

Application of Digital Technologies as Tools for Transformative Agriculture Instructional Delivery in Universities for Graduates' Agripreneurship and Food Security

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Abstract

Agriculture is taught to develop skills in students which will empower them to contribute to national economic development and food security. Unfortunately, our educational system emphasizes the application of conventional teaching methods in delivering instructions, which fails to produce graduates competent enough to carry out agricultural production. This study examined the application of digital technologies as tools for transformative agriculture instructional delivery. Four specific objectives, research questions and hypotheses guided the study. The study adopted a multi-methods research design involving descriptive survey and correlational research designs where 80 subjects representing 64 lecturers of agriculture and 16 HODs in Universities in Enugu State, Nigeria participated. A structured questionnaire was used to collect data. Data collected were subjected to mean, Pearson product-moment correlation, ANOVA and t-test to answer the research questions and test the hypotheses at a 5% significant level. The results showed that the application of digital technologies reduced learners' boredom ($3.52 \pm .75$), improved learners' performance ($3.63 \pm .51$), used as a visual aid for learners ($3.56 \pm .61$), among others. There was a positive, strong and significant relationship between the application of digital technologies and effective instructional delivery ($r = +.895$, $p = .001 < .05$, $F = 17.73$), competency of teachers to the application of digital technologies and effective instructional delivery ($r = +.998$, $p = .001 < 0.5$, $F = 16263.45$), and frequency of the application of digital technologies and effective instructional delivery ($r = +.999$, $p = .001 < .05$, $F = 31436.14$), among others. There was no evidence of autocorrelation and multicollinearity in the regression models. Digital technologies should be applied in teaching to facilitate instructional delivery in agriculture for graduates' agripreneurship and food security.

Keywords: digital technologies, instructional delivery, agripreneurship, food security, learning

Introduction

Agriculture is taught in schools to develop students' skills in producing food and raw materials to feed the growing population and contribute to national economic development. Ifeanyieze and Ukonze (2008) noted that Agriculture is purposely offered to stimulate and sustain students' interest in agriculture, enable student acquire knowledge and practical skills in agriculture, prepare students for further studies in agriculture, prepare and expose students to occupations and opportunities in the field of agriculture. Students are the hope of every nation and must be adequately prepared to carry the national burden.

Unfortunately, our educational system still emphasizes the application of conventional teaching methods in delivering instructions. These methods according to Asogwa et al. (2021) do not produce students competent enough to carry out practical operations in agricultural production. Conventional teaching methods like the lecture method are not activity-based and, therefore, do not stimulate learners to acquire solution to real-life problems based on practical knowledge (Ganyaupfu, 2013). Teachers, according to Ganyaupfu, may try to increase the passage of the content while reducing time and effort so that students may learn. In the conventional lecture method, students are not properly engaged and concentration fades after some time. It is therefore imperative to apply digital technologies in teaching and learning of agriculture to stimulate students' interest and motivate them to learn.

Oviawe (2016) noted that the application of digital technologies in teaching enables the learners to acquire knowledge, develop right attitude, problem-solving and manipulative skills. Yusuf (2007) posited that the use of digital technologies can increase students' collaboration on projects, increase the preparation of students for most careers and vocations, provide opportunities for students constructed learning and improve confidence. According to Agbatogun and Lawunmi (2009), audio visual media contribute immensely to learner's understanding, improve learner's performance, encourage learners' participation in the teaching and learning process and allow for increased individualization of learning. In addition, the use of digital technologies has been found to assist in reducing agriculture teachers' workloads, assist in lesson development and increase their pedagogical repertoire which in turn impact on their quality of instructional delivery (Yusuf, 2007).

There is a growing popularity in the use of digital platforms for effective instructional delivery as many institutions are investing heavily in digital facilities. One major concern in this endeavor however has been on teachers' willingness to use digital technologies in classroom teachings. Thus, Onwe and Ezekwe (2014) noted that not all university lecturers use digital technologies in delivering their lessons for creative academic output. The authors

stressed that majority of the university agriculture lecturers rely heavily on manual and conventional teaching methods in delivering their lessons. Although, Nzeribe (2011) noted that lecturers use less of digital platforms in the classrooms because they are yet to be sufficiently skilled in its use. It is assumed that how a lecturer perceives digital technologies influences his or her attitude to its usage which is in tandem with technology acceptance model of Davis (1989).

The use of digital technologies among lecturers in our universities has been a problem over the years due to their inability to keep abreast with the changing technology. Today, information and communication technology has crept in all facets of academic endeavour giving a leeway for those who are already in tune with the modern trend. Since the inception of digital technologies in our university system, many lecturers have been finding it difficult to cope with the applications. They find the use of digital technologies in teaching and learning as a hydra headed problem that cannot be resolved. Others are still finding the use of digital technologies as very challenging considering how uneasy and the shame it would be in going back to the classroom to receive lessons on ICT. Some others that have the knowledge of application of digital technologies are still being found wanting as they are incompetent to carry on with the necessary tasks required. The use of digital technologies in agriculture instructional delivery would produce graduates equipped with intellectual prowess and manipulative abilities to engage in agripreneurship for food security.

Integration of business into agriculture (agripreneurship) is essential to transit from backyard agriculture to competitive commercial agricultural enterprise in developing countries (Uche & Familusi, 2018). Agripreneurship helps to improve productivity, offer employment opportunities, and foster technological development in the agri-food system (Chahinez, 2025). Agripreneurship development plays a crucial role in enhancing local food production, but faces some challenges, such as limited access to farm credits and inadequate infrastructure (Rizwan, 2024). Entrepreneurship in agriculture offers youths and graduates of agriculture the fertile ground to alleviate unemployment predicaments, refocus their economic base and contribute meaningfully in addressing food security. The application of digital technologies like digital simulations, virtual collaboration, and global information networks to deliver instructions, would enable learners to acquire entrepreneurial knowledge in agriculture and practical competencies in food production (Doka et al., 2025). The use of e-commerce platforms, social media marketing, mobile applications, and digital productivity tools can improve students' entrepreneurial readiness and innovative capacity (Ogongo, et al. 2025). Increased digital literacy and access to digital resources were reported to positively influence students' ability

to generate business ideas, develop creative solutions, and participate in technology enabled agricultural ventures for food security. Hence the need to find out the influence of the application of digital technologies as tools for transformative agriculture instructional delivery in Universities for graduates' agripreneurship and food security.

Purpose of the Study

The study was conducted to examine the application of digital technologies as tools for transformative agriculture instructional delivery in Universities for graduates' agripreneurship and food security.

Specifically, the study sought to examine the:

1. application of digital technologies for effective agriculture instructional delivery.
2. competence of lecturers of agriculture in the application of digital technologies for effective agriculture instructional delivery.
3. frequency of the application of digital technologies for effective agriculture instructional delivery.
4. challenges encountered by the lecturers of agriculture in the use of digital technologies for effective agriculture instructional delivery.

Research Questions

The following research questions guided the study:

1. What are the relationship between the application of digital technologies and effective agriculture instructional delivery?
2. What are the relationship between competence of lecturers in the application of digital technologies and effective agriculture instructional delivery?
3. What are the relationship between frequency of use of digital technologies and effective agriculture instructional delivery?
4. What are the challenges encountered by the lecturers of agriculture in the use of digital technologies for effective agriculture instructional delivery?

Research Hypotheses

The following hypotheses were formulated and tested at 5% significant level.

1. There is a significant relationship between the application of digital technologies and effective agriculture instructional delivery.
2. There is a significant relationship between competence of lecturers in the application of digital technologies and effective agriculture instructional delivery.
3. There is a significant relationship between the frequency of use of digital technologies and effective agriculture instructional delivery.

4. There is a significant difference in the challenges encountered by the lecturers of agriculture in the use of digital technologies for effective agriculture instructional delivery as perceived by the lecturers of agriculture and HODs.

Literature Review

The application of digital technologies in education policy document by UNESCO (2008), envisaged an approach for leveraging information and communication technologies (ICTs) to facilitate quality improvement and transformation in education delivery. A key focus in the policy document is on the use of digital technologies to transform the roles of the teacher and learner in the classroom which has engendered a paradigm shift in the teaching and learning process from an emphasis on the traditional pedagogical methods of teacher-centered, content and lesson-based instruction to more innovative technology-based constructivist methods such as competency-based, problem based, project-based, student-centered interactive learning (Oliver, 2002). The agricultural science systems globally are under a great pressure to adopt these innovative methodologies and integrate digital technologies into the classroom instructional process (Kainth and Kaur, 2009). Many advanced countries including Australia, South Korea and Singapore have integrated and advanced in the use of digital technologies in their educational systems (Oviawe, 2016). Though Nigeria recognized the pivotal role of the application of digital technologies in the revitalization and development of the country's education system as evidenced by many ICT-driven programmers' and initiatives (Ifinedo, 2007), the process of teaching and learning in Nigeria universities today, is still characterized by the old conservative approach of lecturers acting as repertoire of knowledge and students the dormant recipients (Oyelekan, 2008).

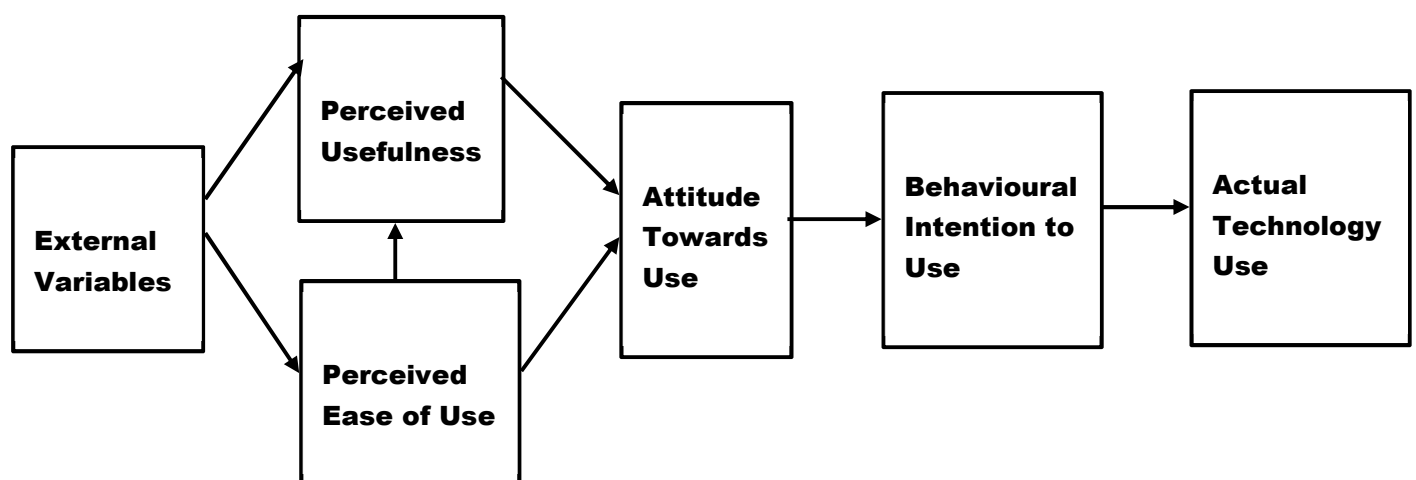
Video technologies such as video camera, video cassette recorder (VCR) and video discs are very effective media in the teaching and learning of agriculture (Osinem, 2008). The discs could be used for guided and independent learning of skills in poultry, rabbit, pigs and crops production, as well as in land/soil management practices (Ikeoji & Kayoma, 2011). Computer and internet access create opportunities for students and teachers of agricultural science to access, store, organize and disseminate agricultural information in ways and methods hitherto unknown. The internet is very important in the teaching and learning of agriculture as it goes a long way to update both the lecturers and students' knowledge by providing the needed information online than in agricultural fields. With appropriate software, the computer has been found to be a very useful and indispensable tool for agriculture instructional delivery. Ikeoji and Kayoma (2011), emphasized that ICT could boost the method of teaching agriculture by showing farm activities recorded in compact discs and VCR to students through the monitor or

visual display unit (VDU) of the computer. Educational technologies such as digital video demonstrations and interactive laboratory exercises allow students to learn-by-doing (Phipps et al., 2008). Learning by-doing and guided discovery are the recommended agriculture instructional delivery methods by the Federal Ministry of Education (FME) (1985). The agriculture instructional content can be achieved using textual, audio, visual and audio-visual platforms thereby, ensuring equity for all categories of learners.

Theoretical Framework

The study was anchored on the Technology Acceptance Model (TAM). Technology acceptance model was developed by Fred Davis in 1989. This model was specifically developed to explain the acceptance and use of technologies. According to Davis (1989), if an individual perceives a given technology as easily usable, then there is a greater propensity of that individual to perceive such technology as useful. The model proposed that both perceive ease of use (PEU) and perceive use (PU) affect the decision of individuals towards the use of technology. When users perceive a specific technology as easy to use and useful, they can develop a positive attitude towards the application of the specific technology. Davis stated that attitude towards use of technology (ATT) and perceive use (PU) affect users' behavioural intention (BI) to use the technology. It implies that when individuals consider a technology as useful, they can create positive behavioural intention of use towards the technology. Thus, 1989 positive behavioural intention of users toward a given technology defines the real use of such technology which is referred to as actual system use (AU). Therefore, ease of use and perceived usefulness of digital technologies shape the attitude of lecturers of agriculture towards the application of such digital technologies in agriculture instructional delivery.

Figure 4: Technology Acceptance Model (TAM) Davis, 1989



Methodology

Ethics

University of Nigeria Research Ethics Committee granted the permission to conduct this study in August 2025. The methodology adopted in this study were in alignment with the research guidelines approved by the research committee. Before the commencement of the study, the participants were informed that participation was entirely voluntary. Participants were assured to withdraw from participation at any time without penalty. All responses were strictly confidential and used solely for research purposes. No personal information of the respondents was disclosed to a third party in any publication, presentation or discussion. The participants were assured of no associated risk in relation to their participation in the study.

Participants

The population of the study consisted of 80 respondents representing 64 lecturers of agriculture and 16 HODs in Universities in Enugu State, Nigeria. No sampling was done as the entire population participated in the study since the size was manageable.

Design of the Study

The study adopted multi-methods research design. Multi-methods research design is an approach involving two or more designs within the same research. This study adopted descriptive survey research and correlational research designs. Descriptive survey research according to Ansari, et al. (2022) is one in which a group of people or item is studied by collecting and analyzing data from only a few people or items considered to be representative of entire group. The study investigated the perception of lecturers and HODs on the extent of application of digital technologies for effective agricultural science instructional delivery, competence of teachers of agriculture in the application of digital technologies for effective agricultural science instructional delivery, frequency of the application of digital technologies for effective agricultural science instructional delivery, and challenges encountered by the teachers of agriculture in the use of digital technologies for effective agricultural science instructional delivery

A correlational research design aims to establish relationships between two or more variables within the same population or between the same variables across two different populations without manipulation (Putri, et al., 2016). The design was further adopted to establish the relationships between application of digital technologies and effective agriculture instructional delivery, competence of lecturers in the application of digital technologies and effective agriculture instructional delivery, and frequency of use of digital technologies and effective agriculture instructional delivery were determined. This study was conducted in Enugu State, Nigeria.

Instrument for Data Collection

The instrument for data collection was a researcher made structured questionnaire named as “Application of Digital Technologies as Tools for Transformative Agriculture Instructional Delivery Questionnaire (ADTTTAIDQ)”. The instrument was divided into two parts. Part one was designed to obtain information on the personal data of the respondents while part two sought information for answering the research questions and testing the null hypotheses. Part two was further divided into four sections A, B, C and D. Each of the items in part two had five point response options of strongly agree (SA), agree (A), undecided (UND), disagree (D) and strongly disagree (SD) for sections A and D, highly competent (HC), moderately competent (MC), fairly competent (FC), slightly competent (SC) and incompetent (IN) for Section B and very often (VO), moderately often (MO), slightly often (SO), rarely often (RO), and not at all (NA) for Section C. Sections A, B, C and D elicited responses from the respondents on the usage of digital technologies for agriculture instructional delivery; competencies of digital technologies application possessed; frequency of digital technologies usage for agriculture instructional delivery and challenges of digital technologies usage for agriculture instructional delivery.

The instrument was validated by five experts, two from the Department of Agricultural Education, two from the Department of Computer and Robotics Education and one from Measurement and Evaluation Unit of Science Education, all from the Ebonyi State University, Abakiliki. The experts were instructed to scrutinize the instrument to detect missing information, mis-spelt words, poorly structured items and unclear statements. The experts were also requested to make suggestion for improving the instrument towards meeting the purpose of the study.

The reliability of the instrument was determined by distributing 20 copies of the structured questionnaire to lecturers of agriculture in the University of Calabar, Cross River State, Nigeria which was outside the study area. The data collected were subjected to the Cronbach alpha method to determine the internal consistency of the items. The result yielded a co-efficient of 0.82 for section A, 0.71 for section B, 0.75 for section C, 0.78 for section D and over all of 0.76. Eighty copies of the instrument were administered on the respondents by the researchers and four research assistants through personal contact. Sixty-nine copies of the completely filled instrument were retrieved within two weeks from the respondents giving a return rate of 86.25%.

Data Analysis

Data collected were subjected to normality test which yielded 0.91 for section A, 0.29 for section B, 0.10 for section C and 0.010 for section D, all greater than 0.05. This signifies that the data collected were normally distributed following Shapiro-wilk test of normality. The demographic characteristics of the respondents was analyzed using frequencies and percentages. Research questions were answered using mean statistic. Decision on the mean was taken using cut-off point of 3.00, which was calculate as $\frac{1+2+3+4+5}{5} = 3$. Any item with the mean value of 3.00 and above was high and interpreted as agree, competent, or often while any item with the mean value below 3.00 was low and interpreted as disagree, incompetent, or not at all. The degree of relationship between the perception of lecturers of agriculture and the HODs was established using regression and Pearson correlation analysis. Analysis of variance (ANOVA) associated with regression was used to compare the mean between the groups. t-test was equally applied to test the hypothesis on the challenges encountered by the lecturers of agriculture in the application of digital technologies. Thus, hypotheses were all tested at .05 level of significance and all analyses were done with IBM Statistical Package for Social Sciences (SPSS) version 25 software.

Results

Table 1: Demographic Characteristics of the Respondents

Demography	Frequency (f)	Percentage (%)
Gender		
Males	54	67.5
Females	26	32.5
Age (years)		
24-35	23	28.75
36-45	37	46.25
46-60	20	25.00
Working Experience		
1-5 years	10	12.50
6-10 years	18	22.50
11-20 years	31	38.75
Above 20 years	21	26.25

The respondents constituted more of the males (54, 67.50%) than the females (26, 32.50.5%) (Table 1). The age range of the respondents between 36-45 years (37, 46.25%) were highest in number which was followed by those within the age range of 24-35 years (23, 28.75%). Respondents between 46-60 years of age (20, 25.00%) were the least participated in the study (Table 1). The respondents of working experience between 11-20 years (31, 38.75%)

were the highest participants and was followed by the respondents that entered into the job in 20 years and above (21, 26.25%). Respondents within the work experience of 6-10 years (18, 22.50%) were second to the least in population and respondents with the work experience between 1-5 years (10, 12.50%) were the least (Table 1).

Table 2: Mean Perception of Lecturers and HODs on the application of digital technologies for Effective Agriculture Instructional Delivery

S/N	Perception on the application of digital technologies	Lecturers		HODs		Overall		Remarks
		$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	
1	The use of digital technologies for teaching reduces learner's boredom	3.51	.74	3.53	.76	3.52	.75	Agree
2	The use of digital technologies for teaching improves learners' performance	3.64	.50	3.62	.52	3.63	.51	Agree
3	Projectors and power point presentation with animations are used as visual aids for learners	3.55	.62	3.57	.60	3.56	.61	Agree
4	Spreadsheets are helpful in the analysis of learners' performances	3.56	.60	3.56	.58	3.56	.59	Agree
5	The world wide web offers a wider range of interesting teaching games, quizzes and puzzles	3.43	.77	3.45	.79	3.44	.78	Agree
6	SMSs, E-mailing, WhatsApp, blogs and forum allow the interaction of lecturers and students after classroom instruction	3.57	.61	3.59	.61	3.58	.61	Agree
7	Photocopy machine saves time in the production of class notes for students.	3.55	.66	3.53	.64	3.54	.65	Agree
8	ICT websites such as web-city allows the introduction of learners to new learning strategies	3.63	.61	3.65	.63	3.64	.62	Agree
9	Data bases allows the proper keeping of students' records	3.58	.55	3.58	.57	3.58	.56	Agree
10	Application of digital technologies makes lessons more interesting	3.63	.45	3.61	.47	3.62	.46	Agree
Total		3.57	.61	3.57	.62	3.57	.61	Agree

The result showed that the lecturers of Agriculture and HODs agreed that application of digital technologies helped to reduce learners' boredom ($3.52 \pm .75$), improved learners' performance ($3.63 \pm .51$), used as visual aids for learners ($3.56 \pm .61$), helpful in the analysis of learners' performance ($3.56 \pm .59$), made interaction of lecturers and students after classroom instructions easier ($3.58 \pm .61$), saved time in production of class notes ($3.54 \pm .65$), exposed

learners to new learning strategies ($3.64 \pm .62$), proper keeping of students' records ($3.58 \pm .56$) and made lessons more interesting ($3.62 \pm .46$) (Table 2).

Table 3: Correlation Matrix of the relationship between the application of digital technologies and Effective Agriculture Instructional Delivery

		Effective Instruction	Application of Digital Technology
Effective Instruction	Pearson Correlation	1	.895**
	Sig. (2-tailed)		.001
	N	80	80
Application of Digital Technology	Pearson Correlation	.895**	1
	Sig. (2-tailed)	.001	
	N	80	80

** . Correlation is significant at the 0.01 level (2-tailed).

The result presented in the Pearson correlation matrix above indicated that there was a positive and strong relationship (+.895) between the application of digital technologies and effective instructional delivery. The result also indicated that the relationship was statistically significant (.001) (Table 3).

Table 4: Regression Model Summary of the relationship between the application of digital technologies and Effective Agriculture Instructional Delivery

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.895 ^a	.801	.799	.15518	2.030

a. Predictors: (Constant), Application of Digital Technology

b. Dependent Variable: Effective Instruction

The Pearson correlation coefficient (R-value) of .895 in the model summary above showed that there was a strong and positive relationship between the application of digital technologies and effective agriculture instructional delivery. The coefficient of determination (R-Square) of .801 showed that 80.1% improvement in agriculture instructional delivery was explained by the application of digital technologies. This showed that the model had a good fit. The Durbin-watson value of 2.03 showed that it had no evidence of autocorrelation as it did not exceed the standard limit of 2.44.

Table 5: ANOVA Analysis of the relationship between the application of digital technologies and Effective Agriculture Instructional Delivery

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.571	1	7.571	314.404	.001 ^b
	Residual	1.878	78	.024		
	Total	9.449	79			

a. Dependent Variable: Effective Instruction

b. Predictors: (Constant), Application of Digital Technology

The result confirmed that the overall regression model was significant. This was indicated by the F-statistics of 314.40 and the associated p-value of .001 ($p=.001<.05$, $F=314.40$), that was found to be significant at 5% level.

Table 6: t-test Analysis of the relationship between the application of digital technologies and Effective Agriculture Instructional Delivery

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.443	.174		2.545	.013		
	Application of Digital Technology	.874	.049	.895	17.731	.001	1.000	1.000

a. Dependent Variable: Effective Instruction

The unstandardized regression coefficient (β) as indicated in the Table 6 revealed that a unit increase in the application of digital technology increased agriculture instructional delivery by .87. It further revealed that there was a direct relationship between the application of digital technologies and effective instructional delivery. The t-value of 17.31 and the associated p-value of .001 ($p=.001<.05$, $t=17.73$) indicated that there was a positive and significant relationship between the application of digital technologies and effective instructional delivery. The collinearity statistics in the coefficient table showed that there was no evidence of multicollinearity as indicated by the tolerance value of 1.00 which was greater than the cut-off point of .10 and supported by the Variance Inflation Factor (VIF) value of 1.00 that was below the cut-off point of 10.

Table 7: Mean Perception of the Respondents on the Competency of Lecturers in the Application of Digital Technologies for Effective Agriculture Instructional Delivery

S/N	Lecturers of agriculture competence in digital technologies	Lecturers		HODs		Overall		Remarks
		$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	
1	Ability to locate and run computer application programmes	2.18	.81	2.30	.83	2.24	.82	Incompetent
2	Ability to connect the computer and its peripherals	3.10	.74	3.12	.86	3.11	.80	Competent
3	Ability to download files from the internet	2.30	.92	2.28	.87	2.29	.90	Incompetent
4	Ability to communicate online with students on assignment related issues	2.14	.71	2.16	.95	2.15	.83	Incompetent
5	Ability to access information on CD/DVD	3.58	.38	3.56	.41	3.57	.40	Competent
6	Ability to retrieve files stored computer	2.16	.89	2.17	.90	2.16	.90	Incompetent
8	Ability to access an internet via its website address	2.08	.95	2.10	.97	2.09	.96	Incompetent
9	Ability to create a basic presentation package	1.93	.82	1.95	.78	1.94	.80	Incompetent
10	Ability to use a scanner to copy images	2.00	.83	2.02	.87	2.01	.85	Incompetent
11	Ability to open a new document in word office	3.07	.77	3.06	.85	3.07	.81	Competent
12	Ability to use spreadsheet package very well	2.32	.47	2.34	.69	2.33	.58	Incompetent
13	Ability to attach files to outgoing e-mails	3.14	.82	3.15	.86	3.15	.84	Competent
14	Ability to organize electronic files into folder	2.09	.81	2.10	.76	2.10	.79	Incompetent
15	Ability to save document in various file formats including HTML and PDF	2.07	.92	2.09	.97	2.08	.95	Incompetent

16	Ability to evaluate students using digital platform	1.93	.79	1.95	.68	1.94	.74	Incompetent
	Total	2.41	.78	2.42	.82	2.42	.80	Incompetent

Results showed that lecturers of agriculture were competent in connecting computer and its peripherals ($3.11 \pm .80$), accessing information on CD/DVD ($3.57 \pm .40$), opening a new document in Microsoft words office ($3.07 \pm .81$) and attaching files to outgoing mails ($3.15 \pm .84$). The results further showed that lecturers of agriculture were incompetent in locating and running computer applications ($2.24 \pm .82$), downloading files from the internet ($2.29 \pm .90$), communicating online with students ($2.15 \pm .83$), retrieving files stored in computer ($2.16 \pm .90$), creating basic presentation ($1.94 \pm .80$), scanning documents ($2.01 \pm .85$), among others.

Table 8: Correlational Matrix of the Relationship Between the Competency of Lecturers in the Application of Digital Technologies for Effective Agriculture Instructional Delivery

		Effective Instruction	Lecturers' Competence
Effective Instruction	Pearson Correlation	1	.998**
	Sig. (2-tailed)		.001
	N	80	80
Lecturers' Competence	Pearson Correlation	.998**	1
	Sig. (2-tailed)	.001	
	N	80	80

** . Correlation is significant at the 0.01 level (2-tailed).

The data presented in the correlational matrix above indicated that there was positive and strong relationship (+.998) between the competence of lecturers in the application of digital technologies and effective instructional delivery (Table 7). The table equally showed that there was a significant relationship (.001) between the competence of lecturers in the application of digital technologies and the effective instructional delivery.

Table 9: Regression Model Summary of the Relationship Between the Competency of Lecturers in the Application of Digital Technologies for Effective Agriculture Instructional Delivery

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.998 ^a	.995	.995	.03109	2.382

a. Predictors: (Constant), Lecturers' Competence

b. Dependent Variable: Effective Instruction

The result presented in regression model summary table above showed that the Pearson correlation coefficient (R) had a value of .998 indicating that the competence of lecturers in the application of digital technologies had a positive and strong relationship with the effective

instructional delivery (Table 9). The coefficient of determination (R-Square) of .995 implied that 99.5% improvement in effective agriculture instructional delivery was accounted by the competence of lecturers in the application of digital technologies. It revealed that the model had a good fit. Similarly, Durbin-watson value of 2.38 indicated that evidence of autocorrelation did not exist in the data set as the value was less than the standard cut-off point of 2.44.

Table 10: ANOVA Analysis of the Relationship Between the Competency of Lecturers in the Application of Digital Technologies for Effective Agriculture Instructional Delivery

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.722	1	15.722	16263.453	.001 ^b
	Residual	.075	78	.001		
	Total	15.797	79			

a. Dependent Variable: Effective Instruction

b. Predictors: (Constant), Lecturers' Competence

Results presented in the ANOVA showed that there was a positive and significant relationship ($P=0.001<0.05$) between lecturers' competence to apply digital technologies and effective instructional delivery (Table 10). This was supported by the F-value of 16263.45 and the associated p-value of .001 at 5% level.

Table 11: t-test Analysis of the Relationship Between the Competency of Lecturers in the Application of Digital Technologies for Effective Agriculture Instructional Delivery

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	T	Sig.	Collinearity Statistics Tolerance	VIF
1	(Constant)	.065	.034		1.919	.059		
	Teachers' Competence	.985	.008	.998	127.528	.001	1.000	1.000

a. Dependent Variable: Effective Instruction

The unstandardized regression coefficient (β) indicated that a unit increase in the teachers' competence to apply digital technology increased effective instructional delivery by .985. It further revealed that there was direct relationship between the competence of lecturers to apply digital technologies and effective instructional delivery. The t-value of 127.528 and the p-value of .001 indicated that there was a significant relationship between the competence of lecturers to apply digital technology and effective instructional delivery. The collinearity statistics as indicated in the tolerance value of 1.00 which was above the standard cut-off point of .10 and supported by the VIF value of 1.00 which was less than the maximum standard cut-off point of 10 indicated that there was no evidence of multicollinearity.

Table 12: Mean Perception of the Respondents on the Frequency of Use of Digital Technologies for Effective Agricultural Science Instructional Delivery

S/N	Frequency of application of the following digital technologies by the lecturers of agriculture	Lecturers		HODs		Overall		Remarks
		$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	
1	Microsoft Office (Microsoft word, Microsoft Excel, PowerPoint, Notepad applications etc)	3.40	.78	3.34	.77	3.37	.78	Often
2	Computer hardware	3.25	.94	3.20	.96	3.23	.95	Often
3	Overhead projectors	1.99	.81	2.21	.85	2.10	.83	Not at all
4	Internet facilities	2.31	.80	2.37	.84	2.34	.82	Not at all
5	e-mail	2.22	.24	2.40	.26	2.31	.25	Not at all
6	Twitter TM	2.15	.77	2.00	.79	2.08	.78	Not at all
7	Photocopying machine	2.35	.94	2.84	.90	2.60	.92	Not at all
8	Public address system	3.45	.86	3.51	.85	3.48	.86	Often
9	Video machine	2.48	.60	2.50	.64	2.49	.62	Not at all
10	Electronic bulletin board	2.06	.83	2.06	.85	2.06	.84	Not at all
11	Geographic information system (GIS)	1.87	.76	1.89	.72	1.88	.74	Not at all
12	Electronic journals/Books	2.09	.91	2.10	.95	2.10	.93	Not at all
13	WhatsApp	3.13	.90	3.15	.91	3.14	.91	Often
	Total	2.52	.78	2.58	.79	2.55	.79	Not at all

Data presented above showed that lecturers of agriculture often apply Microsoft office ($3.37 \pm .78$), computer hardware ($3.23 \pm .95$), public address system ($3.48 \pm .86$) and WhatsApp ($3.14 \pm .91$) in Agriculture instructional delivery. The results further showed that lecturers of Agriculture did not apply overhead projector ($2.10 \pm .83$), internet facilities ($2.34 \pm .82$), e-mails ($2.31 \pm .25$), Twitter ($2.08 \pm .78$), photocopying machine ($2.60 \pm .92$), video machine ($2.49 \pm .62$), electronic bulletin ($2.06 \pm .84$), geographic information system ($1.88 \pm .74$) and electronic journals/books ($2.10 \pm .93$) in Agriculture instructional delivery.

Table 13: Correlation Matrix of the Relationship Between frequency of Use of Digital Technologies and Effective Agriculture Instructional Delivery

		Effective Instruction	Frequency Use
Effective Instruction	Pearson Correlation	1	.999**
	Sig. (2-tailed)		.001
	N	80	80
Frequency of Use	Pearson Correlation	.999**	1
	Sig. (2-tailed)	.001	
	N	80	80

** . Correlation is significant at the 0.01 level (2-tailed).

There was a positive and strong relationship (+.999) between the frequency of the application of digital technologies and effective instructional delivery. The result further

showed that the relationship between the frequency of the application of digital technologies and effective instructional delivery was significant (.001) (Table 13)

Table 14: Regression Model Summary of the Relationship between the Frequency of the Application of Digital Technologies and Effective Instructional Delivery

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.999 ^a	.998	.997	.03729	2.000

a. Predictors: (Constant), Frequency Use

b. Dependent Variable: Effective Instruction

The Pearson correlation coefficient (R) showed that there was a positive and strong relationship (+.999) between the frequency of the application of digital technologies and effective instructional delivery (Table 14). The coefficient of determination (R-Square) of .999 showed that 99.9% increase in effective instructional delivery was accounted by the frequency of the application of digital technologies. It implied that the model had a good fit. The Durbin-watson value of 2.00 showed evidence of no autocorrelation.

Table 15: ANOVA Analysis of the Relationship Between the Frequency of the Application of Digital Technologies and Effective Instructional Delivery

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	43.709	1	43.709	31436.143	.001 ^b
Residual	.108	78	.001		
Total	43.817	79			

a. Dependent Variable: Effective Instruction

b. Predictors: (Constant), Frequency Use

There was a statistically significant relationship ($p=.001<.5$, $F=31436.14$) between the frequency of the application of digital technologies and effective instructional delivery. The hypothesis was therefore, upheld (Table 15).

Table 16: t-test Analysis of the Relationship Between the Frequency of the Application of Digital Technologies and Effective Instructional Delivery

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.013	.022		.602	.549		
	Frequency Use	.995	.006	.999	177.302	.000	1.000	1.000

a. Dependent Variable: Effective Instruction

The unstandardized regression coefficient (β) indicated that a unit increase in the frequency of the application of digital technologies increased effective instructional delivery by .995. The results further revealed that there was direct relationship between the frequency of the application of digital technologies and effective instructional delivery. The t-value of 177.30 and the corresponding p-value of .001 indicated a significant relationship between the

frequency of the application of digital technologies and effective instructional delivery. The collinearity statistics as indicated in the tolerance value of 1.00 which was above the standard cut-off point of .10 and supported by the VIF value of 1.00 which was less than the maximum standard cut-off point of 10 indicated that there was no evidence of multicollinearity (Table 16).

Table 17: Relationship between the Demography of the Respondents and Effective Agricultural Instructional Delivery

		Effective Instruction	Gender of the Respondents	Age of the Respondents	Working Experience
Effective Instruction	Pearson Correlation				
	Sig. (2-tailed)				
	N	80			
Gender of the Respondents	Pearson Correlation	-.170			
	Sig. (2-tailed)	.132			
	N	80	80		
Age of the Respondents	Pearson Correlation	.963**	-.138		
	Sig. (2-tailed)	.001	.223		
	N	80	80	80	
Working Experience	Pearson Correlation	.966**	-.127	.996**	
	Sig. (2-tailed)	.001	.261	.001	
	N	80	80	80	80

** . Correlation is significant at the 0.01 level (2-tailed).

A negative and weak relationship existed between the gender and effective instructional delivery (-.17). The relationship was also not significant (.13). There was a positive and strong relationship between age of the respondents and effective instructional delivery (+.963) and the relationship was significant (.001). Furthermore, a positive and strong relationship existed (+.966) between the working experience of the lecturers of agriculture and effective instructional delivery. The relationship was equally significant (.001) (Table 17).

Table 18: Regression Model Summary of the Relationship Between the Frequency of the Application of Digital Technologies and Effective Instructional Delivery

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.967 ^a	.935	.932	.11620	1.792

a. Predictors: (Constant), Working Experience, Gender of the Respondents, Age of the Respondents

b. Dependent Variable: Effective Instruction

The Pearson correlation coefficient (R-value) of .967 in the model summary above showed that there was a strong and positive relationship between the gender, age, working experience of the lecturers of agriculture and effective agriculture instructional delivery. The coefficient of determination (R-Square) of .935 showed that 93.5% improvement in agriculture instructional delivery was jointly explained by gender, age and working experience of the agriculture lecturers. This showed that the model had a good fit. The Durbin-watson value of

1.79 showed that it had no evidence of autocorrelation as it did not exceed the standard limit of 2.44 (Table 18).

Table 19: ANOVA Analysis of the Relationship Between the Frequency of the Application of Digital Technologies and Effective Instructional Delivery

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	14.771	3	4.924	364.662	.001 ^b
	Residual	1.026	76	.014		
	Total	15.797	79			

a. Dependent Variable: Effective Instruction

b. Predictors: (Constant), Working Experience, Gender of the Respondents, Age of the Respondents

The result confirmed that the overall regression model was significant. This was indicated by the F-statistics of 364.66 and the associated p-value of .001 ($p=.001<.05$, $F=364.66$), that was found to be significant at 5% level (Table 19).

Table 20: t-test Analysis of the Relationship Between the Frequency of the Application of Digital Technologies and Effective Instructional Delivery

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.266	.137		1.947	.055		
	Gender of the Respondents	-.020	.012	-.048	-1.619	.110	.967	1.035
	Age of the Respondents	.001	.341	.001	-.001	.999	.007	143.385
	Working Experience	.949	.345	.960	2.746	.008	.007	142.976

a. Dependent Variable: Effective Instruction

The unstandardized regression coefficient (β) as indicated in Table 20 showed that gender had a negative relationship with the effective instructional delivery (-.02) (Table 38). It further revealed that there was an inverse relationship between gender and effective instructional delivery. The t-value of -1.62 and the corresponding p-value of .11 showed that gender had no significant relationship with the effective instructional delivery. The collinearity statistics showed no evidence of multicollinearity as the tolerance value was .97 which was above .10 and the VIF value was 1.04 which was less than 10. Furthermore, the unstandardized regression coefficient for the age showed that a unit increase in age improved effective instructional delivery by .001. The t-value of -.001 with the associated p-value of .999 showed that there was no significant relationship between age and effective instructional delivery. There was evidence of multicollinearity as the tolerance value of .007 was less than the standard cut-off point of .10 and supported by the VIF value of 143.39 which was greater than 10. The unstandardized regression for the working experience showed that a unit increase in the

working experience increased effective instructional delivery by .949. The t-value of 2.75 and the associated p-value of .008 ($p=.008<.05$, $F=2.75$) indicated that there was a positive and significant relationship between the working experience and effective instructional delivery. The collinearity statistics in the coefficient table showed that there was evidence of multicollinearity as indicated by the tolerance value of .007 which was less than the cut-off point of .10 and supported by the Variance Inflation Factor (VIF) value of 142.97 that was above the cut-off point of 10 (Table 20).

Table 21: Mean perception of the Respondents on the Challenges Encountered by the Lecturers of Agriculture in the Application of Digital Technologies for Effective Agriculture Instructional Delivery

S/N	Challenges in the application of digital technologies	Lecturers		HODs		Overall		Remarks
		$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	
1	Inadequate access to appropriate digital facilities	3.85	.40	3.89	.39	3.87	.40	Agree
2	Insufficient time for training	2.32	.67	2.36	.69	2.34	.68	Disagree
3	Negative attitude to ICTs in Agricultural science	3.87	.63	3.86	.67	3.87	.65	Agree
4	Inconsistent power supply	3.53	.55	3.55	.59	3.54	.57	Agree
5	ICTs fear and anxiety	3.33	.75	3.37	.79	3.35	.77	Agree
6	Inadequate ICTs Technical support staff	3.50	.50	3.52	.56	3.51	.53	Agree
7	Poor funding of ICTs in institutions	3.35	.68	3.39	.70	3.37	.69	Agree
8	Inadequate encouragement of lecturers for the use of ICTs	3.81	.39	3.80	.41	3.81	.40	Agree
9	Poor computing skills of the lecturers	4.40	.60	4.44	.58	4.42	.59	Agree
10	High cost of digital technologies	3.52	.54	3.54	.56	3.53	.55	Agree
11	Inability of lecturers to promote students' interest in ICTs	2.82	.60	2.86	.64	2.84	.62	Disagree
Total		3.48	.57	3.51	.60	3.50	.59	Agree

Results presented above showed the challenges encountered by the lecturers of agriculture in agriculture instructional delivery to include inadequate access to appropriate digital facilities ($3.87\pm.40$), negative attitude to ICTs ($3.87\pm.65$), inconsistent power supply ($3.54\pm.57$), ICTs fear and anxiety ($3.35\pm.77$), inadequate ICTs technical support ($3.51\pm.53$), poor funding ($3.37\pm.69$), inadequate encouragement of lecturers ($3.81\pm.40$), poor computing

skills ($4.42 \pm .59$) and high cost of digital technologies ($3.53 \pm .55$). The results further showed that insufficient time for training ($2.34 \pm .68$) and inability of the lecturers to promote students' interest in ICTs ($2.84 \pm .62$) were not challenges encounters by the lecturers of agriculture in Agriculture instructional delivery (Table 21).

Table 22: t-test of the Challenges Encountered by the Lecturers of Agriculture in the Application of Digital Technologies for Effective Agriculture Instructional Delivery

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Scores	Equal variances assumed	.582	.448	-1.761	78	.082	-.27375	.15542	-.58317	.03567
	Equal variances not assumed			-1.590	20.663	.127	-.27375	.17220	-.63222	.08472

The t-value of -1.76 and the p-value of .082 indicated that there was no statistically significant difference ($p=.082 > .05$, $t=-1.76$) in the perception of lecturers of agriculture and HODs on the challenges encountered by the lecturers of agriculture in the application of digital technologies for effective Agriculture instructional delivery. The hypothesis was therefore not upheld.

Discussion

Application of digital technologies helped to reduce learners' boredom, improved learners' performance, used as visual aids for learners, helpful in the analysis of learners' performance, made interaction of lecturers and students after classroom instructions easier, saved time in production of class notes, exposed learners to new learning strategies, proper keeping of students' records and made lessons more interesting. There was a positive, strong and significant relationship between the application of digital technologies and effective instructional delivery. The 81.1% improvement in agriculture instructional delivery was explained by the application of digital technologies. This showed that the model had a good fit.

Ogar et al. (2025) discovered that the application of digital technology helped in broadening access to quality education, increased the effectiveness of teachers, enhanced individualized learning and bridged rural-urban divide. Integration of digital technologies in agricultural instructional delivery had the abilities to facilitating instructional delivery thereby enhancing learning outcome among the students (Vincent-Riwo & Nwosu, 2022). It was found that the combination of digital technology and conventional instructional delivery systems yielded a comprehensive educational experience that accelerate students' academic achievement and retention (Olajide, 2024).

Lecturers of agriculture were competent in connecting computer and its peripherals, accessing information on CD/DVD, opening a new document in Microsoft words office and attaching files to outgoing mails. Lecturers of agriculture were incompetent in locating and running computer applications, retrieving files stored in computer, creating basic presentation, scanning documents, among others. There was a positive, strong and statistically significant relationship between the competence of lecturers in the application of digital technologies and effective instructional delivery. A unit increase in the teachers' competence to apply digital technology increased effective instructional delivery by 98%. This showed that the model had a good fit. Weke (2018) reported that digital competent teachers are trained to apply digital technologies to enhance instruction and should be able to provide education services that would enhance learning experiences of the students. A substantial association was found among teachers' digital proficiency, their instructional delivery efficacy and students' learning outcome in higher education (Irum, et al., 2024). Regular supervision and professional development programmes were critical to improving teachers' digital competences for the actualization of technology-driven classrooms and learners' performance in schools and colleges (Ukala & Adieme, 2025).

Lecturers of agriculture often applied Microsoft office, computer hardware, public address system and WhatsApp in Agriculture instructional delivery. However, lecturers of Agriculture did not apply overhead projector, internet facilities, e-mails, Twitter), photocopying machine, video machine, electronic bulletin, geographic information system and electronic journals/books in Agriculture instructional delivery. There was a positive, strong and statistically significant relationship between the frequency of the application of digital technologies and effective instructional delivery. The 99.9% increase in effective instructional delivery was accounted by the frequency of the application of digital technologies. This showed that the model had a good fit. Nasrudin and Nasrudin (2025) reported that lecturers apply

rudimental ICT applications like Microsoft Word, PowerPoint, email, and internet browsing, while allergic to the use of advanced applications like database systems, plagiarism detection software, and multimedia design applications. It was found that students moderately utilize digital instructional technologies, where the highest levels of usage was recorded lecture videos and academic social media groups (Macaulay & Akpan, 2025). There was a positive and significant relationship between lecturers' frequency of digital technology utilization for teaching and the lecturers' professional competence (Uko & Uko, 2024).

Challenges encountered by the lecturers of agriculture in the application of digital technologies to include inadequate access to appropriate digital facilities, negative attitude to ICTs, inconsistent power supply, ICTs fear and anxiety, inadequate ICTs technical support, poor funding, inadequate encouragement of lecturers, poor computing skills and high cost of digital technologies. There was no statistically significant difference in the challenges encountered by the lecturers of agriculture in the application of digital technologies for effective Agriculture instructional delivery. Srivastava and Dey (2018) noted that poor access to digital technologies and network connectivity, poor technical support and inadequate training of teachers were the challenges limiting the application of digital technologies in classroom instruction. The findings were in agreement with Ogunbodede, et al. (2023) who reported that lecturers experience hardship in digital skills acquisition due to inadequate opportunity for ICT training, expensive nature of ICT literacy training, insufficient ICT facilities and lack of sponsorship. Evidence had shown that there were persistent gaps in teachers' technical and pedagogical ability to use digital technologies to effectively enhance learning outcomes of students in the classroom environment (OECD, 2025). The use of digital technologies in instructional delivery was affected by incessant nature of power supply, inadequate computer hardware, poor funding, and lack of in-service training of lecturers to utilize modern technology (Onuegbu, 2020). The ability of teachers to maximize the application of digital technology for instruction was hindered by insufficient devices, unreliable internet connectivity, power interruptions, and gaps in digital literacy among the lecturers (Salgado & Paglinawan, 2025).

Conclusion

Application of digital technologies as tools for transformative agriculture instructional delivery is paramount to improving the quality of education and equipping the graduates. It was found that digital technologies improve instructional delivery. The lecturers' ability to apply digital technologies, competency of lecturers to the application of digital technologies and frequency

of application of digital technologies, all affect instructional delivery abilities of the lecturers in agriculture. Digital technologies as modern tools for instructional delivery promote students' comprehension, increase agricultural skills acquisition and improve their agrepreneural engagement for food security.

Recommendations

Based on the findings, it was recommended that:

1. Education policy makers should integrate digital technologies application policy into Universities education system.
2. Universities should upskill their lecturers under continuous professional development to acquire digital technology skills in applying the technology in classroom teaching and learning.

Declaration of Interest

The authors have no potential conflict of interest to declare

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