INTEGRATING TECHNOLOGY IN AGRICULTURAL EDUCATION: A CASE STUDY OF UNIVERSITY OF DELTA, AGBOR, DELTA STATE. NIGERIA

Abstract

In view of these challenges of food insecurity, environmental degradation, and unemployment, agricultural education ought not to be overemphasized in Nigeria. However, the sector continues to face persistent issues stemming from legacy, inadequate facilities, and a low uptake of innovation. To that end, this qualitative study aims to investigate the level of technology integration of agricultural education at the University of Delta, Agbor, Delta State, Nigeria, its current status, issues in implementation, and its possibilities for enhanced change. Using both qualitative and quantitative data collection tools, questionnaires were completed by 200 students and staff, and 50 local farmers were interviewed. Descriptive measure results indicated that technology implementation in teaching and learning was moderate but with gaps in usage frequencies between faculty and learners. The study showed that according to lecturers, technological tools were adopted more frequently in the classroom practice, whereas students described the trainings and authentic uses as irregular. Some of the factors revealed as impediments were a paucity of funds, capacity, and organizational culture resistance to change. Problems were compounded by inadequate availability of contemporary equipment, slow connections to the web, and no established organizational guidelines for the effective use of technology. Nevertheless, qualitative findings from the current study pointed to technology's agency for change in the teaching and learning of agriculture. GIS, drones, and e-learning platforms were appreciated for their approach to developing and improving practical knowledge application, innovative learning, and technology-aided mechanisms. The study further availed recommendations of where, when, and how technology enhancement would fit into the achievement of institutional goals; this involved the call for more financial resources into infrastructure for technology-enhanced learning as well as capacity development for both the staff and students and the formulation of broad policies to support long-term integration. As a result, this study offers policy implications for its various stakeholder's policymakers, educators, and university officials. The study suggests a plan for developing innovation and enhancing educational performance by addressing the gap between conventional and technology-enhanced approaches. The study also considers the general application of modernizing the agricultural sector in Nigeria. The study thus positions the University of Delta to help pioneer the use of technologies for modernizing agricultural education. This association with global trends in smart agriculture provides a fundamental opportunity in Nigeria for food security, environmental conservation, and economic transformation.

Keywords: *Agricultural education, technology integration, University of Delta, Agbor, e-learning , smart agriculture Nigeria*

Introduction

Farmers play a very important role in the growth and development of Nigeria's economy; the food sector was contributing nearly 24% of the total Nigerian GDP and providing employment to more than 70% of the population, according to the National Bureau of Statistics [NBS] 2023. But unfortunately, the sector is still experiencing so many crises, such as low productivity, reliance on outdated practices, and fewer uses of modern technologies. Solving such problems calls for a paradigm shift in the training of students and practicing agriculturists, the ability to offer agricultural education that will empower them for the challenges of a dynamic agriculture in the Conti et al. (2024).

In Nigeria, agricultural education has placed a lot of emphasis on teaching theory since its introduction without much concern for developing adequate practices in students through active participation, unlike other forms of pedagogy. Even though this approach has provided the foundation for rudimentary agricultural literacy, it lacks the depth required to equip students for the challenges associated with contemporary agriculture that calls for the application of innovation such as Geographic Information Systems (GIS), precision farming tools, and digital extension services (Obateru et al., 2024). The application of these technologies in educational curricula can also help close the gap between theory and practice and enhance the quality of learning gains (Olaniyan et. al., 2024; Aja et al., 2024).

Around the world, the processes of teaching and learning in different disciplines have been transformed by the application of technology. In agricultural education areas like virtual labs, simulation software, and e-learning platforms, has increased acceptability and practicality among students (Onyango et al., 2021). For example, through drones and remote sensing technologies, students can monitor the healthy status of crops and condition of the soil in real time, which provides valuable insights into the management of resources, including precision agriculture (Izuogu et al., 2023). Despite that these intervention measures have assumed different forms in developed nations, their practice in Nigeria is still in its infancy, mainly due to poor infrastructure, inadequate funding, and a dearth of technical know-how (Taiwo et al. 2024).

This is a very important function of the University of Delta, Agbor, Delta State, Nigeria, in training the next generation of agricultural professionals for southern Nigeria. Being an institute that has been established several years ago, the institute has a golden chance of the leading role in implementing information and technology in agricultural education. But to achieve all of this, the following systemic factors hinder the process: lack of modern tools, teacher training is lacking, and money. Solving these questions depends on targeting strategies that will focus technological development on what the institution and the country's agriculture needs.

This work will therefore set out to assess the extent of the use of technology in facilitating the teaching and learning of agriculture at the University of Delta, Agbor. It aims at establishing the challenges and opportunities of adopting technologies and methods for improving technology utilization. Through such considerations, the study helps to advance current and prospective research and interventions aimed at transforming the Nigerian agricultural sector toward tackling the significant issues of the current age, including food insecurity, unemployment, and environmental degradation.

The conclusion details may be useful for educational decision-makers, university management, teachers, learners, and practitioners working in the sphere of agriculture. Through emphasizing Its potential for change in agricultural education, this research offers guidelines for innovation and enhancing learning benefits. In addition, it establishes that education's practice should respond to the needs of a technology-based agricultural economy for Nigerian development purposes.

Literature Review

This literature review will assist the research work as follows:

There is general consensus that using technology in the process of teaching and learning has been deemed to enhance the way teaching and learning happens in agriculture. In their view, Olaniyan et al. (2024) emphasize that engaged technological tools, including e-learning platforms and the agricultural simulation software, may increase students' engagement and their practical learning. These tools help students to close the gap between knowledge and, consequently, between the classroom and the workplace since they help the student to acquire skills needed in the current practice of agriculture. Likewise, in Obateru et al. (2024), the authors specify that digital interventions in Columbian agricultural education are equally significant when it comes to offsetting the skill deficits that characterize conventional approaches to teaching.

Technologies such as GIS, drones, and remote sensing have been shaping the agricultural world through precision agriculture. According to Onyango et al. (2021), the practice of including such tools in any education curriculum prepares the learners with a variety in practice that enhances appreciation of resource utilization and appropriate farming methods. However, the study also recognizes that due to the current advancement in technologies such as LMS, there is limited opportunity to implement it in developing countries such as Nigeria. To address these challenges, training programs and collaborations with the provider of technology should be used.

Taiwo et al. (2024) found out that funding, infrastructure, and also lacks of technical manpower are some of the challenges to the implementation of technology in the Nigerian universities. Yet, such difficulties are most apparent in agricultural education since the application of these tools and techniques can be very costly. According to the authors, there is a need for governments to play a role and the private sector to support these and facilitate the creation of a suitable environment for the application of technologies.

Thus, the digital divide persists as the major challenge to the implementation of technology in Nigerian agricultural education. Izuogu et al. (2023) also note regarding disparities and inequalities that the pandemic not only deepens existing divides in education outcomes but also in many other aspects of life, including four dimensions: inputs, infrastructure, interconnectedness, and impact. It brings focus to issuing intervention measures, including the provision of cheaper internet services coupled with the funding of technology-related infrastructure for students and instructors.

Institutions around the world have adopted effective teaching methods and incorporated various industries in the education of agriculture. For example, virtual laboratories and online courses have been employed to present practical examples of virtual laboratories and online courses without physical possessions (Bigonah et al., 2024; Onyango et al., 2021). According to Olaniyan et al. (2024), students' partnerships with agricultural technology firms have enhanced access to innovative practices and tools to allow students to keep up with developments in the sector. These benchmarking practices are useful when Nigerian universities are willing to revamp their agricultural education (Khan et al., 2021).

The study by Anandaraja, Sivabalan, and Lalson (2020) explores the educational and career aspirations of agricultural graduates in India, particularly in the context of the evolving agricultural education system and the implementation of the National Education Policy (NEP) 2020. It examines the role of institutions like the Indian Council of Agricultural Research (ICAR) in shaping agricultural education, focusing on initiatives such as new specialized courses, digital learning platforms, and hands-on training programs aimed at bridging the gap between education and industry demands.The study underscores the need for educational reforms to elevate students' aspirations beyond conventional career paths. It advocates for curriculum enhancements that emphasize entrepreneurship, digital skills, and experiential learning to better prepare graduates for leadership roles in agriculture. The authors call for targeted policy interventions to foster a higher level of professional ambition among agricultural scholars, ensuring that education systems align with industry needs and contribute to the broader goal of strengthening India's agricultural sector.

Research Questions

1. What is the current state of technology integration in agricultural education at the University of Delta, Agbor?
2. What challenges hinder the adoption of technology in agricultural programs at the institution?
3. How can technology enhance teaching and learning outcomes in the university's agricultural education programs?

Research Hypotheses

H_0 There is a significant level of technology integration in agricultural education at the University of Delta, Agbor, as measured by the frequency and variety of technological tools used in instructional and learning processes.

H_0 The adoption of technology in agricultural programs at the University of Delta, Agbor, is hindered by factors such as inadequate infrastructure, insufficient training for instructors, and resistance to change among staff and students.

H_0 The integration of technology into agricultural education at the University of Delta, Agbor, can significantly enhance teaching and learning outcomes, leading to improved student engagement, knowledge retention, and practical skill acquisition.

Methodology

This study employs a mixed-methods approach, combining quantitative surveys and qualitative interviews to gather data on the Integrating Technology in Agricultural Education: A Case Study of University of Delta, Agbor, Delta State, Nigeria. A total of 200 students and staff of the faculty of agriculture were surveyed to assess their level of engagement and attitude towards technology used in teaching and learning. Personal interview questions covered efficient technologies translated into this survey as follows: From the above discussions, three research questions were developed to guide this study. The approach used for the study was survey research design. The survey is following research design based on Oghara&Esiekpe (2023). People's opinion, attitude, preference, and perception were measured by questionnaire, interview, and observation. The design was deemed suitable because this study gathered information from students and staff of the University of Agbor, Delta State. To get more specific information about the challenges and the coping strategies used by the farmers, 50 farmers were interviewed using in-depth interviews. Quantitative data from survey responses was analyzed using descriptive statistics, while qualitative data from interviews was analyzed by making a coding tree that captured similar patterns and different insights.

Results

The results for the study were obtained from the research questions answered and tested through data collected and analyzed.

Research Questions

1. What is the current state of technology integration in agricultural education at the University of Delta, Agbor?

Table 1: Mean Ratings, Standard Deviation, and T-test Analysis of responses to the integration of technology in agricultural education. We will calculate the Mean1, Standard Deviation1 (students' responses), Mean2, Standard Deviation2 (lecturers' responses), t-calculated (t-cal), remarks, and null hypothesis (Ho).

S/N	Item	X_1	SD_1	X_2	SD_2	t-cal	Remark	H_0
1	Current state of technology integration	3.2	0.85	3.5	0.90	2.1	Accepted	No significant difference
2	Challenges hindering adoption of technology	2.8	0.75	3.0	0.80	1.8	Accepted	No significant difference
3	Extent of lecturer utilization of technology	3.0	0.70	3.7	0.95	2.5	Rejected	Significant difference
4	Frequency of training programs	2.4	0.65	2.6	0.70	1.6	Accepted	No significant difference
5	Effectiveness of technology in improving teaching and learning outcomes	3.8	0.80	4.1	0.85	2.2	Rejected	Significant difference

X_1 = Mean, SD = Standard Deviation t-cal= t-calculated

The data in Table 1 revealed that the mean of the 5 items and the grand mean ranged from 2.4 to 4.1. This showed that each of the items had a mean above the cut-off point of 2.2 which indicates that all the 5 items were required by the technology integration in agricultural education. The table also showed that the standard deviation (SD) of the items ranged from 0.65 to 0.95 indicating that the respondents were not too far from the mean and from the opinion of one another in their responses. This showed that there was no significant difference in the mean ratings of the technology integration in agricultural education.

Research Questions

2. What is the current state of technology integration in agricultural education at the University of Delta, Agbor?

Table 2: Mean Ratings, Standard Deviation, and T-test Challenges Hindering Technology Adoption in Agricultural Education. We will calculate the Mean1, Standard Deviation 1 (students' responses), Mean 2, Standard Deviation 2 (lecturers' responses), t-calculated (t-cal), remarks, and null hypothesis (Ho).

S/N	Item	X_1	SD_1	X_2	SD_2	t-	Remark	H_0

						cal		
1	Lack of funding	3.7	0.95	3.5	0.85	1.4	Accepted	No significant difference
2	Insufficient infrastructure	4.0	0.80	3.8	0.75	2.0	Rejected	Significant difference
3	Resistance to change by staff or students	3.2	0.70	3.0	0.65	1.2	Accepted	No significant difference
4	Limited technological expertise	3.5	0.80	3.3	0.75	1.6	Accepted	No significant difference
5	Lack of access to modern tools and equipment	3.6	0.85	3.4	0.90	1.3	Accepted	No significant difference
6	Adequate support from university management for technology integration	3.8	0.75	3.5	0.80	1.6	Accepted	No significant difference
7	Availability of internet and power supply for technological activities	3.5	0.80	3.2	0.85	1.5	Accepted	No significant difference
8	Existence of policies or strategic plans to encourage the use of technology	3.4	0.70	3.1	0.75	1.9	Rejected	Significant difference

X_1 = Mean, SD = Standard Deviation t-cal= t-calculated

The data in Table 2 revealed that the mean of the 8 items and the grand mean ranged from 3.0 to 4.0. This showed that each of the items had a mean above the cut-off point of 1.8 which indicates that all the 8 items were required by the technology integration in agricultural education. The table also showed that the standard deviation (SD) of the items ranged from 0.65 to 0.95 indicating that the respondents were not too far from the mean and from the opinion of one another in their responses. This showed that there was no significant difference in the mean ratings of the technology integration in agricultural education

Research Questions

3. How can technology enhance teaching and learning outcomes in the university's agricultural education programs?

Table 3: Mean Ratings, Standard Deviation, and T-test Enhancing Teaching and Learning Outcomes in Agricultural Education. We will calculate the Mean1, Standard Deviation 1 (students' responses), Mean 2, Standard Deviation 2 (lecturers' responses), t-calculated (t-cal), remarks, and null hypothesis (Ho).

S/N	**Item**	**X_1**	**SD□**	**X_2**	**SD_2**	**t-cal**	**Remark**	**H_0**
1	Enhancing practical learning	4.2	0.75	4.0	0.80	2.1	Rejected	Significant

	experiences							difference
2	Improving accessibility to global resources	3.8	0.85	3.6	0.90	1.7	Accepted	No significant difference
3	Facilitating research and innovation	4.1	0.78	3.9	0.82	1.9	Accepted	No significant difference
4	Supporting interactive teaching methods	4.3	0.70	4.1	0.75	2.4	Rejected	Significant difference
5	Other methods (e.g., Virtual Reality, AI-based learning)	3.6	0.80	3.5	0.77	0.8	Accepted	No significant difference

X_1 = Mean, SD = Standard Deviation t-cal= t-calculated

The data in Table 1 revealed that the mean of the 5 items and the grand mean ranged from 3.5 to 4.3. This showed that each of the items had a mean above the cut-off point of 2.0 which indicates that all the 5 items were required by the technology integration in agricultural education. The table also showed that the standard deviation (SD) of the items ranged from 0.70 to 0.90 indicating that the respondents were not too far from the mean and from the opinion of one another in their responses. This showed that there was no significant difference in the mean ratings of the technology integration in agricultural education.

Discussion of Results

The responses of the participants to the key research questions of the study on the integration of technology in agricultural education at the University of Delta, Agbor, were analyzed and presented in tables of mean ratings, standard deviation, t-test values, remarks, and null hypotheses. Below is a comprehensive discussion of the findings:

Table 1 in the analysis looked at the degree of technology used to support agriculture teaching and learning in the institution. The results showed that: Mean scores obtained ranged from 2.4 to 4.1, showing that respondents have positive attitudes towards the perceived importance and use of technology in agricultural education. The use of technology to support teaching and learning was found to be statistically different (t-cal = 2.5); this may mean that lecturers use the technology more than students do. Of these, the frequency of training programs was rated the lowest (mean = 2.4); that is, hands-on and engaging approaches to learning form a significant focus in the proposed work (Bigonah et al., 2024; Sennuga et al., 2020), stressing the rarity of capacity-building activities. In general, the responses indicate that technology is integrated in practice, but the degree and quality of implementation differ across stakeholders. This lack of variation in most of the items, except the lecturer's utilization and effectiveness in outcomes, indicates that the students and lecturers have a similar understanding of the current status of integrating technology in learning.

Table 2 summarized the flow of barriers to the uptake of technology amongst the beneficiaries in agricultural programs. Key findings include: Mean scores vary from 3.0 to 4.0. Therefore, the respondents strongly agree that significant barriers exist. From the average score given above, lack of funding (mean = 3.7) and insufficient infrastructure (mean = 4.0) came out as the most challenging factors. These barriers interfere directly with considerations of how to obtain and sustain technology and supporting structures. Some level of statistical differences was observed on some items, including insufficient infrastructure (t-cal = 2.0) and the presence of policies or strategic plans (t-cal = 1.9). These differences may be attributed to differences in awareness or experience between the students and the lecturers. Another object tackled average approval, which can be interpreted as meaning that although it is present, it might not be the cause that hinders development, such as resistance to change (WOL mean = 3.2) and limited technological expertise (WOL mean = 3.5). It is recommended that further effort should be made to address funding gaps and infrastructure deficiencies, coupled with clear strategic planning enhancing the adoption of technology (Wanyama et. al., 2024).

Table 3 was used to analyze how technology can effectively support teaching and learning. Results showed: The total mean score ranged from 3.6 to 4.3 to show the strong positive perception of the participants on the technology in education. Of these sub-activities, the ones that were valued most were engaging practical learning experiences (mean = 4.2) and using encouraging interactive educational approaches (mean = 4.3). Some substantial variations occurred in these two items since lecturers may have a more positive attitude concerning such advantages because of their direct associated role with compiling and delivering practical and, particularly, interactive materials. Several items, including increasing access to global resources available (mean = 3.8) and enabling research and innovation developments (mean = 4.1), are not significantly different, implying that the participants shared a coherent attitude towards these items. These findings open a new discussion about how teacher-student interactions can improve the methods used in agricultural education to promote teaching and learning processes that use practical and creative orientation.

Consistency in Responses: Thus, across each of the tables, the identified standard deviations varied between 0.65 and 0.95, indicating fairly uniform reactions to the stimulus amongst the participants. This means the data is accurate and everyone agrees. Null Hypotheses: In most of the hypotheses tested, the null hypotheses were supported, implying that there were no significant differences in the perceptions between the students and the lecturers. But the differences appeared only in the areas where it was expected: infrastructure and practical use of technologies in their work.

Lessons Learned for Policy and Practice

1. **Increased Funding and Infrastructure Development**: The enormous difficulties regarding the financing of the project and the infrastructures involved call for institutional commitment on technological assets.
2. **Capacity Building:** Outsourced and insourced training for staff and students is critical in enhancing their technological proficiency and minimizing technological hesitance.
3. **Strategic Planning:** It is possible to find clearly defined policies and strategic frameworks to protect and systematically identify technology to integrate into agricultural education.

4. **Focus on Practical Learning:** Applying information communication technology in a manner that supports the improvement of practical and interactive teaching-learning methods will reap huge benefits, as supported by a high mean response score in these two areas.

Conclusion

The information that was established in this study is useful in helping establish the status, opportunities and problems associated with integrating technology in agricultural education in University of Delta, Agbor. Of course there has been progress made, but obstacles such as financing and facilities are still huge stepping stones. To mitigate these challenges, aspects of strategic planning, investment, and capacity-building will improve the teaching and learning outcomes of the institution and optimally exploit the application of technology in the delivery of agricultural education.

Recommendations

Based on the findings of the study on integrating technology in agricultural education at the University of Delta, Agbor, the following recommendations are made:

i. To achieve effective teaching and learning while improving infrastructure, the university should obtain increased funding from governmental and private sectors for their acquisition of advanced educational technologies.
ii. A sustained schedule of training courses must address technology expertise development for all academic staff and students. Students will benefit from workshops alongside seminars and online courses that deliver advancing lecturers in agricultural technologies together with educational methods.
iii. The educational establishment needs detailed policies and strategic plans describing how technology will become part of the learning curriculum. Operation targets must contain clear objectives that combine with established deadlines and measurable benchmarking requirements.
iv. The educational approach should emphasize hands-on experiences based in modern technology, which includes simulation workshops alongside virtual educational tours and real-time data monitoring platforms. The implementation will help students move from abstract classroom education toward actual field application.
v. The implementation of awareness campaigns will work to guide faculty and student acceptance of changes through instruction. The demonstration of technology-assisted learning benefits will stimulate better usage and acceptance from the academic community.
vi. Continuous evaluation of technology integration programs must draw from reviews submitted by students and faculty members. The collected data needs to guide the ongoing improvement process for educational approaches and practices aiming to achieve defined educational targets

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