International Journal on Computational Engineering

Journal Homepage www.comien.org/index.php/comien

Assessment of Gender-Based Differences in Cloud Resource Utilization among Secondary School Teachers in Cross River State, Nigeria

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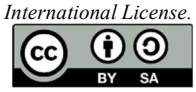
***Abstract*— This paper assessed gender differences in the use of cloud resources by science teachers in Cross River State secondary schools, in Nigeria. A descriptive survey design was used for this study and participants were 487 science teachers who were randomly drawn through stratified sampling. A self-developed survey instrument comprising a set of questions on cloud resource usage and technology self-efficiency was used to obtain data. The study also showed that there was no significant relationship between gender and the use of cloud computing ($t = 1.192$, $p = 0.437$) this implies that gender does not determine the use of cloud resources among Science teachers. The same applied to the use of cloud resources with no noteworthy difference between male and female science teachers ($\chi 2 = 0.720$, $p > 0.05$). These results imply that the gender differential in the adoption of educational technology may be decreasing in this regard, contrary to what has been observed in prior studies. The results presented herein are optimistic from an equity standpoint; however, they also provide a stimulus to future research that is aimed at exploring other variables that could shape the utilization of cloud resources in education, including support, training, and infrastructure. Hence, the study concludes by proposing Professional Development PD programs as well as policy changes aimed at enhancing equitable and effective utilization of cloud resources in science instruction while the findings may be useful for similar contexts in developing nations.**

***Keywords*— Gender disparities; cloud resource utilization; science education; secondary schools; educational technology.**

Manuscript received 5 Jun. 2024; revised 19 Aug. 2024; accepted 23 Sep. 2024. Date of publication 31 Dec. 2024.



I. INTRODUCTION

The use of technology in learning environments is seen as a fundamental aspect of contemporary practices in learning institutions, owing to the totality of societal change processes that characterize the 21st century. It is important to understand that in the modern interconnected high-tech world educational systems are forced to use new technologies as the path to success. Among these technologies, cloud computing has been recognized as one of the most revolutionary technologies that can afford unprecedented opportunities to improve the teaching and learning processes in various contexts of education [1].

Cloud computing is the sort of computing that involves the provision of computing resources such as software, storage space, processing power and networking capacity through a shared pool of resources that can be massively scalable and configurable for the customers' requirements. ICT's revolution of infrastructure in Information Technology has challenged educational conceptions in various ways, which are favourable to educators and students. The last of these benefits is increased collaboration capacity, better access to educational materials, means for using high-level computational means for carrying out complicated educational tasks [2].

The utilization of cloud resources is not limited to storage solutions in education but opens a door to a lot more opportunities. The use of cloud systems thus allows students and teachers to work in real-time regardless of location and thus the formation of virtual learning communities. In addition, the scalability and flexibility of cloud services give a scenario for educational institutions to balance up their

technological resources against the ever-changing demands to optimize resource usage and cost [3]. But as we found out in the literature, the delivery and use of cloud resources in educational contexts are not an exception to the 'one size fits all' rule like most technologies. Several discoveries about the extent and character of cloud resources differ among educators including, institutional support systems, individual technological self-efficacy and personal belief systems of the teachers and faculty related to the targeted use of technology. Among these factors, gender has been identified as an especially interesting factor, especially when taking into consideration the historical and ongoing discourses on the gender digital divide.

Gender has always been used in conjunction with technology, and their combination has always been a topic of research in the field of education among other disciplines. Some of the articles indicated that the gender disparity in general technology adoption is decreasing [4], but another even pointed out the difference between male and female educators' attitudes and effective use of educational technologies [5]. These disparities could present themselves in numerous forms right from the disparity in technology self-efficacy to the disparity in the kind and the type of tools used as well as the use of the same. This knowledge is important for several reasons as the following subtopics will reveal with regard to the gender differences in technology adoption and usage. Firstly, it makes it possible to design advocacy and promotion initiatives that are more effective in ensuring that educational technology is utilized fairly across the various schools. Secondly, it enables one to define factors that may limit the engagement of specific categories of educators in the use of educational technologies. Finally, it expands on how increased attention is being paid to the representation of women in STEM disciplines where technology competence is becoming more and more essential.

The issue reveals an even bigger problem for developing countries because of the distribution of gender in the use of educational technologies. Most of these nations are facing some form of difficulty that affects education and in this list, technology has been considered as a way which can be used to solve most of these gaps in education systems. However, if influences with technology gaps based on the gender of educators persist, there are threats of worsening inequalities in education.

This study adopted Cross River State in the South-South geopolitical zone of Nigeria as the area of focus for analysis of these issues. Like most areas in developing nations, Cross River State of Nigeria has been striving to enhance the quality of education with special emphasis on the application of Information Communication Technology. These efforts are in line with the ongoing National strategy towards the use of innovation for the improvement and expansion of the quality education delivery system in Nigeria. However, the process of attaining effective use of technologies in education systems is not easy, especially in developing countries. Constraints or challenges which include; infrastructure, access to the devices, and lack of proper training for teachers may limit the optimal use of technology in learning. Further, when these challenges affect some groups of educators, for example, women, then there is a potentiality that the ministry may reinforce or contribute to the creation of new forms of gender gaps in education.

Among the disciplines that can receive an obvious advantage from the inclusion of cloud resources, is science education. The potential applications are vast and transformative: virtual laboratories offer students an opportunity to practising experiments that may be expensive or too risky in actual dissection areas; data analysis tools allow students to handle large datasets, thus making them probationary researchers; collaborative research platforms help connect students of all areas of the world to broader ideas and research minds [6]. Since science education is considered a powerful tool for the encouragement of innovations and as one of the main stimuli to economic development, it is significant to provide equal availability and utilization of these new educational technologies. Should there be a gender factor in how science teachers employ cloud resources, then it will improve the standard of science instruction which in turn shapes scientific capabilities in the region. This study, therefore, seeks to find out gender differences in the use of cloud resources in teaching by Cross River State secondary education science teachers.

In addressing these disparities, and in employing additional variables like technology self-efficacy, the research designs the study in hopes to yield findings that could guide policies and actions of equity regarding technological utilization in science education.

A. Statement of the Problem

The use of cloud computing resources in teaching and learning: A significant feature that has been observed in our educational system, more especially in the teaching and learning of science. The main advantages of employing cloud resources are the enhancement of cooperation among participants, the availability of high-performance computational solutions and the possibility to store and share extensive amounts of data [7]. However, it is possible that the acquisition and application of these resources may not be the same for all educators or may be impacted by such variables as gender and the intensity as well as the manner of the use of cloud resources. That is why this disparity is most alarming in the context of developing countries, where the integration of technologies in education has been discussed as a tool to level "educational playing fields" and drive the corresponding countries' development [8]. In Nigeria particularly Cross River State, previous studies have been made on the implementation of technology integration in enhancing the education system yet a lot of questions are still unanswered one of which is; how does gender affect the use of Cloud resources among science teachers in secondary education?

The issue of gender-related digital divide in technology adoption and utilization has been a burning topic of discussion across different sectors including education. As some studies have indicated that the gender gap currently is shrinking when it comes to the use of technologies [4], there are still other studies which are reporting the existence of profound differences between the way male and female educators engage and employ educational technologies [5]. Such disparities may therefore present themselves in the form of disparities in information technology self-efficacy, disparities in the kind of information and the application of information

that the different groups prefer and employ. These gender differences could also have profound implications on the quality of teaching and learning outcomes in the context of cloud education, especially for science education which could benefit from technologically enhanced teaching and learning tools [6]. However, there is limited research done to investigate gender equity as it relates to the actualization of cloud resources among science teachers in developing countries, particularly Nigeria.

The issue, therefore, is whether there is a gender factor that contributes to the distribution and use of cloud resources in science teachers in Cross River State secondary education, and possible consequences for equality in education and quality. For instance, if male and female science teachers differ in their incorporation and utilization of the cloud resources, it would result in inequalities in the interactions that students have with the resources which may further widen the gender gaps in the uptake of science [9]. Furthermore, it is equally important to understand these disparities to be able to design proper intervention strategies that would ensure technology integration for all. The absence of gender perception on the use of cloud resources in teaching and learning among science teachers is likely to hamper the effectiveness of cloud-based e-learning technologies for education as it will not be responsive to the individual needs of both male and female teachers. Therefore, this study seeks to fill this knowledge gap to understand the extent and patterns of the gender gap in the use of cloud resources amongst science teachers in secondary schools in Cross River State, while considering factors such as; perceived technology self–efficacy, perceived usefulness, and perceived ease of use of cloud resources. In this regard, this study aims to highlight such factors to contribute to the development of effective educational policies and practices toward effective utilization of cloud resources in science education for improved teaching and learning in Cross River State and other similar settings.

B. Research Objective

1. Investigate the correlation between gender and the utilization of cloud resources among science teachers in secondary schools in Cross River state
2. Establish if there is a significant difference in the use of cloud resources for teaching among male and female science teachers in Cross River State secondary schools.

C. Research Questions

1. What is the correlation between gender and the utilization of cloud computing among science teachers in secondary schools in Cross River state?
2. Is there a significant difference in the use of cloud resources for teaching among male and female science teachers in Cross River State secondary schools?

D. Cloud Computing

The act of storing or accessing software, applications, and data via the Internet as opposed to a computer's hard disc directly is referred to as "cloud computing" (Raza, 2020). According to Mell and Grance [1], cloud computing is defined by the National Institute of Standards and Technology (NIST) as a model that facilitates ubiquitous, convenient, on-demand network access to a shared pool of reconfigurable computing resources, such as networks, servers, storage, applications, and services, that can be quickly provisioned and released with minimal management effort or service provider interaction. Rajeswari [10], further asserts that cloud computing is the process of using IT infrastructure to provide clients with services over the Internet. According to Jadeja and Modi [11], the primary goals of the cloud are to solve complex computational issues, maximize the utilization of dispersed resources, and aggregate these resources to increase throughput. In addition, the phrase "cloud computing" also refers to the shared hardware and software that are present in cloud computing settings. According to Armbrust et al. [12], hardware refers to all of the infrastructure (systems software, storage servers, compute servers, and so forth) housed in data centres, which serves as the foundation for cloud computing and cloud environments. Shared software refers to applications that are provided as services over the Internet.

1) Cloud Computing in Education: Cloud computing has become one of the revolutionary technologies across different fields, and education is no exception. It is defined as the provision of computing services through the Internet (the cloud of the Internet) from servers, storage, databases, networks, applications, analytics, and intelligence that are faster, more flexible, and economically more advantageous than traditional computing methods [1]. When adopted in education cloud computing offers a means for storage and access to edutainment resources, collaboration and education from a distance.

Some of the advantages of adopting cloud computing in education have been explained in this paper as educationists have stressed the following advantages of cloud computing. For example, Sultan [3] described how CC can assist educational entities in solving issues to do with cost-cutting and speedy and efficient communication, security and privacy. From the study conducted by Arpaci [13], it was established that the use of cloud computing in educational institutions enhanced students' performance as well as their self-efficacy levels.Investigate the correlation between gender and the utilization of cloud resources among science teachers in secondary schools in Cross River state

A. Gender and Technology Adoption in Education

Gender and its role in technology integration in teaching and learning have been discussed in many scholarly papers. Some early research proposed a lot of gap between males and females, with males having a higher level of use of technology and being more favourably disposed to technology use in learning than females [14]. But there are also studies which offer a much more balanced view of the problem. In the following studies, it has also been established that the gender gap in technology is closing especially with the young generation [4]. Some authors continue the discussions stating that although the average rates of usage have already become close, gender differences in preferences and attitudes towards using technologies in learning contexts are still rather significant [5]. Specific causes that have been postulated to influence the gender gap in the use of technology among teachers include Self-efficacy, perceived usefulness, and

perceived social influence as proposed by [15]. Other external influences in this case are structural tests that also address demographic disparities in the adoption of technology, including access to technology, training and institutional support [16].

1) Cloud Resource Utilization in Science Education: Cloud resources refer to a variety of applications and services offsite which can be used to make information management, access and control processes seamless [3]. Within the educational field, cloud resources include services like Google Drive and Microsoft OneDrive that provide secure and elastic storage services to students and teachers as well as cascading tools such as learning management systems (LMS), including Canvas, Blackboard, and Moodle [17].

The incorporation of cloud resources in science teaching and learning presents a lot of advantages. With cloud-based virtual laboratories, students are able to get closer to real experimental setups that may not be possible to stage in actual class today due to amongst other reasons they are bulky or dangerous [18]. Cloud-based apps are such tools that may let students collaborate in research and data analysis as it takes place in actual scientific work [19]. The use of cloud resources can offer science teachers a plethora of tools, resources, and data sets that can supplement their teaching. However, the implementation of these resources is more than just being able to gain access to the technology, but also having the competencies and self-efficacy to use these technologies in teaching practices [20].

2) Gender and Cloud Computing Utilization: When it comes to using cloud computing, gender matters. According to research, there are gender differences in cloud computing service acceptability and intention [21]. Moreover, there are notable disparities in favour of gender in the behavioural intention to utilize cloud computing depending on gender [22]. These results emphasize how crucial it is to take gender into account while researching the use of cloud computing and online privacy policies. Researchers have been interested in examining whether gender differences in technology usage have persisted over time, particularly in the field of education. Significant results about gender differences in university students' use of social media have been found in several research conducted worldwide. Almazroi et al. [21] looked at how gender affected university students in the Kingdom of Saudi Arabia's usage of cloud computing resources. To achieve the research goal, 451 Saudi higher education students' replies were used in an SEM study to ascertain the impact of gender on computing acceptability in the setting of the Kingdom of Saudi Arabia. The results of this study indicate that the intentions of male and female students to use cloud computing vary, with trust being a key factor in determining behavioural intention for male students but not for female students. Conversely, it was discovered that for male students alone, appearance did not significantly predict PU.

Michalopoulou and Kalloniatis [23] attempted to ascertain if the educational background and gender of Internet users had an impact on how people perceive and handle online privacy while using cloud resources. A web-based survey was disseminated by email and social media platforms, including Facebook, LinkedIn, and Google+. The main premise is that there could be a link between a user's gender, educational background, and perceptions and behaviours related to online privacy. Gender has an impact on online users' understanding of online privacy and how they act upon it, according to an investigation of a representative sample of Greek Internet users. Additionally, the authors discovered a relationship between the users' educational backgrounds and the problem of online privacy.

Within the Nigerian context, Emeya and Udukeke [24] conducted a study on the ability of vocational studies lecturers to teach vocational education through cloud assessment. The results of the study established that there was no discernible difference between the mean responses of male and female lecturers regarding the impact of cloud assessment on their ability to teach vocational education in tertiary institutions in the state of Akwa Ibom.

3) Cloud Technology Use in the Nigerian Education Context: Implementation of technologies like cloud resources in educational contexts in countries like Nigeria like in other developing countries has been limited due to challenges such as inadequate infrastructure support, inadequate funding, and unequal distribution of education technology and skilled teachers [25]. There is however increasing awareness of the effectiveness of technology in helping to solve educational problems as well as enhancing the teaching-learning process [26].

In Cross River State, some measures have been taken towards enhancing the use of Technology in Education such as the provision of computers as well as Internet facilities in schools [27]. Nonetheless, related studies regarding the adoption and usage of particular technologies like cloud resources by teachers in this regard are scarce. In this regard, this research should seek to add its voice to the existing literature on gender by exploring gender differences in the usage of cloud resources among science teachers in Cross River State secondary schools. Thus, the research looks at this particular context and technology to aim at developing results that could help design interventions to encourage equal application of technology within the realm of science among the selected group.

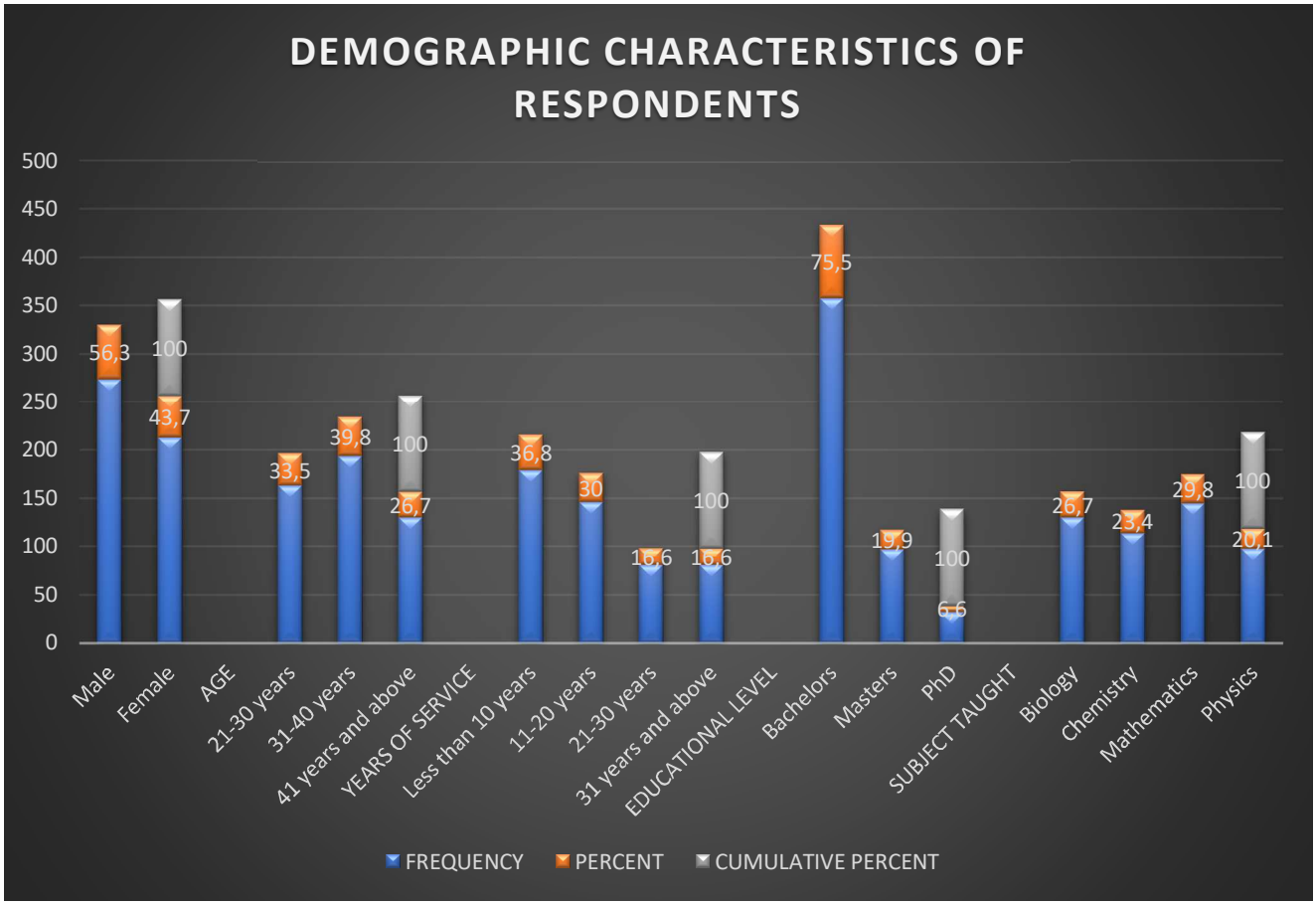
II. Material and Method

A. Research Design

To examine gender differences in the use of cloud resources by science teachers in Cross River State secondary schools, the research design adopted for the present study was a descriptive survey. Such a design was used as it enabled the researcher to gather quantitative data from a large number of respondents to look at the regularity and correlation between variables [28].

B. Population and Sample

The target population for this study included science teachers in public Secondary schools in Cross River State Nigeria. The study involved 500 science teachers selected from 100 public secondary schools across the Calabar and Ogoja Educational Zones of the State.



Field Survey, 2024

Fig. 1 Bar showing the Demographic Characteristics of Respondents

C. Instrumentation

To gather data, a standardized survey instrument with 30 questions was developed and called the 'Cloud Resource Utilization Questionnaire' abbreviated as CRUQ. The questionnaire consisted of two sections:

1. Demographic Information
2. Cloud Resource Utilization (30 items)

The responses gathered were on a 5- 5-point Likert scale that included the following options: Strongly Disagree = 1; Disagree = 2; Neutral = 3; Agree = 4; Strongly Agree = 5.

The instrument was reviewed and validated by professionals in educational technology and measurement and evaluation. A preliminary study was first carried out to determine the credibility of the instrument which got a Cronbach's alpha coefficient of 0.89 for the Cloud Resource Utilization scale and 0.. 90 for the subscale of the Technology Self Efficacy scale showing that the internal consistency was high.

D. Data Collection Procedure

The researchers obtained permission from the Cross River State Ministry of Education and school principals before administering the questionnaires. The questionnaires were distributed to the selected teachers, and they were given a week to complete them. Out of 500 questionnaires distributed, 487 were properly filled and returned, representing a return rate of 97.4%.

E. Text Font of Entire Document

Data analysis was conducted using the Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics, including means and standard deviations, were used to analyze the data. An independent t-test was used to answer research question 1 and test the hypothesis. The Pearson Product Moment Correlation (PPMC) was used to answer research question 2.

III. Results and Discussion

A. Demographic Information

TABLE I
DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Category	Frequency	Percent	Cumulative Percent
GENDER			
Male	274	56.3	
Female	213	43.7	100.0
AGE			
21-30 years	163	33.5	
31-40 years	194	39.8	
41 years and above	130	26.7	100.0
YEARS OF SERVICE	179	36.8	
Less than 10 years	146	30.0	
11-20 years	81	16.6	
21-30 years	81	16.6	100.0
31 years and above			

Category	Frequency	Percent	Cumulative Percent
EDUCATION LEVEL			
Bachelors	358	75.5	
Masters	97	19.9	
PhD	32	6.6	100.0
SUBJECT TAUGHT			
Biology	130	26.7	
Chemistry	114	23.4	
Mathematics	145	29.8	
Physics	98	20.1	100.0

Field Survey, 2024

Table 1 and Figure 1 present the frequency, percentage and cumulative percentage for the different categories of gender, age, and years of service, education level and subject taught based on a survey of 487 respondents. From the analysis, the gender distribution shows that 56.3% of the respondents were male, while 43.7% were female. This indicates a slightly higher representation of males in the sample.

Regarding age distribution; the highest percentage of the respondents (39. 8%) were in the 31-40 years category, the second highest percentage, 33. 5% were in the 21-30 years category, while only 26. 7% of the respondents were 41 years and above. This means that the respondents were well represented in the survey across the ages and most of the respondents were young and middle-aged.

In terms of years of service or experience, the largest number (36. 8%) had less than 10 years of experience, the next category being 11-20 years of experience (30. 0%). The two age groups of 21-30 years and 31 years and above each comprised 16 per cent of the respondents. 6% of the respondents.

Level of education data reveals that most of the respondents were educated up to the bachelor's level accounting 73. 5%, master's degree was 19. 9% while PhD accounted for 6. 6% of the respondents. Regarding the subject taught, the highest number of the respondents (29. 8%) taught mathematics, 26. 7% biology, 23. 4% chemistry, and 20. 1% physics.

B. Research Question 1: What is the correlation between gender and the utilization of cloud computing among science teachers in secondary schools in Cross River State?

To answer this research question, the data from the questionnaire was analyzed using ANOVA statistics to find the relationship between the variables: gender and utilization of cloud computing. The result is presented in Tables 2 and 3 below.

TABLE II
MEAN AND STANDARD DEVIATIONS OF THE TWO GENDER CATEGORIES

Gender	Mean	Std. Deviation	N
Male	3.3905	.27932	274
Female	3.4096	.25563	213
Total	3.3989	.26911	487

TABLE III
CORRELATION BETWEEN GENDER AND UTILIZATION OF CLOUD RESOURCES

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	.044[a]	1	.044	.604	.437	.001
Intercept	5541.615	1	5541.615	76457.413	0.00	.994
Gender	.044	1	.044	.604	.437	.001
Error	35.153	485	.072			
Total	5661.177	487				
Corrected Total	35.196	486				

From table 3 above, it is revealed that the mean scores for the male and female are 3.39 and 3.41 respectively. Similarly, Table 4 shows a p-value of 0.437, greater than the level of significance (p-v > 0.05). This significance score in the ANOVA table reveals that there is a negative correlation between gender and the utilization of cloud resources among science teachers in secondary schools in Cross River State. Gender does not affect the utilization of cloud computing.

Overall, while there is a small effect size in the relationship between gender and the utilization of cloud resources, the statistical analysis shows that this relationship is not statistically significant.

C. Research Question 2: Is there a significant difference in the use of cloud resources for teaching among male and female science teachers in Cross River State secondary schools?

To answer this research question, the data for gender and utilization of cloud resources for teaching were used. The result is presented in Table 4 below.

TABLE IV
CORRELATION BETWEEN GENDER AND UTILIZATION OF CLOUD RESOURCES FOR TEACHING

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	.011[a]	1	.011	.129	.720	.000
Intercept	5469.906	1	5469.906	65079.411	0.000	.993
Gender	.011	1	.011	.129	.720	.000
Error	40.764	485	.084			
Total	5599.828	487				
Corrected Total	40.775	486				

Table 4 above shows that the p-value of 0.720 is greater than the level of significance (p-v > 0.05). The alternative hypothesis is not accepted. Therefore, it is concluded that there is no significant correlation between gender and the utilization of cloud resources among science teachers in

secondary schools in Cross River State. This is the case because there is no digital divide among genders, as no gender (male or female) is disadvantaged in the utilization of cloud resources in Cross River State.

D. Discussion of Results

The main research question of this study was to determine gender differences in the usage of cloud resources among secondary school science teachers in Cross River State. The findings of the research offer several significant implications that would help in understanding the role of gender in the use of cloud computing technologies in this type of learning institution. Firstly, the current study established that gender did not affect the use of cloud computing among Science teachers (F= 0. 437). This is a very important finding given the fact that some prior empirical work has indicated fairly large gender differences in the use of ICT in educational contexts [14]. The results of the study also revealed a fair distribution of the mean scores for the use of Cloud Computing resources where male teachers had a mean score of 3.39 while female teachers had a mean score of 3.41. These findings mirror recent studies that indicate a decreasing gender divide in the use of technology especially among the younger generation [4]. This might perhaps be due to emerging trends in Nigeria and other developing countries where there is diversification toward Information communications technology in education and or teaching so maybe there is a level playing ground as far as male and female teachers are concerned.

An additional important finding of the study is that there is an absence of a gender gap in the usage of cloud resources for teaching among male and female science teachers. This is indicated by a p-value of 0.720. This also supports the argument advanced earlier that, as far as this particular study is concerned, gender does not seem to play a role in the decision to use cloud technologies for educational pursuits. These findings are therefore void of any inclination towards female science teachers implying that both male and female teachers in Cross River State are equally embracing cloud resources in practice. This could suggest that practices for improving gender inequalities in the use of technology in learning, within the Nigerian education system, are slowly producing results. However, it should be understood that the lack of major gender divides does not mean that the use of cloud resources is absolutely optimal. It is important to note that the study did not measure the degree of cloud technology implementation and that it could still be implemented among the sample. Thus, the absence of significant gender differences in usage also suggests that there may still be opportunities for an increase in the use of cloud resources in the teaching of science and improvement of the effectiveness of the learning process.

IV. Conclusion

This study set out to assess gender differences in the use of cloud resources by science teachers in Cross River State secondary schools, in Nigeria. The findings reveal a promising landscape of gender equity in the adoption and use of cloud technologies in this educational context. Contrary to some previous research suggesting significant gender gaps in technology adoption, this study found no significant correlation between gender and cloud computing utilization, nor any significant difference in cloud resource utilization in teaching between male and female science teachers.

These results are encouraging and suggest that, at least in the realm of cloud resource utilization, the digital gender divide may be narrowing among science teachers in this region of Nigeria. This could be indicative of broader societal changes, successful educational policies, or the inherently collaborative nature of cloud technologies that may encourage more equitable use patterns. However, it is crucial to interpret these findings cautiously. While gender parity in usage is a positive sign, it does not necessarily indicate optimal levels of cloud resource utilization across the board. The absence of gender disparities should not be mistaken for universal high adoption or effective integration of these technologies in teaching practices.

Based on these findings and considerations, the following recommendations are proposed: *Targeted Professional Development:* While gender may not be a significant factor, there may still be varying levels of proficiency in cloud resource utilization among teachers. Schools and educational authorities should implement targeted professional development programs that focus on enhancing skills in cloud-based educational technologies. These programs should be designed to cater to teachers with different levels of technological proficiency, regardless of gender. *Infrastructure Enhancement:* To support and encourage the use of cloud resources, it is crucial to ensure that schools have adequate technological infrastructure. This includes reliable internet connectivity and access to necessary hardware. Educational authorities should prioritize infrastructure development to create an environment conducive to cloud resource utilization. *Institutional Support:* Education institutions in Nigeria must promote the culture of the adoption of cloud technologies in learning institutions. This might involve establishing guidelines for the adoption of cloud resources in curriculum development and delivery strategies as well as helping the teachers with the technical aspects. *Curriculum Integration and Student Engagement:* School administration should seriously start thinking about adding cloud-based technologies into the science curriculum officially. Other research areas that should be explored in the future should include how the teachers' usage of cloud resources affects the students' participation and performance. This could shed light on the efficacy of these technologies in science learning.

References

[1] P. Mell and T. Grance, *The NIST Definition of Cloud Computing*, National Institute of Standards and Technology, 2011.

[2] I. Arpaci, K. Kilicer, and S. Bardakci, "Effects of security and privacy concerns on educational use of cloud services," *Computers in Human Behavior*, vol. 45, pp. 93–98, 2015.

[3] N. Sultan, "Cloud computing for education: A new dawn?" *International Journal of Information Management*, vol. 30, no. 2, pp. 109–116, 2010.

[4] Z. Cai, X. Fan, and J. Du, "Gender and attitudes toward technology use: A meta-analysis," *Computers & Education*, vol. 105, pp. 1–13, 2017.

[5] T. Teo, X. Fan, and J. Du, "Technology acceptance among pre-service teachers: Does gender matter?" *Australasian Journal of Educational Technology*, vol. 31, no. 3, pp. 235–251, 2015.

[6] S. M. Balasubramaniam *et al.*, "Blending virtual with conventional learning to improve student midwifery skills in India," *Nurse Education in Practice*, vol. 28, pp. 163–167, Jan. 2018, doi:10.1016/j.nepr.2017.10.028.

[7] J. A. González-Martínez, M. L. Bote-Lorenzo, E. Gómez-Sánchez, and R. Cano-Parra, "Cloud computing and education: A state-of-the-art survey," *Computers & Education*, vol. 80, pp. 132–151, Jan. 2015.

[8] S. S. Oyelere, J. Suhonen, and E. Sutinen, "M-learning: A new paradigm of learning ICT in Nigeria," *International Journal of Interactive Mobile Technologies (iJIM)*, vol. 13, no. 7, pp. 28–45, 2019.

[9] G. Stoet and D. C. Geary, "The gender-equality paradox in science, technology, engineering, and mathematics education," *Psychological Science*, vol. 29, no. 4, pp. 581–593, 2018.

[10] V. Rajeswari, "Cloud computing: A paradigm shift in IT," *International Journal of Engineering and Advanced Technology (IJEAT)*, vol. 8, no. 6, pp. 2354–2357, 2019.

[11] Y. Jadeja and K. Modi, "Cloud computing - Concepts, architecture and challenges," in *2012 International Conference on Computing, Electronics and Electrical Technologies (ICCEET)*, Kumaracoil, India, 2012, pp. 877–880.

[12] M. Armbrust *et al.*, "A view of cloud computing," *Communications of the ACM*, vol. 53, no. 4, pp. 50–58, Apr. 2010.

[13] I. Arpaci, "Antecedents and consequences of cloud computing adoption in education to achieve knowledge management," *Computers in Human Behavior*, vol. 70, pp. 382–390, 2017.

[14] V. Venkatesh and M. G. Morris, "Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behaviour," *MIS Quarterly*, vol. 24, no. 1, pp. 115–139, 2000.

[15] V. Venkatesh, M. G. Morris, G. B. Davis, and F. D. Davis, "User acceptance of information technology: Toward a unified view," *MIS Quarterly*, vol. 27, no. 3, pp. 425–478, 2003.

[16] L. Kvasny, "Cultural (re)production of digital inequality in a US community technology initiative," *Information, Communication & Society*, vol. 9, no. 2, pp. 160–181, 2006.

[17] R. Almajalid, "A survey on the adoption of cloud computing in education sector," *International Journal of Advanced Computer Science and Applications (IJACSA)*, vol. 11, no. 3, pp. 222–226, 2020.

[18] T. de Jong, M. C. Linn, and Z. C. Zacharia, "Physical and virtual laboratories in science and engineering education," *Science*, vol. 340, no. 6130, pp. 305–308, 2013.

[19] B. Zheng, J. Lawrence, M. Warschauer, and C. H. Lin, "Middle school students' writing and feedback in a cloud-based classroom environment," *Technology, Knowledge and Learning*, vol. 20, no. 2, pp. 201–229, 2015.

[20] P. A. Ertmer and A. T. Ottenbreit-Leftwich, "Teacher technology change: How knowledge, confidence, beliefs, and culture intersect," *Journal of Research on Technology in Education*, vol. 42, no. 3, pp. 255–284, 2010.

[21] A. A. Almazroi, E. Kabbar, S. S. A. Naser, and K. Shen, "Gender differences in cloud computing acceptance and intention," *International Journal of Advanced Computer Science and Applications (IJACSA)*, vol. 10, no. 8, pp. 320–326, 2019.

[22] C. Royal, "Gender differences in the intention to adopt cloud computing in higher education," *Journal of Information Technology Education: Research*, vol. 18, pp. 157–171, 2019.

[23] G. Michalopoulou and C. Kalloniatis, "Investigating the impact of educational background and gender on online privacy perceptions in the cloud computing era," *International Journal of Information Security Science*, vol. 6, no. 1, pp. 11–21, 2017.

[24] S. E. Emeya and O. U. Udukeke, "Cloud computing for vocational education: Assessing lecturers' capabilities in Nigerian institutions," *Journal of Vocational Education & Training*, vol. 72, no. 2, pp. 231–245, 2020.

[25] D. A. Oluwole, "Access to and use of information and communication technology (ICT) in Nigerian public schools: Implications for teaching and learning," *Bulgarian Journal of Science and Education Policy*, vol. 9, no. 2, pp. 252–270, 2015.

[26] N. A. Adedokun-Shittu and A. J. K. Shittu, "Assessing the impacts of ICT deployment in teaching and learning in higher education: Using ICT impact assessment model," *Journal of Applied Research in Higher Education*, vol. 7, no. 2, pp. 180–193, 2015.

[27] E. E. Ekon and E. I. Eni, "Utilization of ICT facilities for enhancing instructional delivery of science subjects in secondary schools in Cross River State, Nigeria," *Global Journal of Educational Research*, vol. 17, no. 1, pp. 51–59, 2018.

[28] J. W. Creswell and J. D. Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, Sage Publications, 2017.