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The Use of Information Communication Technologies for Effective Teaching and Learning of Agricultural Science in Public Secondary Schools in Ilorin South Local Government Area of Kwara State, Nigeria

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Abstract

This study evaluates the use of ICT for effective teaching and learning of agricultural science in public secondary schools in Ilorin South Local Government Area of Kwara State, Nigeria. Employing a descriptive survey research design, data were gathered using structured questionnaires from 200 respondents selected through a multi-stage sampling technique. Results indicate that among the eleven items tested on availability and accessibility of ICTs for effective teaching and learning of agricultural science, 3 of the items disagreed indicating with the mean values that projectors (1.96), printers (1.81) and photocopier machines (1.73) were not adequately available and accessible for effective teaching and learning of agricultural science in the study area. Computer Based Test (1.27) has not been used to conduct termly exams for the students while ICTs were being used for effective teaching and learning of agricultural science in the study area. 4.5% of the total students had excellent grades before the use of ICTs and 23.0% had excellent grades after the use of ICTs for effective teaching and learning of agricultural science in the study area. Inadequate ICTs in schools and classrooms was ranked 1st, lack of standby internet/ Wi-Fi connectivity was ranked 2nd and Inadequate support (training and re-training of the teachers) was ranked 3rd were major challenges hindering the use of ICTs for effective teaching and learning of Agricultural Science in the study area. T-test showed a significant difference in the academic performance of the students before and after being taught with ICTs in the study area ($t = 4.912$, $p<0.05$). PPMC showed a significant relationship between the challenges hindering the use of ICTs and effective teaching and learning of agricultural science in the study area ($r = 2.634$, $p<0.05$). The study concluded that students' academic performance improved after being taught with ICTs despite the fact that most schools did not have adequate ICT facilities for effective teaching and learning of agricultural science in the study area. Therefore, the study recommended that there is need for training and re-training of agricultural science teachers on the professional use of ICTs. Regular funding for the maintenance of ICTs in the school and this fund can be sourced for from government, old students' association and well-to-do individuals in the society. There is need for educational stakeholders and policy makers to put in place policies that will fully support ICT based agricultural science curriculum for the present and for future purposes.

Keywords: Technologies, effectiveness, teaching, learning, schools

INTRODUCTION

The world today is assuming a global village status through the use and application of information and communication technologies (ICTs). ICT as a tool has been utilized in the effective management of education in so many countries (Weimer, 2021). Countries of the world are said to be developed or not depending on their level of educational development. For students to be fully integrated into the global system through the use of internet and other computer applications, such students ought to pass through the required training as offered by the teachers. The product of teaching (student) ought to be in a position not only to learn the subject but to harness all the necessary information and development of the computer (Esu, 2021). Technological innovations in teaching and learning of agriculture have greatly shaped agriculture globally with new insights into precision agriculture, Artificial Intelligent (AI), climate smart agriculture, use of drones, digital agriculture and from the creation of the plow to the global positioning system (GPS) driven precision farming equipment, humans have developed new ways to make farming more efficient and grow more food. These iterations are key to feeding the ever-expanding global population with the decreasing freshwater supply. Explore developments in agricultural technology and its impacts on civilization with this collection of classroom resources. Creating more sustainable farming practices increasingly requires adopting new technologies that help with crop management, pest control, quality control, and integrated disease management (David, 2021). The farming instructor app gives agricultural information to rural farming communities and educational settings. One of the ways by which innovative technology improves agricultural education teachers' productivity is mobile app (Ayogu, 2021).

Okafor (2022) defines teaching as a profession that involves an experienced professional which serves multiple roles of an instructor, a parent, a caregiver, an adviser, a mentor and a model. The importance of the teacher in the teaching of Agriculture for the sustenance of life through production of food and in transformation of the learner is acknowledged since teachers are involved at every stage of a leaner's educational attainment (Siemen, 2022). Agricultural science education is hinged on the national philosophy of agriculture. It emphasizes self-reliance based on the production of students of agriculture endowed with balanced approach between principles and practices of agriculture for academic and skills development which enable them to be self-sufficient and reliant in the near future (Anao, 2020). Agricultural science is generally focused on producing seasoned skilled manpower that will shape and develop agricultural industries around the world. Agriculture as a profession provides diverse food and fiber to feed the growing population of the world. Agricultural science is a deliberate attempt by man to cultivate crops, rear animals and care for them, for the benefit of feeding the world population (Hammer, 2020). The teaching and learning of agricultural science in all level of education especially at the foundation level is aimed at producing citizens with skills, competencies and reasoned judgment to successfully live and add meaningfully to the economic growth of Nigeria. According to Landu (2021) a country's development is determined by its individual resources. The main significance of Agricultural education in Nigeria is the provision of the much needed skilled manpower to accelerate the growth of the economy. Agriculture education is mandatory among students in secondary schools in order to perform the roles of teaching, research and service to the growth of the citizens (Smith, 2019).

Secondary education is meant to serve as a pivotal to national development through appropriate manpower training in order to inculcate proper values for the positive growth of the individual and society. National and international examination bodies now lay more emphasis on Computer Based Test (CBT) as a means to reduce the cost incurred on papers and other prints. CBT can accommodate 10,000 students per day depending on the capacity of the CBT hall (Aduwa and Iyanu, 2020). Barnett

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et al. (2022) describes innovative teaching strategy as a new method of teaching that is applicable through the use of Information and Communication Technology (ICT) for effective delivery of content knowledge which makes teaching and learning flexible and more attractive for both learner and the teacher. The global effect of post Covid-19 era, there has been so many exciting and innovative technology empowered approaches acceptable to teaching and learning. Productive teachers in all stages of education designed and adopted different teaching strategies with their students using different types of devices and different methods of access to use for teaching and learning constructs. One of these is Student Created Content-based Teaching Strategies (SCCTS) (Okafor, 2022).

Student Created Content-based Teaching Strategies (SCCTS) is an innovative method of teaching that involves students to learn and experience by virtue of what they created by their own digital content and this is applicable to the teaching and learning of agricultural science at all levels. They often have to access and curate materials and put together a flow or layout which portrays a meaning interpretation of their learning content (David, 2021). They have to delve into the subject that they are creating the content about and learn the application they are using to create it. When they are done and they share their work, their sense of accomplishment and purpose can be a beautiful thing to behold. And they can experience it over and over again as they share their work with others using today's digital tools like YouTube, social media platforms and internet (Okafor, 2022).

Another leading and most adopted innovative teaching technologies is Mobile Learning-based Teaching Strategy (MLTC). This is an innovative teaching technology that involves the power, availability and wide use of the smart phone, the tablet and emerging devices like Google Glass and other wearable technology. Mobile technology is exactly what the name implies--technology that is portable." Examples of mobile devices include laptop computers, personal digital assistants, tablets, mobile phones and smartphones, global positioning system (GPS) devices, and wireless debit and credit card payment terminals. Certainly, the direct connectivity means that students can respond to questions instantly and teachers can immediately gauge where their whole class is in terms of their response to questions. Additionally, however, change must occur in how teachers/instructors integrate the use of this technology in their models of instruction. In making these kinds of changes, however, teachers should be encouraged to develop different mindsets of understanding of the technology and how it changes things for effective instruction which in turns enhance teacher's productivity (Robert et al., 2021).

Teacher productivity is also viewed in terms of change, which takes place in the knowledge, attitude, and behaviour of learners because of teacher's engagement. It is expressed as the process of reaching the aims and intended goals of teaching and thus contributing enormously to the quality of teaching (Lim, 2020). Globally, Teacher productivity is affected by challenges of quality classroom delivery, non-application of innovative teaching technological strategies, inadequacies of qualified teachers to prepare the next generation of citizens, organizational factors that affect teachers' productivity and instructional qualities among others. Okebukola (2020) also argued that university graduates in most Africa countries view teaching profession as an alternative in relation to job acceptance in the absence of lucrative white-collar vocations.

Information and communication technologies (ICTs) are now a global phenomenon and any nation that does not want to be left behind has to articulate measures to be connected to the positive side of the international digital device (Daniel, 2022). Nigeria is no less an exception among countries of the world. But, the problem has been that since the invention of computer literacy. Education being the bedrock of cultural transformation has not been able to address this problem as apathy militating against teaching and learning of agricultural science noted by Philip (2020) that education holds the key to a better world for Nigerians and with the new development in computer science. Since all the students need computer literacy to excel in life and some major e-examinations like Computer Based Test (CBT) and promotion exams are now being written with the use of computer. Therefore, the computer literacy of the computer science teachers, methodologies used, instructional materials, computer laboratory facilities, students interest, school environment could hinder effective teaching

and learning of computer science in public secondary schools. Despite the many measures put in place to improve students' performance, poor grades at National Exams are still prevalent (Esu, 2021).

Consequently, previous studies indicate that teacher's productivity has been investigated separately with some set of variable(s) such as teacher's productivity and job satisfaction; teacher personality and teacher's productivity; influence of instructional strategies on teacher's productivity in tertiary institutions and effect of certification on teacher's productivity (Ronitt, 2024). However, little has been done as regard educational innovative teaching technology and psycho-demographic factors like teacher's self-esteem, Locus of Control as well as teacher's qualification vis-à-vis teacher's production. Poor academic performance of students in agricultural science exams are traced to poor teaching methodologies, and the students are exposed to CBT in their entrance exams into tertiary institutions (Daniel, 2022). It is against this background that this study therefore evaluates the use of ICTs for effective teaching and learning of agricultural science in selected public secondary schools in Ilorin South Local Government Area of Kwara State, Nigeria.

The study specifically

1. verified the availability and accessibility of ICTs for effective teaching and learning of agricultural science in the study area.
2. investigated the type of ICTs used for effective teaching and learning of agricultural science in the study area.
3. determined the difference in academic performance of students before and after being taught with ICTs in the study area.
4. identified the challenges hindering the use of ICTs for effective teaching and learning of agricultural science in the study area.

Hypotheses

H_{01}: There is no significant difference in the academic performance of the students before and after being taught with ICTs in the study area.

H_{02}: There is no significant relationship between the challenges hindering the use of ICTs and effective teaching and learning of agricultural science in the study area**.**

METHODOLOGY

Study Area

Kwara State is located in the North-Central region of Nigeria. It was created on May 27, 1967, and has its capital in Ilorin. The state is divided into several Local Government Areas (LGAs), each with its own administrative headquarters. Kwara State has total land area of 35,705Km^2. Population is 3,390,330 (Male- 1,729,068 and Female- 1,661,262). Kwara State has 16 Local Government Areas (Kwara State Government Diary, 2025). There are both public and private secondary schools and it is one of the major educational zone which has introduced teaching and learning of agricultural science into the school curriculum as well as researcher's familiarity of the location which granted easy access to the school principal, vice principal and agricultural science teachers association coupled with the needed opportunity to supervise and monitor the whole research exercise accordingly. Ilorin South is a Local Government Area in Kwara State, Nigeria. Its headquarters are in the town of Ipata. It has an area of 174 km^2 and a population of 208,691 at the 2016 census.

This study adopted a survey research design**.** A multi-stage sampling procedure was employed for this study. The first stage involved purposive selection of ICT oriented agricultural science teachers in the study area. While, at the second stage was purposive selection of agricultural science teachers who combined the use of ICTs with their teachings and at the third stage, two (2) agricultural science teachers and forty-eight (48) students each were randomly selected from four selected public secondary schools namely: Government Secondary School (GSS), Government Day Secondary School (GDSS), Unity Community Secondary School (UCSS) and Federal Government College (FGC) in IIorin South Local Government Area in Kwara State to make a total of 200 respondents as the sample size. Data collection was conducted using a structured questionnaire titled "Questionnaire on the use of ICTs for effective Teaching and learning of Agricultural Science in Public Secondary Schools in Kwara State". The

instrument was designed to capture availability and accessibility of ICTs for effective teaching and learning of agricultural science, types of ICTs used, difference in students' academic performance before and after the usage of ICTs, and challenges hindering the use of ICTs for effective teaching and learning of agricultural science in Kwara State. To ensure validity, the questionnaire was subjected to face and content review by professionals in agricultural science education and educational research to confirm that the items adequately covered the study objectives. A pilot study was also conducted among 25 randomly selected agricultural science teachers and students outside the study area to refine ambiguous questions and improve clarity. The instrument's reliability was tested using Cronbach's alpha, yielding a reliability coefficient of 0.81, indicating a high level of internal consistency and dependability of the responses. Descriptive statistics such as frequency counts, percentage, mean, standard deviation were used to describe the availability, accessibility and academic performance, while, inferential statistics such as t-test and Pearson's Product Monument Correlation (PPMC) were used for testing the hypotheses.

RESULTS AND DISCUSSIONS

Table 1. Mean Ratings on the Availability and accessibility of ICTs for effective teaching and learning of agricultural science in the study area (n=200).

Items	Mean	SD	Remarks
Laptops or Desktops	2.03	.69	Agree
Projectors	1.96	.47	Disagree
Printers	1.81	.85	Disagree
Photocopier machines	1.73	.94	Disagree
PowerPoints	2.00	.81	Agree
Microsoft applications	2.70	1.06	Agree
Computer simulations	2.01	.71	Agree
E-lesson notes	2.95	.72	Agree
E-report sheet	3.04	.71	Agree
E-recording of scores	2.69	.88	Agree
Flash drives	2.05	.70	Agree

Note: Mean $\geq$2.0 (Highly Available and Accessible; Moderately Available and Accessible; Available and Accessible; Not Available and Accessible).

Results in Table 1 shows that among the eleven items tested on availability and accessibility of ICTs for effective teaching and learning of agricultural science, 3 of the items disagree indicating that projectors (1.96), printers (1.81) and photocopier machines (1.73) were not adequately available and accessible for effective teaching and learning of agricultural science in the study area.

Table 2 shows that among the 8 types of ICTs used for effective teaching and learning of agricultural science in the study area. Computer Based Test (1.27) has not been used to conduct termly exams for the students while ICTs were being used for effective teaching and learning of agricultural science in the study area.

Table 2. Type of ICTs used for effective **teaching and learning of agricultural science.**

ICTs used	Mean	Std	Decision
Whiteboards/Projector boards	3.64	1.96	Agree
Teaching with educational apps	3.54	1.33	Agree
Use of plickers and phone scanners	3.72	1.42	Agree
Laptops/Desktops	3.11	1.34	Agree
Online assignments and qiuzzes	3.55	1.93	Agree
Teaching with projector	3.91	1.76	Agree
Computer Based Test (CBT)	1.27	0.16	Disagree
Laboratory tests by using simulations	3.55	1.73	Agree

Table 3. Differences in students' academic performance before and after being taught with ICTs (n=200).

Scores/Grades	Before ICTs Frequency	Percentage	After ICTs Frequency	Percentage
0 – 39 (Fail)	19	9.5	2	1.0
40 – 49 (Pass)	54	27.0	7	3.5
50 – 59 (Credit)	102	51.0	82	41.0
60 – 69 (Very Good)	16	8.0	63	31.5
70 & above (Excellent)	9	4.5	46	23.0
Total	200	100.0	200	100.0
Minimum	15		38	
Maximum	70		96	
Mean	42.5		49.5	
Std	14.2		16.5	

Results in Table 3 indicates that 4.5% of the total students had excellent grades before the use of ICTs and 23.0% had excellent grades after the use of ICTs for effective teaching and learning of agricultural science in the study area. It can be deduced that the usage of ICTs for effective teaching and learning of agricultural science in the study area is capable of resulting into brilliant academic performance among the students.

Table 4. Mean Ratings of the Responses on challenges hindering the use of ICTs for effective teaching and learning of Agricultural Science in the study area.

Items	Mean	Ranking
Time allotted for agricultural science periods is small	1.03	14th
Inadequate ICTs in schools and classrooms	2.34	1st
Inadequate support (training and re-training of the teachers)	2.27	3rd
Irregular payment of salaries and wages for teachers	1.04	13th
Lack of fund the maintenance of the ICTs	2.23	4th
Parents' and students' interest to study agriculture	2.20	5th
Inability to teach and use technical content at a distance	2.15	7th
Large class size and lack of class control	2.19	6th
Erratic power supply with high cost of generating set	2.11	8th
Lack of standby internet/ Wi-Fi connectivity	2.30	2nd
Lack of competent skills by both teachers and students	2.09	9th
Unrealistic expectations from government	2.03	11th
Lack of financial support from communities and parents	1.97	12th
Lack of security for computer lab during long vacations	2.04	10th

Note: Mean $\geq$2.0 (Challenges were rated severe, mild and not a challenge).

Table 5 reveals that among the 14 challenges hindering the use of ICTs for effective teaching and learning of Agricultural Science in the study area; inadequate ICTs in schools and classrooms was ranked 1st, lack of standby internet/ Wi-Fi connectivity was ranked 2nd and Inadequate support (training and re-training of the teachers) was ranked 3rd and lack of fund the maintenance of the ICTs was ranked 4th while parents' and students' interest to study agriculture was ranked 5th.

Testing of Hypotheses

Hypothesis One: There is no significant difference in the academic performance of the students before and after being taught with ICTs in the study area.

Table 5. T-test results on the academic performance of the students before and after being taught with ICTs in the study area.

Variables	t-value	p-value	Decision
Before After	4.912	0.031	Significant

Significant at p<0.05

Table 5 showed that there was a significant difference in the academic performance of the students before and after being taught with ICTs in the study area ($t = 4.912$, $p<0.05$). This implies that usage of ICTs for effective teaching and learning of agricultural Science resulted into good grades and excellent performance in the study area.

Hypothesis Two: There is no significant relationship between the challenges hindering the use of ICTs and effective teaching and learning of agricultural science in the study area**.**

Table 6. Correlation results between the challenges hindering the use of ICTs and effective teaching and learning of agricultural science in the study area.

Variables	r-value	p-value	Decision
Challenges Effective teaching and learning	2.634	0.042	Significant

Significant at p<0.05

The result of correlation analysis presented in Table 6 showed that there was a significant relationship between the challenges hindering the use of ICTs and effective teaching and learning of agricultural science in the study area ($r = 2.634$, $p<0.050$). This implies the challenges hindering the use of ICTs and effective teaching and learning of agricultural science in the study area.

DISCUSSION OF FINDINGS

Findings on the availability and accessibility of ICTs for effective teaching and learning of agricultural science in the study area corroborate the findings of Weimer (2021) that agricultural science teachers must be confident to use correct ICT terminology when directing students on agricultural usage. Samuel (2021) on the agricultural system engineering and laboratory facilities that unavailability of most needed facilities in the agric-laboratories is liable to render teaching and learning ineffective even when the best agricultural science teachers are available. It also supports the finding of David (2021) that unavailability of burglary proof, ventilation, ceiling fans or air conditioners and generating set give thief's easy entry into the agric-laboratory and make effective teaching and learning of agricultural science unachievable.

Results on the type of ICTs used for effective teaching and learning of agricultural science in the study area is in agreement with the findings of Daniel (2022) also revealed that agricultural science cannot be taught and learned effectively in abstract like many other subjective and agricultural science contained both theoretical and practical aspects and the practical requires thorough demonstration and identification of the specimens. This finding contradicts the findings of Nwachuckwu (2021) that ICTs makes teaching and learning of boring to students who from rural areas and were never used to ICTs tools from elementary.

Findings on the difference in academic performance of students before and after being taught with ICTs in the study area is in line with

the findings of the findings of Eric, Peter and Trevor (2023) on the structure and interpretation of computer programs that since Computer Based Test (CBT) is vast replacing paper or written examinations globally, there is need for agricultural science teachers to use digital camera, scanner, printer, flash drive, laptop, internet searches as instructional materials to aid effective teaching and learning. Discoveries on the challenges hindering the use of ICTs for effective teaching and learning of agricultural science in the study area support the findings of Ofsted, (2021) on factors hindering students' academic performance in computer science that duration allotted for agricultural science periods is too small and lack of appropriate teaching technologies coupled with nonchalant attitudes of the parents to fund assignments. Further findings from this study also in consonance with the findings of WorldNet, (2022) on the problems of effective teaching strategies of agricultural science that inadequate funding for training and re-training of the staff and erratic power supply with high cost of fuel to put on the generating set were seriously affecting effective teaching and learning of agricultural science in public junior secondary schools in Ilorin Local Government Area of Kwara State.

There was a significant difference in the academic performance of the students before and after being taught with ICTs in the study area and this is in agreement with the findings of Roberts (2024) that ICT facilities as instructional materials or as simulations in place of real practical class used by teachers for effective teaching and learning of agricultural science aroused students interest and directly improve their academic performance. There was also a significant relationship between the challenges hindering the use of ICTs and effective teaching and learning of agricultural science in the study area**.** In contrary, Ayogu (2021) found out that age of the learners can hinder effective teaching and learning when all necessary tools are available.

CONCLUSION AND RECOMMENDATIONS

It was obvious that most ICT facilities needed were not adequately available and accessible in some of the schools in the study area. Students' academic performance gradually improved after been taught with ICTs. It became known that needed instructional materials such as functioning digital camera, scanner, printer, laptop, internet source were not adequately provided for and used during classroom teaching and practical classes and not all instructional materials for topics in agricultural science can be improvised by the teacher. Among the challenges identified hindering the use of ICTs for effective teaching and learning of agricultural science are duration (time) allotted for agricultural science periods is too small, lack of software, inadequate workshops and re-training seminars, irregular payment of salaries and wages for the teachers, large class size, erratic power supply with high cost of fuel to put on the generating set coupled with students' interest and nonchalant attitudes of the parents to fund their wards' assignments or group projects. Therefore, the study recommends that the workload of agricultural science teachers should be reduced or limited in order to concentrate on teaching of agricultural science only and can have enough time for the students during practical classes. There is need for training and re-training of agricultural science teachers on the professional use of ICTs. Regular funding for the maintenance of ICTs in the school and this fund can be sourced for from government, old students' association and well-to-do individuals in the society. The parents can also provide their children with a laptop in order to practice what the teachers have taught at home. There is need for educational stakeholders and policy makers to put in place policies that will fully support ICT based agricultural science curriculum for the present and for future purposes.

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