) with standard deviation value of 12.68. Based on this result and in line with the decision value, it can be inferred that the level of students' knowledge on cloud computing in tertiary institutions in Ondo state is Average.

Research Question 2: What is the attitude of Mathematics Education students towards cloud computing?

Table 7: Students' level of Attitude towards the use of Cloud Computing

S/N	ITEM	Mean	Std. D.	Decision
1.	I feel more encouraged when I make use of Cloud Computing.	3.39	1.03	Positive
2.	I will love to have an internet gadget for accessing the cloud.	2.78	1.21	Positive
3.	I learn at my own pace when using the Cloud Computing and it makes me happy.	2.57	1.07	Positive
4.	I love to use Cloud Computing for my academic activities.	2.77	1.08	Positive
5. H	I feel loved when on the same platform with colleagues on the cloud.	2.70	1.01	Positive
6.	I get easily irritated when I'm on the cloud for a long time.	2.08	0.99	Negative
7.	I love Cloud Computing because I can learn anytime and anyplace easily.	2.89	1.05	Positive
8.	Using Cloud Computing for instructional activities makes the concept more interesting to me.	2.50	1.12	Positive
9.	I dislike Cloud Computing because of unstable network.	2.71	0.96	Positive
10.	Accessing the cloud helps my retention of the concept.	2.94	1.16	Positive
11.	I am always happy while making research on the cloud.	2.82	1.20	Positive
12.	Pictorial explanation of concepts on the cloud makes it more interesting to me.	3.11	1.00	Positive
13.	I love using Cloud Computing as it allows access to audio and audio visual contents.	3.40	0.85	Positive
14.	Ease of use of Cloud Computing encourages me to learn.	3.10	1.09	Positive
15.	Staying too long on the cloud affects my sight.	2.63	1.15	Positive

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16.	Working with Cloud Computing is fun for me.	2.95	1.02	Positive
17.	Usage of Cloud Computing has made me loose interest in studying Mathematics.	2.26	0.67	Negative
18.	My encounter with Cloud Computing makes me to love Mathematics the more.	3.19	0.67	Positive
	Grand Mean	**2.82**	**1.07**	**Positive**

Table 7 shows the attitude of students towards cloud computing in tertiary institutions in Ondo State. The table reveals that out of the 18-attitude test given, only two of the items had a negative attitude from the respondents. Meanwhile, based on the value of the weighted average (2.82 out of 4.00 maximum value obtainable) which falls within the decision value for ***positive***, it can be inferred that the attitude of Mathematics Education students towards cloud computing in tertiary institutions in Ondo state is positive.

Hypotheses Testing

Ho_1: There is no significant difference in the mean score of the Students' knowledge of Cloud Computing based on Gender, School type and Academic level.

Table 8: Summary of t-test Showing Difference in Gender and School type of Students' Knowledge of Cloud Computing

Grouping Variable		**N**	**Mean**	**Std. D**	**df**	**t**	**Sig.**	**Remark**
Gender	Male	138	47.60	17.93	305	-.190	.630	Not Significant
	Female	169	48.18	15.23				
School type:	College of Education	135	48.55	17.13	305	.034	.973	Not Significant
	University	172	48.48	16.38				

Table 8 above shows that the mean score for male students is 47.60 while that of female students is 48.18. The values of the mean scores do not reveal a significant difference. The p value for gender is 0.630 which is greater than p value of 0.05, this implies that there is no significant difference in the mean score of the students' knowledge of cloud computing based on gender. Likewise, that the mean score for College of Education is 48.55 while that University is 48.48. The values of the mean scores do not reveal a significant difference. The p value for the school type is 0.973 which is greater than p value of 0.05, this implies that there is no significant difference in the mean score of the students' knowledge of cloud computing based on school type.

Table 9: Descriptive Statistics of Students' Knowledge

Academic Level	**N**	**Mean**	**Std. Dev.**
200L	68	46.52	16.94
300L	160	48.28	17.00
400L	79	50.68	15.74
Total	**307**	**48.51**	**16.68**

Table 10: Summary of ANOVA for students' knowledge

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Model	Sum of Squares	Df	Mean Square	F	Sig.	Remark
Between Groups	648.337	2	324.168	1.166	.313	Not Significant
Within Groups	84534.374	304	278.074			
Total	**85182.710**	**306**				

Table 9 shows that the mean score for students in 200Level is 46.53, those in 300level are 48.28 while that of students in 400level is 50.68. Table 10 shows that the p value of 0.313 which is greater than the p value of 0.05 indicates that there is no significant difference in the mean score of the students' knowledge of cloud computing in Ondo State, Nigeria based on school academic level. Therefore, there is no significant difference in the mean score of the students' knowledge of cloud computing based on their gender, school type and school academic level. Hence, hypothesis 1 is retained.

Ho_2: There is no significant difference in the mean scores of student's attitude towards cloud computing based gender, school type and school level.

Table 11: Summary of t-test Showing Difference in Gender and School type of Students' Attitude towards Cloud Computing

Grouping	Variable	N	Mean	Std.	Df	t	Sig.	Remark
Gender	Male	138	48.96	3.33	305	-.834	.405	Not Significant
	Female	169	51.04	4.24				
School type:	College of Education	135	49.02	3.65	305	-.549	.584	Not Significant
	University	172	50.98	4.01				

Table 11 shows that the mean score for male students is 48.96 while that of female students is 51.04. The values of the mean scores do not reveal any appreciable difference. From the table 11 it could also be observed that the p value for gender which is 0.405 is greater than 0.05, which implies that there is no significant difference in the mean score of the students' attitude towards cloud computing based on their gender. Likewise, table 11 shows that the mean score for male students in College of Education is 49.02 while that of University is 50.98. The values of the mean scores do not reveal any appreciable difference. From the table 11 it could also be observed that the p value for school type which is 0.584 is greater than 0.05, which implies that there is no significant difference in the mean score of the students' attitude towards cloud computing based on their school type.

Table 12: Summary of ANOVA showing difference in the Students attitude towards cloud computing based on school academic level Descriptive Statistics of Students' Attitude

Academic Level	N	Mean	Std. Dev.
200L	68	49.56	4.08
300L	160	51.06	3.67
400L	79	51.62	3.79
Total	**307**	**50.87**	**3.85**

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Table 13: Summary of ANOVA for students' Attitude

Model	Sum of Squares	Df	Mean Square	F	Sig.	Remark
Between Groups	166.922	2	83.461	3.796	.303	Not Significant
Within Groups	4377.866	304	14.401			
Total	**4544.788**	**306**				

Table 12 shows that the mean score for students in 200Level is 49.56, those in 300level are 51.06 while that of students in 400level is 51.62 while table 13 shows that the p value of 0.303 on the table is greater than p value of 0.05, this implies that there is no significant difference in the mean score of the students' attitude to cloud computing in Ondo State, Nigeria based on school type. Therefore, there is no significant difference in the mean score of the students' attitude towards cloud computing based on their gender, school type and school academic level. Hence, hypothesis 2 is retained.

Ho_3: There is no significant relationship between level of knowledge and attitude of students on the use of cloud computing.

Table 10: Summary of Pearson Product Moment Correlation showing Relationship between Level of Knowledge and Students' Attitude to Cloud Computing

Variable	Mean	Std. Deviation	N	r	Sig	Remark
Knowledge	48.51	16.68	307	.021	.708	Not Significant
Attitude	50.87	3.85				

Table 12 shows that the mean score for students' knowledge of cloud computing is 48.51 while that of the attitude of students towards cloud computing is 50.87. the r calculated is less than the critical value of r, therefore, there is no significant relationship between level of knowledge and students' attitude to the use of cloud computing in the institutions (N = 307; r = .021; p>0.05). Hence, hypothesis 3 is accepted.

DISCUSSION OF FINDINGS

The present study examined the knowledge and attitude of students to cloud computing in tertiary institutions in Ondo State, Nigeria. The result of this study revealed that the students had average cloud computing knowledge. Despite the introduction of IT into the curriculum of preparatory schools, colleges of education and in the universities, the level of computer literacy and emerging tools among students is very low. This perhaps may be due to poor access to advanced and latest ICT infrastructures in most higher institutions or the inadequacy of the IT courses provided in the universities and colleges. This finding is supported by the study conducted by Ameh et al. (2018) which submitted that students in the College of Medicine and Health Sciences, University of Gondar had inadequate knowledge of cloud computing and very low utilization. Also, the result of this study is a bit higher than a study conducted by Kalid et al. (2015) that only 18.7% of the total sampled in their study demonstrated good knowledge of cloud computing and emerging technologies.

Findings from this study revealed that the attitude of students towards the use of cloud computing in tertiary institutions is positive. This might be due to majority of the students agreed that learning to use the cloud computing is easy for them, nearly all the students find it easy to use cloud computing to do their work, and also high percentage of the students find cloud computing easy to use. Hessen (2015) concluded that cloud computing can enhance and make it simpler for students and lecturers to work on common platforms. Another reason could also be that cloud learning and teaching gained huge appreciation and importance and its reliable

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technology is the reason that led to the academic circle paying attention (Luo et al., 2018). The platforms also became famous because of the convenience they provided.

Results from this study revealed that there is no significant difference between male and female students' attitudes towards the use of cloud computing in Ondo State. In contrast to this finding, Guillén-Gámez et al. (2020) found that students had a positive attitude towards technology, but it was higher in the male gender. Meanwhile, in the current study, even though there is no significant difference between male and female students' attitudes towards the use of cloud computing in Ondo State, the result indicates that female students held a slightly more positive attitude than male ones. This counters the study by Yanti et al. (2018) who opined that males have more positive attitudes toward technology and their using of technology in education process is more frequent than the females. They concluded that among the factors that influence successful integration of technology into teaching-learning process are attitudes and beliefs towards technology.

Also, this study did not find a significant difference between University and College students' attitudes towards the use of cloud computing in tertiary institutions in Ondo State. In agreement with this finding, Wani and Rasool (2015) found that though the university institutions have better facilities for innovations of modern educational technology as compared to their colleges of education counterparts, no variations were found in the attitudes of both groups regarding the implementation of these innovations. This suggests that both university and colleges of education students in Ondo State have a similar attitude towards the use of cloud computing in tertiary institutions.

This study also did not see any significant difference in the mean score of the students' attitude towards cloud computing based on gender, school type and school academic level in Ondo state. Countering this finding, Olubunmi et al. (2017) found out that the impact of cloud services on students' attitudes towards mathematics education between public universities in Benue state turned out to have the female mathematics education students having higher attitude than that of their male counterpart though gender displayed positive attitudes towards the use of cloud computing.

CONCLUSION

Based on the findings of our study, we conclude that:

1. Students have average level of knowledge of cloud computing.
2. Students have Positive attitude towards cloud computing.
3. Students' knowledge of cloud computing do not depend on their Gender, school type and academic level.
4. Students' attitude towards cloud computing does not depend on gender, school type and school academic level.
5. There is no relationship between level of knowledge and attitude of students on the use of cloud computing.

RECOMMENDATIONS

Based on the findings of our study, we make the following recommendations:

1. There is the need for state and federal government to enhance funding of the various institutions to enable them to acquire the needed cloud computing facilities which will help the students access to cloud services.
2. Various tertiary institutions should organize periodic refresher workshops, seminars and conferences to update students' knowledge on the latest trend in the ever-changing ICT world, especially on the utilization of cloud services.

3. Schools must ensure full access of students to cloud services to develop the level of attitude of students in the usage of cloud computing.

4. Lecturers should be encouraged to teach the students with the use of cloud computing to allow the students to keep having a positive attitude towards cloud computing.

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