

APPLICATION OF INFORMATION AND COMMUNICATION TECHNOLOGY IN
ENHANCING TEACHING OF AGRICULTURAL SCIENCE IN PUBLIC SENIOR
SECONDARY SCHOOLS IN ZARIA, KADUNA STATE, NIGERIA

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Abstract

The study determined challenges and strategies of teaching agricultural science for the purpose of improving teaching skills using information and communication technology (ICT) in public secondary schools in Zaria. A survey research design was adopted to distribute the questionnaire comprising three sections and 33 items. Of the 14 registered schools, a total population of 15 out of the 17 agricultural science teachers returned the validated questionnaire with a reliability coefficient of 0.89. A 4-point rating scale, Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD) were assigned values 4, 3, 2, and 1, respectively and used to evaluate the perceived challenges and strategies of improvement. Data on socio-economic characteristics were subjected to descriptive statistics of percent while mathematical technique (confrontation index) was used to answer the research questions. Results indicated that married (73.33 %) male (73.33 %) teachers between the ages of 36–40 years (46.67 %) dominated, and the majority held B.Sc. (Ed) in agricultural education, with 6-10 years of teaching experience. A Confrontation Index (CI) of 24-59 and a mean range of 1.6 to 3.93 indicated that 90 % of the challenges were perceived by the teachers to retard the use of ICT in teaching the subject. Similarly, a CI of 44-60 and a mean of 2.93-4.00 indicated that the 17 identified strategies were imperative. Therefore, the study concluded that inadequate use of ICT due to numerous challenges, resulting to absolute application of traditional teaching methods. Therefore, there is a for training and retraining of teachers through in-service programmes, regular and sustainable salary and sufficient funding to motivate teachers and facilitate the supply of the required facilities.

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Introduction

Information and Communication Technology (ICT) has resulted in changes that have impacted various elements of our society. It offers innovative methods for delivering content, facilitating communication, and providing access to vast resources (Omotayo, 2015). The potential of ICT in education is widely recognized with ICT tools, such as computers, the internet, and mobile devices, among others. Such facilities enrich the educational landscape by enabling interactive

learning, fostering student collaboration, and providing real-time access to agricultural information and research (Kakar and Manjula, 2022). The education sector has reaped the most significant benefits from technological advancement amongst other sectors with first-hand technologies, challenging traditional teaching and learning methodologies and access to knowledge (UNESCO, 2015).

Agricultural education is a cornerstone of Nigeria's development, particularly in the northern region, where agriculture is the

primary source of livelihood for a significant portion of the population. The importance of agricultural education lies in enhancing food production security and equipping individuals with the necessary skills for sustainable farming practices and improved economic well-being. Globally, there is a high demand for food and other agricultural output due to the increase in world population. The call falls on agricultural educators to transform the production sector by producing competent, literate farmers who can transform the agricultural production sector. This can only be attained if the teachers can access relevant agricultural information, retrieve, communicate, and expose their students to these innovative ideas capable of transforming agricultural education (Salubi, 2019). Effective agricultural education can lead to increased productivity, better resource management, and the promotion of innovative agricultural techniques (Adebayo and Adesope, 2007). In this context, integrating Information and Communication Technology (ICT) into agricultural science and education has emerged as a transformative approach that can enhance teaching and learning experiences.

Information and communication technology facilitates teaching and learning through multimedia, simulations, and interactive content, making agricultural science lessons more engaging, diverse, and motivating for teachers and students (Salubi, 2019). It enhances research and development by using computers, the internet, journals, and databases for their work (Showole and Bisallah, 2014). ICT application in teaching and learning also facilitates feedback between the teacher and the student (Bakare and Olaniyi, 2017). ICT creates higher thinking skills and positions students in a better condition to deal with ongoing technological change in society and

the workplace (Goodwin, 2012; Elo *et al.*, 2020). ICT also increases effectiveness, broadens knowledge, and ensures retention of skills, according to Elo *et al.* (2020), among others

The northern region of Nigeria faces unique socio-economic and infrastructural challenges that impede the effective use of ICT in education. Many rural areas lack the necessary infrastructure, such as reliable electricity and internet connectivity, to utilize ICT tools (Yusuf and Balogun, 2011; James, 2013; Patel and Shukla, 2014; Fabregas *et al.*, 2019). Furthermore, the low levels of ICT literacy among educators and students present another significant barrier to effective integration. Many teachers in Northern Nigeria have not received adequate training in using ICT for educational purposes, resulting in a lack of confidence and competence in utilizing these tools in their teaching practices (Omotayo, 2015). This situation is further compounded by cultural attitudes towards technology, where traditional teaching methods may be preferred over modern approaches that incorporate ICT (Oye *et al.*, 2011). Reports have also shown that inadequate ICT facilities and infrastructure (Rahman, 2016), lack of training and skills (Hennessy *et al.*, 2010; Onu and Ezhim, 2019), high costs of purchasing and maintaining ICT equipment (Aduwa-Ogiegbaen and Iyamu, 2005; Fabregas *et al.*, 2019) are challenges. Other impediments include language barriers, poor connectivity and limited internet options in rural areas, lack of technical support and maintenance (Salubi, 2019; Jannet *et al.*, 2014), resistance to change, and negative attitudes Jannet and Melody, 2014) and inadequate funding and investment (Adeoye *et al.*, 2013). Consequently, ICT's potential to enhance agricultural education remains largely untapped, leading to missed

opportunities for improving educational quality and relevance.

In light of these challenges, it is crucial to investigate the specific barriers to ICT integration in agricultural education in Northern Nigeria. Understanding these challenges will provide insights into the current ICT use in educational settings and inform the development of targeted interventions and policy recommendations. The need for such research is underscored by the increasing emphasis on technology-driven solutions in education, particularly in the wake of the COVID-19 pandemic and other natural disasters such as flooding and hurricanes, which has highlighted the importance of digital literacy and access to technology in ensuring continuity of learning. Therefore, considering the dominant traditional method of teaching (Oye *et al.*, 2011), the need for enhanced ICT and numerous challenges of lack of infrastructures, electricity and culture, among others, the study sought to establish challenges and possibly develop strategies that enhance the use of ICT in teaching agricultural science in Zaria Local Government Area.

Statement of Problem

Despite the potential benefits of ICT in enhancing educational outcomes, integrating ICT in the teaching and learning of Agricultural Education in secondary schools in northern Nigeria remains a significant challenge, with several barriers impeding its adoption and utilization. Understanding the socio-economic characteristics of the teachers is essential to address these issues, as their background influences their ability to adapt and utilize ICT tools (Jegade, 2009). In Zaria, speculations are bound on the impact of language barriers, poor connectivity and, limited internet, lack of technical support and maintenance, particularly in rural areas. Furthermore, identifying the

specific challenges faced in ICT integration and developing strategies to overcome these barriers are critical for improving the quality of Agricultural Education in northern Nigeria, particularly in secondary schools, which for now is still a mirage. Though not common in the north, the advantage of digital learning and continuing education during pandemic and natural disasters *Ceteris paribus* demands that strategies are needed to facilitate teaching and learning. Against this background, there is a need to establish the challenges facing the use of ICT by Agricultural Science teachers.

Objectives of the Study

Specifically, the study sought to;

- i. Determine the socio-economic characteristics of Agricultural Science teachers in Zaria Local Government Area.
- ii. Identify challenges faced by Agricultural Science teachers in Zaria Local Government Area regarding the use of ICT.
- iii. Assess strategies for improved use of ICT by Agricultural Science teachers in Zaria Local Government Area.

Research Questions

The following questions guided the study.

- i. What are the socio-economic characteristics of Agricultural Science teachers in Zaria Local Government Area?
- ii. What ICT challenges do Agricultural Science teachers face when using ICT in Zaria Local Government Area?
- iii. What are strategies for improved use of ICT by Agricultural Science teachers in Zaria Local Government Area?

Methodology

Area of Study

The research was conducted in Zaria Local Government Area (LGA), which lies

between latitude 11.07° and 12° North and longitude 07.44° and 80 East (Nwanosike, 2013) and has a total land area of 300 square kilometres (Ubandoma *et al.*, 2021). Zaria LGA hosts Ahmadu Bello University Annex campus, Federal College of Education, Polytechnic, and several public and private primary and secondary schools. Records from the Quality Assurance Office of the Kaduna State Ministry of Education, Zaria Zone, indicated 14 registered public senior secondary schools in the Local Government Area.

Experimental Procedure

The survey research design was employed for the study. The study population comprised 17 agricultural science teachers in 14 registered public senior schools based on records from the Kaduna State Ministry of Education, Zaria Zonal Education Office. Of the 14 schools, 11 were purposefully visited, while the remaining had no agricultural teachers at the time of the investigation. The instrument questionnaire comprised three sections, namely the demographic information of the teachers, challenges faced in the use of ICT, and strategies for improvement in the use of ICT, and was distributed to 17 teachers; however, 15 were retrieved.

The instrument was validated by three experts from the Federal College of Education Zaria, with a reliability coefficient of 0.89 using Cronbach Alpha. A 4-point rating scale was used to evaluate the perceived challenges and strategies of improvement as Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD), and values 4, 3, 2, and 1 were assigned, respectively.

Data Analysis

Data on socio-economic characteristics were analyzed using descriptive statistics. At

the same time, the challenges and strategies of ICT were subjected to a mathematical technique called Challenge Confrontation Index (CCI) and Strategy Confrontation Index (SCI) following Onwunali *et al.* (2023):

$$\begin{aligned} \text{CCI} &= [\text{C}_{\text{SAX}5}] + [\text{C}_{\text{AX}4}] + [\text{C}_{\text{UX}3}] + [\text{C}_{\text{DX}2}] + [\text{C}_{\text{SDX}1}] \\ \text{SCI} &= [\text{S}_{\text{SAX}5}] + [\text{S}_{\text{AX}4}] + [\text{S}_{\text{UX}3}] + [\text{S}_{\text{DX}2}] + [\text{S}_{\text{SDX}1}] \end{aligned}$$

Where CCI = Challenge Confrontation Index
SCI = Strategy Confrontation Index

SD = Strongly Disagree
D = Disagree
A = Agree
SA = Strongly Agree

The expected range of the Confrontation Index was 1 to 60 for the teachers, while the acceptance range for the research questions was adopted from Entiabang and Etop (2018) and amended as follows,

- 1 = 1.0 - 1.49 Strongly Disagree
- 2 = 1.5 - 2.49 Disagree
- 3 = 2.5 - 3.49 Agreed
- 4 = 3.5 - 4.0 Strongly Agree

The mean benchmark of ≥ 2.5 determined the decision for the significance of challenges and strategies, while below < 2.4 is not acceptable.

Results

Results in Table 1 revealed that the majority of the teachers were male (73.33 %) between the ages of 36–40 years (46.67 %) and were married (73.33 %). The majority studied agricultural education (53.33 %) and, as such, were qualified teachers, as 55.33 % held a B.Sc. (Ed) with 6-10 years of teaching experience. It is evident from the results that most of the teachers are young and have the requisite qualifications to teach Agricultural Science in secondary schools, but not ICT based on government policy.

Table 1: *Socio-economic Characteristics of Agricultural Science Teachers in Zaria Senior Secondary Schools, 2024*

Variable	Frequency	Percentage (%)
Sex		
Male	11	73.33
Female	4	26.67
Age (in years)		
26 – 30	1	6.67
31 – 35	4	26.67
36 – 40	7	46.67
41 – 45	2	13.33
46 – 50	1	6.67
Marital Status		
Single	3	20.00
Married	11	73.33
Widowed	1	6.67
Qualification		
NCE	1	6.67
B.Sc.	2	13.33
B.Sc. Ed.	8	53.33
M.Sc. Ed.	1	6.67
Others	2	13.33
Years of Teaching Experience		
1 – 5	3	20.00
6 – 10	7	46.67
11 – 15	3	20.00
21 – 25	1	6.67
26 – 30	1	6.67
Area of Specialization		
Agricultural Education	8	53.33
Biology Education	3	20.00
Integrated Science Education	3	20.00
Forestry	1	6.67
Total	15	100

Results (Table 2) showed a Confrontation Index of 24-59 with a corresponding mean range of 1.6 to 3.93 in a confrontation index of 1-60, indicating that 90 % of the challenges were perceived to retard the use of ICT in

teaching agricultural science. Results also revealed that, of the 10 identified challenges, 9 with a mean range of 2.56-3.93 in an average mean of 3.13 were perceived by teachers as pressing challenges in the use of ICT in

teaching agricultural science, except for incompetence in internet browsing (1.60), which is expected because most teachers use mobile phone for internet activities. A Standard Deviation of 0.25 to 1.12 was also indicated as widespread from the mean (3.13), which implied that the challenges were pressing on the teachers. The most significant

challenges include inadequate ICT skilled teachers, gadgets, and power supply. Other challenges are a lack of laboratory, teachers' incompetent skills, poor knowledge of PowerPoint usage, excel for calculation, word processing in typing and printing, and poor internet facilities, networks and services.

Table 2: *Challenges of using information and communication technology in teaching agricultural science in Zaria Senior Secondary Schools*

S/No	Items	CCI	\bar{x}	SD	Decision
1	Inadequate number of ICT-skilled teachers	59	3.93±0.06	0.25	Agreed
2	Inadequate computers, printers, scanners, photocopiers	58	3.87±0.09	0.34	Agreed
3	Inadequate power supply	53	3.53±0.19	0.72	Agreed
4	Lack of ICT laboratory	53	3.35±0.19	0.72	Agreed
5	Teachers incompetent skills in ICT application	52	3.47±0.13	0.50	Agreed
6	Inadequate experience of teachers in PowerPoint usage	45	3.00±0.16	0.63	Agreed
7	Low experience of teachers in the use of Excel for calculation	44	2.93±0.29	1.12	Agreed
8	Incompetence in word processing (typing & printing)	41	2.73±0.26	0.99	Agreed
9	Poor internet facilities, network and service	38	2.53±0.23	0.88	Agreed
10	Incompetence of teachers' internet browsing	24	1.60±0.22	0.84	Disagreed
			3.13		

± = *Standard error of the difference of means*, SD = *standard deviation*, \bar{x} = *Mean*, CCI = *challenge confrontation index*

Results (Table 3) revealed a confrontation index of 44-60, corresponding to a mean of 2.93-4.00 in a CI of 1-60 and a mean of 4.00, indicating that the 17 identified strategies were paramount to improving teaching and learning of agricultural science using ICT. The relationship between the standard deviation of 0.0 to 1.12 with a general mean of 3.70 indicated a wide spread that

confirmed teachers' perceived strategies to the challenges. However, results expressly indicated that regular and sustainable salaries and sufficient funding are necessary for using ICT, as it will motivate teachers and facilitate the supply of the required facilities, followed by sufficient administrative funding and adequately equipped and spacious classrooms.

Table 3: *Strategies for improving the use of information and communication technology in teaching agricultural science in Zaria, 2024*

S/N	Items	SCI	\bar{x}	SD	Decision
1	Sustainable salary structure and regular payment	60	4.00±0.0	0.0	Agreed
2	Sufficient administrative funds for agriculture	59	3.93±0.06	0.25	Agreed
3	Availability of well-equipped and spacious classroom	59	3.93±0.06	0.25	Agreed
4	Required teacher-student class ratio	59	3.93±0.06	0.25	Agreed
5	Regular school inspection by the Ministry of Education	58	3.87±0.09	0.34	Agreed
6	Adequate farm tools and machines to ease students' work	58	3.87±0.09	0.34	Agreed
7	Financial motivation of teachers	58	3.87±0.09	0.34	Agreed
8	Regular supply of electricity	58	3.87±0.09	0.34	Agreed
9	Recruitment of enough and qualified Agric. Science teachers	57	3.80±0.10	0.40	Agreed
10	Regular Agricultural workshops and conferences for teachers	57	3.80±0.10	0.40	Agreed
11	Functional and convenient Agric. Science farm for practical	56	3.73±0.15	0.57	Agreed
12	ICT training on Agric. Science packages and program	56	3.73±0.15	0.57	Agreed
13	Availability of ICT facilities in the secondary schools	55	3.67±0.19	0.73	Agreed
14	Provision of well-equipped Agric. Science laboratory	53	3.53±0.15	0.59	Agreed
15	Training and retraining of teachers to enhance knowledge	52	3.47±0.23	0.88	Agreed
16	Effective career guidance and counsellor for students	45	3.00±0.23	0.89	Agreed
17	Regular agricultural exhibitions, farm shows, quizzes, competitions, and seminars for students	44	2.93±0.29	1.12	Agreed

3.70

± = *Standard error of the difference of means*, SD = *standard deviation*, \bar{x} = *Mean*, SCI = *Strategy confrontation index*

Discussion

Findings showed the domination of youths and degree holders in agricultural education. They can be attributed to the retrenchment of teachers by the former governor El-Rufai-led government, which emphasized recruiting young graduates with degrees in their respective disciplines through the Teachers Service Board (TSB). Similarly, Ikeoji (2018) reported that animal husbandry teachers in the Niger Delta are mostly male that studied

B.Sc.(Ed) agricultural education with 6-10 years teaching experience.

The challenges reflected in the results were incompetence in word processing and poor internet facilities, network, and service, though they were significantly ranked relatively low. This may be probably based on speculations that teachers believe they could easily use their mobile phones to type and access the internet for basic Google searches and communicate with their family and friends on social media. Hence, do not care for

computers, and schools don't have functional ICT laboratories to facilitate training. Reports have shown that inadequate training, lack of technical support, funding, and maintenance militate against the use of ICT in teaching agricultural science (Hennessy *et al.*, 2010; Adeoye *et al.*, 2013; Jannet *et al.*, 2014; Salubi, 2019). This may be attributed to the government's inadequate attitude towards funding education and teachers' unwillingness to accept technological innovation, probably due to high costs and irregular power.

Earlier reports have supported that regular and sustainable salaries and sufficient funding are necessary for using ICT to motivate teachers (Adeoye *et al.*, 2013). It was also observed that training and retraining of teachers was imperative as most teachers are incompetent and tend to shy away from digital applications (Onu and Ezhim, 2019). Such exercise updates teacher knowledge and provides a secure place to preserve equipment and facilities. The provision of laboratory and ICT facilities *inter alia* is paramount in using ICT in teaching and learning agricultural science in senior secondary school. It will facilitate learning and maintain educational continuity under any circumstances. Teachers also agreed that a regular supply of power and recruitment of qualified ICT teachers would facilitate the use of ICT. Rahma (2016) reported a suitable budget for purchasing ICT facilities should be secured. He also emphasized integrating ICTs into the faculty's strategy and policy planning and a capacity-building program designed to train the staff members on the effective use of ICTs in the classrooms. Ivande *et al.*, 2018 among other functions, reported that applying ICT techniques improved the teaching and learning of agricultural science, fostered rural

connectivity and provided rural communities with online services for job placement.

Conclusion

The use of ICT in public secondary schools in Zaria Educational Zone of Kaduna State is faced with impeding challenges such as inadequate and unskilled teachers, insufficient facilities, inconsistent power supply, and lack of laboratory *inter alia*. However, motivation through sustainable salaries of teachers, training and retraining of teachers through in-service programmes and engagement of skilled teachers *are sine qua non*. Other strategies like adequate government funding and the establishment of well-equipped ICT laboratories to facilitate accessibility to students will improve teaching and learning and students' academic performance, particularly now that the Computer Based Test (CBT) is used in several examinations in Nigeria.

Recommendations

Based on the study, the following were advanced to improve the teaching and learning of agricultural science in Zaria senior secondary schools;

1. Through the Teachers Service Board (TSB), the Kaduna State government should ensure gender equity by engaging more female agricultural teachers.
2. Kaduna State government, through the Ministry of Education, Non-governmental Organizations (NGOs) and other agencies like Adolescent Girls Initiative for Learning and Empowerment (AGILE) should improve funding of schools, particularly for ICT to foster training and retraining of teachers, purchasing and maintenance of facilities and equipment, supply electricity and provide internet services.

3. Recruitment of ICT-trained and qualified teachers is necessary, as such teachers could assist in the in-service training of the present ICT incompetent teachers, making it easier and cheaper, and at the same time, boost the use of ICT in teaching agricultural science in public schools in Zaria.
4. Poor remuneration of teachers constituted a serious challenge to the use and application of ICT; therefore, enhancement and regular salary payment by state and local government authorities is paramount to teaching and learning agricultural science in Zaria public secondary schools.
5. There is also a serious need for a proper feedback mechanism by government agents through the supervision of public schools to ascertain the management and maintenance of the few centres available in some schools for sustainable teaching and learning activities.

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