International Journal of Agricultural and Home Economics Education (IJAHEE)
Vol. 11 No. 2, 11-25 (December 2024)
ISSN: 2971-639X (Online)
ijvocter.com

Lecturers' Perceptions on the Integration of Artificial Intelligence Technology into Agricultural Education in Universities in Southeast Nigeria

Olorkor N. (PhD) & Gideon, Nwabueze Monday
Department of Agric. /Vocational Education
Michael Okpara University of Agriculture Umudike, Abia State Nigeria
Correspondence: gideonnwabuezemonday@gmail..com

Received: August 12, 2024|**Accepted:** December 2, 2024|**Published**: December 30, 2024

Abstract: *This study explored lecturers' level of awareness, perceived potentials, and anticipated barriers on the integration of AI technologies into Agricultural Education. A sample of 56 lecturers from universities in Southeast Nigeria participated in this descriptive exploratory study. Data was collected using a structured questionnaire, and the findings were analyzed using descriptive statistics. The results revealed that a substantial portion of Agricultural Education lecturers had limited awareness of AI technologies, with 44.29% demonstrating no awareness and 24.06% having slight awareness. However, 17.5% showed moderate awareness, 8.86% had high awareness, and 5.29% were very aware. While there was a general moderate awareness of integration of AI technologies, there were variations in awareness levels for specific technologies. Among others, results of this study also indicated that lecturers recognized AI's capacity to enhance program efficiency, improve educational content, offer personalized learning experiences, tailor content to individual needs, and enhance assessment methods. However, lecturers perceived several barriers to integrating AI technologies into Agricultural Education. These barriers included a lack of technical infrastructure, initial acquisition costs, financial constraints, resistance from peers, lecturers' lack of training, concerns about data privacy and security, the displacement of traditional teaching methods, students' limited awareness, regulatory and compliance challenges, difficulty finding AI-based educational resources, student resistance to AI methods, ethical dilemmas, lack of institutional support and policies, and the time and effort required for planning and implementation. Based on the findings of this study, researchers recommend the need for government and university administrators to provide a comprehensive training and capacity building of lecturers, and necessary infrastructures that would enable the integration of emerging AI technologies into Agricultural Education.*

Keywords: Education, Agricultural Education, AI, Emerging AI technologies, Awareness, Potentials, Barriers

Citation: Olorkor & Gideon (2024). Lecturers' Perceptions on the Integration of Artificial Intelligence Technology into Agricultural Education in Universities in Southeast Nigeria. *International Journal of Agricultural and Home Economics Education*, 11(2), 11-25

Background

Artificial intelligence (AI) is one of the emerging technologies globally. It is progressively and consistently taking over tasks once performed by humans. Ahngar *et al.* (2022) asserted that AI involves mimicking human intelligence in computer systems that are programmed to emulate human thought and behavior, encompassing abilities such as learning and problem-solving. Similarly, evidence from some studies shows that AI exert significant influence on our daily existence, expanding our capabilities and enabling us to make changes in our surroundings, and also in various sectors of the economy (Gandhi *et al.,* 2020; Kundalia *et al.,* 2020). Indisputably, the advent of AI technologies has led to a profound revolution in numerous global industries (Talaviya *et al.,* 2020), including education (Bailey, 2023).

According to Nwana in Chan and Tsi (2023), the application of AI in the field of education can be traced back to the 1950s when computer-assisted instruction was introduced. Thus, authors argue that since then, it has evolved into intelligent tutoring systems (ITS), which have now become a common tool for teaching and learning in institutions. Presently, a wide array of AI technologies, ranging from ITS providing one-on-one tutoring to virtual teaching assistants, are being actively utilized in the realm of education. In their review of AI research in education, Goksel & Bozkurt (2019) identified three principal themes that have garnered substantial attention from researchers: adaptive learning, expert systems and ITS, and the future role of AI in educational processes. These themes also underscore the prevailing trends in AI development within the field of education.

Studies examining the integration of AI in education have explored various forms of AI deployment in classroom settings, emphasizing the advantages they offer in terms of student learning. Beyond ITS, dialogue-based tutoring systems powered by natural language processing can be harnessed to facilitate collaborative knowledge construction as students engage in conversations with AI (UNESCO, 2021). Web-based AI systems can also deliver personalized feedback and manage administrative tasks that were previously handled by human teachers (Chen, Chen, & Lin, 2020). The authors further pointed out that natural language processing and machine learning, such as AI-driven language learning platforms, are the most widely adopted AI methods in education due to their effectiveness. As AI technologies continue to advance, they hold considerable promise for personalized and adaptive learning, real-time feedback, and intelligent administrative and support systems (Renz, Krishnaraja, & Gronau, 2020). This liberation of educators from time-consuming tasks allows them to focus on higher-level responsibilities like curriculum development and student mentoring.

In addition to traditional computer-based AI systems, evidence in some literature indicate that innovative technologies like humanoid robots, chatbots, and virtual reality systems are being integrated into the educational process (UNESCO, 2021, ThinkML Team, 2022; Chen, Chen & Lin, 2020; These technologies can elevate student engagement by creating interactive, personalized, and immersive learning environments (Malik, Tayal & Vij, 2019). Notably, a study by Blikstein (2016) found that AI-supported classrooms resulted in higher engagement levels and greater student achievement compared to traditional classrooms. Consequently, research into the perception of integrating AI technologies into education is expected to gain momentum, as the potential benefits of AI in education become increasingly recognized.

The integration of AI technologies into university-level teaching and learning represents a profound transformation in education (Bailey, 2023), including Agricultural Education. According to Guerra (2023), AI-driven tools offer a range of benefits, including personalized learning, real-time assessment, and data-driven insights, enhancing the overall educational experience. More so, these authors further argue that these technologies have the potential to address diverse learning needs and styles, making education more inclusive, automate administrative tasks, allowing educators to focus on teaching and research.

In Universities, AI technologies find utility in various forms. According to Attaran *et al.* (2018), three primary AI software applications in education include personal tutors, intelligent assistance for collaborative learning, and intelligent virtual reality. Intelligent Tutoring Systems (ITS) are poised as alternatives to traditional one-on-one instruction. Leveraging learner models, algorithms, and neural networks, ITS can customize each student's learning path, provide cognitive support, and foster active learning through dialogue and collaboration (Simhadri & Swamy, 2023). The authors further explain that to facilitate and moderate online collaboration, AI in Education (AIEd) can play a pivotal role by enabling adaptive group formation based on learner models. It can promote group interaction and summarize conversations, aiding human tutors in guiding students toward course objectives. Intelligent Virtual Reality (IVR) builds upon these principles, engaging students in high-quality virtual reality (VR) and game-based learning environments, with virtual agents assuming roles ranging from instructors to peers, even in digital or remote laboratories (Büching *et al.,* 2019). According to Simhadri & Swamy (2023), AI when applied in education can assess and provide immediate feedback, enabling continuous evaluation of student progress, departing from traditional stop-and-test methods. Also, the scholars stated that Algorithms can accurately predict a student's likelihood of failing an assignment or withdrawing from a course.

In addition, the successful adoption of AI, by lecturers in universities also presents challenges, including the need for faculty training and the ethical use of data (Nguyen, 2023). Moreover, AI is a tool, not a replacement for human educators. The role of teachers in fostering critical thinking, creativity, and interpersonal skills remains irreplaceable. The overreliance on AI might undermine the crucial human element of education (Nguyen, 2023). Some literature have indicated that integrating AI technologies in higher education in Nigerian universities faces several barriers. These include educators' lack of awareness and understanding (Lin *et al.,* 2022), limited technological infrastructure (Mobayo *et al.,* 2021), inadequate skills and knowledge, institutional and attitudinal factors, and ethical considerations (Popenici & Kerr, 2017). This study argues that addressing these barriers requires a comprehensive approach that includes professional development for educators, investment in technological infrastructure, and the development of ethical guidelines for AI use in education.

Recently, AI technologies have gained significant attention in Nigerian universities. Thus, there is a need to understand the level of awareness among lecturers on the integration of this technology. Few related studies have explored this subject-view and shed light on the current state of awareness among educators. For instance, a systematic review conducted by Zawacki-Richter *et al.* (2019) examined the research on AI applications in higher education and highlighted the lack of involvement of educators in this area. The study found that there is still substantial room for educators to engage in innovative research and practice with AI in education. This suggests that the level of awareness among lecturers may be relatively low, and there is a need for more meaningful research and practice in this field. Similarly, Alkanaan (2022) conducted a quantitative

study to assess the awareness of pre-service science teachers regarding the implication of AI in science education. The study revealed a low level of awareness among pre-service science teachers, indicating that there is a need for increased awareness and training in this area. Furthermore, Xu & Ouyang (2022) conducted a systematic review on the application of AI technologies in STEM education. The study highlighted the challenge of integrating diverse AI techniques and complex educational elements to meet instructional and learning needs. This suggests that lecturers may face challenges in implementing AI technologies in their teaching practices, which could be attributed to a lack of awareness and training. On the contrary, Olatoye *et al.* (2022) conducted a study on the awareness of vocational and technical education lecturers in utilizing technologies, including AI, during the COVID-19 pandemic. The findings revealed a moderately high level of awareness among vocational and technical education lecturers. This suggests that the level of awareness may vary across different disciplines and contexts.

With the rapid integration of Artificial Intelligence (AI) in various industries, including agriculture, it is imperative to understand the level of awareness and perceptions of Agricultural Education lecturers on potentials, and challenges associated with AI technologies integration. Evidently, plethora of literature show the revolutionizing potentials of AI in current agricultural practices across the globe (Talaviya *et al.*, 2020; Liakos *et al.*, 2018; Hemalatha and Sujatha, 2015; Sanders *et al.*, 2021; Alreshidi, 2019; Syeda *et al.*, 2021; Gupta *et al.*, 2023). Thus, Dinrifo, Alonge, Audu and Adegbenjo (2022) argue that the perceptions of university lecturers in Southeast Nigeria regarding the integration of AI technologies into agricultural education are crucial as AI becomes increasingly essential in the agricultural industry. However an extensive search of literatures on electronic databases by the researchers reveal that there seems to be paucity of information regarding the perceptions of lecturers of Agricultural Education on the subject-views under investigation, especially in Universities in Southeast Nigeria, despite how AI technologies have been revolutionizing agricultural practices (Talaviya *et al.*, 2020). Evidently, a systematic review of research on AI applications in higher education reveals that perceptions of educators are underrepresented in the literature (Zawacki-Richter *et al.*, 2019). Consequently, the theoretical gaps which prompted this study included a lack of information on how Agricultural Education lecturers in Southeast Nigerian Universities perceive AI integration, the underrepresentation of educators' views in AI research, and the urgent need to understand how lecturers view and are aware of the integration of AI technologies into Agricultural Education. More so, In Southeast Nigeria, the agriculture sector is a critical component of the region's economy, providing livelihoods to a significant portion of the population. However, a pressing issue confronting this sector is the chronic shortage of manpower in both the agricultural workforce and agricultural education. Furthermore, the evolving landscape of modern agriculture demands innovative solutions, and one of the promising avenues for addressing these challenges is the integration of Artificial Intelligence (AI) technologies. It is expected by the researchers that the findings of this study would spur policy decisions and actions on integration of AI technologies that will in turn help to fill the gap created by lack of human labour found in the agricultural sector as well as agricultural education. This study investigated lecturers' perceptions on integrating AI technologies into Agricultural Education in Universities in Southeast Nigeria.

Specific Objectives

This study investigated:

1. the level of awareness of Agricultural Education lecturers on integration of AI technologies into Agricultural Education in Universities in Southeast Nigeria;
2. lecturers' perceived potentials of integrating AI technologies into Agricultural Education in Universities in Southeast Nigeria and
3. lecturers' perceived anticipated barriers in the integration of AI technologies into Agricultural Education in Universities in Southeast Nigeria.

Research Questions

This study addressed the following research questions

1. What is the level of awareness of lecturers on integration of AI technologies into Agricultural Education in Universities in Southeast Nigeria?
2. What are the lecturers' perceived potentials of integrating AI technologies into Agricultural Education in Universities in Southeast Nigeria?
3. What perceived barriers do Agricultural Education lecturers anticipate in the integration of AI technologies into Agricultural Education?

Research Methodology

This study adopted an exploratory descriptive survey. According to George (2023), an exploratory research is a type of research design that is conducted when a researcher is initially investigating a topic or problem, and there is limited existing information or knowledge about it. The author further asserted that the primary purpose of exploratory research is to gain a better understanding of the subject and generate ideas. This study was delimited to public Universities in South-east Nigeria, and lecturers of Agricultural Education. The study area and target population were more accessible to the researchers, making it a pragmatic choice. Consequently, researchers conveniently sampled 56 lecturers of Agricultural Education in six (6) public Universities in South-east Nigeria. Convenience sampling was chosen by researchers for its practicality and ease of data collection, especially when time, resources, and accessibility are constraints (Sedgwick, 2013). However, while convenience sampling, as a non-probability sampling technique, may not provide a full representative sample of all Agricultural Education lecturers in South-east Nigeria, it can still offer valuable insights.

The instrument for data collection was a structured questionnaire titled "AI Technologies in Agricultural Education Questionnaire (AITAEDQ)". The 53 items in the questionnaire (AITAEDQ-53) were adapted from evidence in several related literature reviewed by the researchers (Talaviya *et al.,* 2020; Sanders *et al.,* 2021; Alreshidi, 2019; Syeda *et al.,* 2021; Gupta *et al.,* 2023; Zawacki-Richter *et al.,* 2019; Attaran *et al.,* 2018; Simhadri & Swamy, 2023; Guerra, 2023; Mobayo *et al.,* 2021; Lin *et al.,* 2022; Popenici & Kerr, 2017). These items were grouped into 3-clusters besides a section which captured the demography of respondents. Items in the questionnaire cluster which elicited data on the level of awareness of respondents on AI technologies were structured on 5-point scale: Not Aware At ALL [NAAA], Slightly Aware [SA], Moderately Aware [MA], Very Aware [VA] and Extremely Aware [EA], while the other two clusters were structured on 4-point scale [Strongly Agreed-4, Agreed-3, Disagree-2, Strongly Disagree-3]. Thereafter, AITAEDQ was subjected to content validation by three experts in the field of agricultural education, after which little adjustment was made. A pilot study with 10 respondents outside the area of study was conducted. The average reliability coefficient of the instrument was 0.87 [Cluster: 0.87, Cluster 2: 0.91; Cluster 3: 0.84]. Thus, based on Cronbach's

Alpha thumb rule by George and Mallery (2003) the instrument was considered good or fit for data collection. According to George and Mallery (2003), when considering Cronbach's Alpha, a score exceeding 0.90 demonstrates exceptional internal consistency, surpassing 0.80 is considered good, exceeding 0.70 is regarded as acceptable, exceeding 0.60 is questionable, surpassing 0.50 is considered poor, and falling below 0.50 is considered unacceptable. Additionally, the researchers administered the AITAEDQ-53 to lecturers of Agricultural Education in Southeast Universities who gave their consent to participate in the study. During data collection, the anonymity of respondents was ensured. Consequently, data collected through the questionnaire were cleaned (data cleaning), organized and analyzed using SPSS version 26. Data was analyzed using descriptive statics such as percentages, frequencies, means and standard deviations. To determine the level of awareness of lecturers, the real limits of the 5-point awareness scale was applied, using grand or average percentage of items. While, perceived potentials and barriers to integration were described using 2.50-average of the 4-point scale. Mean value equal or above 2.50 was described as "agreed or perceived", and mean value less than 2.50 was regarded as "Disagreed or not perceived"

Results

Results of the data analysis are presented below to address the questions posed by this study.

Research Question 1: What is the level of awareness of lecturers on integration of AI technologies into Agricultural Education in Universities in Southeast Nigeria?

Table 1: Level of Awareness of Lecturers on Integration of AI Technologies into Agricultural Education

		Level of Awareness of Agric. Education Lecturers [n=56]				
S/N	**AI Technologies in Agricultural Education**	**NAAA**	**SA**	**MA**	**VA**	**EA**
1.	AI-powered Autonomous Tractors	30 (53%)	10 (18%)	6 (11%)	6 (11%)	4 (7%)
2.	Robots with AI Vision System	22 (39%)	16 (29%)	12 (21%)	4 (7%)	2 (4%)
3.	Drones	26 (46%)	14 (25%)	8 (14%)	6 (11%)	2 (4%)
4.	AI-enabled IoT (Internet of Things)	32 (57%)	8 (14%)	6 (11%)	6 (11%)	4 (7%)
5.	Sensors for Data Collection	20 (36%)	18 (32%)	12 (21%)	4 (7%)	2 (4%)
6.	Image Processing	28 (50%)	12 (21%)	10 (18%)	4 (7%)	2 (4%)
7.	Unmanned Aerial Vehicles (UAVs)	30 (53%)	10 (18%)	8 (14%)	6 (11%)	2 (4%)
8.	Machine Learning Algorithms (e.g., SVM, Random Forest)	24 (43%)	14 (25%)	12 (21%)	4 (7%)	2 (4%)
9.	Chatbots	22 (39%)	16 (29%)	10 (18%)	4 (7%)	4 (7%)
10.	Virtual Assistants	30 (53%)	8 (14%)	12 (21%)	4 (7%)	2 (4%)
11.	AI-powered Farm Management Software	26 (46%)	12 (21%)	8 (14%)	6 (11%)	4 (7%)
12.	Blockchain	24 (43%)	14 (25%)	10 (18%)	4 (7%)	4 (7%)
13.	Intelligent Tutoring Systems (ITS)	22 (39%)	16 (29%)	12 (21%)	4 (7%)	4 (7%)

14.	Natural Language Processing (NLP)	32 (57%)	8 (14%)	6 (11%)	6 (11%)	4 (7%)
15.	Virtual Reality (VR) and Augmented Reality (AR)	26 (46%)	12 (21%)	10 (18%)	4 (7%)	4 (7%)
16.	Chatbots	20 (36%)	18 (32%)	14 (25%)	2 (4%)	2 (4%)
17.	Virtual Assistants	30 (53%)	10 (18%)	8 (14%)	6 (11%)	2 (4%)
18.	Image Processing	24 (43%)	14 (25%)	12 (21%)	4 (7%)	2 (4%)
19.	Machine Learning Algorithms (e.g., Support Vector Machines)	28 (50%)	12 (21%)	10 (18%)	6 (11%)	2 (4%)
20.	Dialogue-Based Tutoring Systems	22 (39%)	16 (29%)	10 (18%)	6 (11%)	4 (7%)
21.	Predictive Analytics	32 (57%)	8 (14%)	8 (14%)	6 (11%)	2 (4%)
22.	Adaptive Learning Systems	20 (36%)	18 (32%)	12 (21%)	4 (7%)	2 (4%)
23.	Learning Management Systems (LMS)	28 (50%)	12 (21%)	10 (18%)	6 (11%)	2 (4%)
24.	Data Analytics and Learning Analytics	26 (46%)	14 (25%)	12 (21%)	4 (7%)	4 (7%)
25.	Plagiarism Detection Tools	24 (43%)	14 (25%)	10 (18%)	6 (11%)	2 (4%)
26.	Speech Recognition	30 (53%)	8 (14%)	8 (14%)	8 (14%)	2 (4%)
27.	Edutainment	26 (46%)	12 (21%)	10 (18%)	4 (7%)	4 (7%)
28.	Early Intervention Systems	22 (39%)	16 (29%)	10 (18%)	4 (7%)	6 (11%)
	Average Percentage	**44.29%**	**24.06%**	**17.5%**	**8.86%**	**5.29%**

NAAA *(Not Aware AT ALL),* ***SA*** *(Slightly Aware),* ***MA*** *(Moderately Aware),* ***VA*** *(Very Aware),* ***EA*** *(Extremely Aware)*

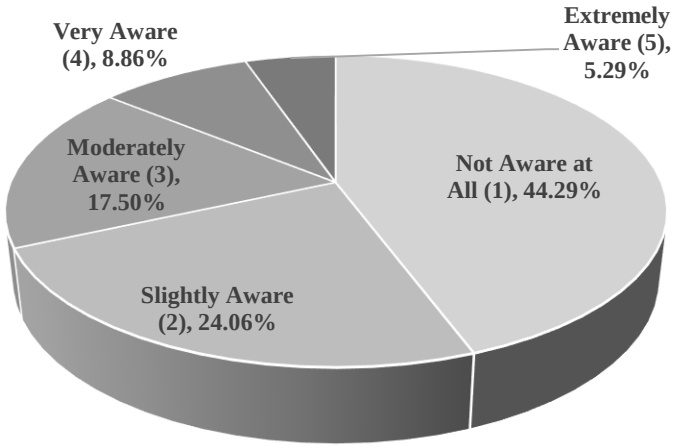

Figure 1: *Level of Awareness of Lecturers on Integration of AI Technologies into Agricultural Education*

Results from data analysis represented in *Figure 1* above (*also in Table 1*) indicate that an average of 44.29% of the respondents surveyed [n = 56] demonstrated a complete lack of awareness of integration of AI technologies. This finding implies that a significant portion of Agricultural

Education lecturers surveyed had little to no knowledge about the integration of AI technologies into Agricultural education. On the other hand, an average of 24.06% of the respondents were slightly aware of AI technologies. This suggests that a moderate portion of the survey participants possessed some basic understanding of the integration of these technologies, although their awareness may not be highly extensive. In addition, an average of 17.5% of the respondents displayed a moderate level of awareness on the integration of AI technologies. This signifies a substantial group of participants with a reasonable grasp of these technologies. Conversely, an average of 8.86% of respondents have a high level of awareness concerning the integration of AI technologies into Agricultural Education. Although this group is smaller in size, they exhibited a noteworthy understanding of these technologies. Finally, a small portion of the respondents with an average of 5.29% were very aware of the integration of these technologies. However, this group stands out as having the most profound level of awareness among all respondents regarding AI technologies. Generally, based on the percentage distribution of responses for each item shown in Table 1, it appears that respondents are moderately aware of integration of many AI technologies. However, there are variations in awareness levels, with some technologies being slightly more known than others. Additionally, some technologies have a wider range of awareness levels, as indicated by the percentage distribution.

Research Question 2: What are the lecturers' perceived potentials of integrating AI technologies into Agricultural Education in Universities in Southeast Nigeria?

Table 2: Lecturers' Perceived Potentials of Integrating AI Technologies into Agricultural Education

[n = 56]

S/N	Perceived Potentials of Integrating AI Technologies	$\bar{x}$	*S*
1.	Emerging AI technologies can enhance the efficiency of agricultural education programs.	3.41	.0092
2.	AI has the potential to improve the quality of educational content and resources in agriculture.	3.43	.0063
3.	AI-driven personalized learning experiences can benefit students in agricultural education.	3.12	.0043
4.	AI can help tailor educational content to meet individual learning needs in agriculture.	3.45	.0043
5.	AI technologies can improve assessment and evaluation methods in agricultural education.	3.52	.0001
6.	AI can enable more interactive and engaging learning experiences in agricultural education.	3.41	.0092
7.	AI can assist educators in identifying areas where students may be struggling and provide targeted support in agricultural education.	3.01	.0011
8.	AI is likely to play a role in bridging the gap between theory and practical application in agricultural education.	3.45	1.0516
9.	AI technologies are valuable tools for simulating real-world agricultural scenarios in the learning process.	3.48	.0071
10.	AI has high potential in preparing students for the evolving technological landscape in the agriculture industry.	3.46	.0067
11.	AI plays a crucial role in promoting sustainability and environmentally responsible practices in agricultural education.	3.45	.0048

$\bar{x}$ = sample mean, S = standard deviations for the sample

Data in Table 1 above show that the mean values ranging from 3.12 to 3.52 on a 4-point Likert Scale, which is above 2.50-average. This implies that the results in Table 2 above indicate that

majority of the respondents perceived or agreed that the integration of AI technologies can enhance the efficiency of agricultural education programs [$\bar{x}$: 3.41, *S*: .0092], improve educational content in agriculture [$\bar{x}$: 3.43, *S*: .0063], AI-driven personalized learning experiences can be beneficial for students in agricultural education [$\bar{x}$: 3.12, *S*: .0043], AI can tailor educational content to meet individual learning needs in agriculture [$\bar{x}$: 3.45, *S*: .0043], enhance assessment and evaluation methods in agricultural education [$\bar{x}$: 3.52, *S:* .0001], enhance interactivity and engagement in learning experiences in agricultural education [$\bar{x}$: 3.41, *S*: .0092], assist educators in identifying areas where students may be struggling and provide targeted support in agricultural education [$\bar{x}$: 3.01, *S*: .0011], bridge the gap between theoretical knowledge and practical application in agricultural education [$\bar{x}$:3.45, *S*: 1.0516], AI technologies as valuable tools for simulating real-world agricultural scenarios in the learning process [$\bar{x}$: 3.48, *S:* .0071], AI's potential to prepare students for the evolving technological landscape in the agriculture industry ($\bar{x}$: 3.45, *S:* .0048): and promoting sustainability [$\bar{x}$: 3.45, *S*: .0048]. Furthermore, the low to moderate standard deviations shown in Table 2 above on 7 out of the 8 items [Range: *S*: 0001-.0092] indicates a relatively narrow to moderate range of opinions, suggesting a general consensus among lecturers of Agricultural Education on the potentials of integrating AI technologies into Agricultural Education. However, the relatively high standard deviation on lecturer's perceptions of AI's potentials to bridge the gap between theoretical knowledge and practical application in agricultural education [*S*: 1.0516], suggests a wider range of opinions on this topic, indicating a more diverse range of perspectives.

Research Question 3: What perceived barriers do Agricultural Education lecturers anticipate in the integration of AI technologies into Agricultural Education?

Table 3: Lecturers' Perceived Barriers to Integrating AI Technologies into Agric. Education

[n =56]

S/N	Perceived Barriers to Integration	$\bar{x}$	*S*
1	Lack of technical infrastructure (e.g., hardware, software)	3.71	.0000
2	Initial costs associated with AI technology acquisition	3.88	.0016
3	Shortage of funding and resources	3.50	.0001
4	Resistance from fellow educators	3.65	.0021
5	Lecturers' lack of training	3.80	.0006
6	Concerns about data privacy and security	3.56	.0011
7	Displacement of traditional teaching methods	3.77	.0000
8	Lack of student awareness and understanding of AI	3.40	.0015
9	Regulatory and compliance issues	3.88	.0032
10	Difficulty finding AI-based educational resources	3.96	.0018
11	Resistance from students preferring traditional methods	3.70	.0024
12	Challenges related to the ethical use of AI	3.43	.0013
13	Lack of institutional support and policies	3.14	.0045
14	Time and effort required for planning and implementation	3.93	.0000

$\bar{x}$ = sample mean, S = standard deviations for the sample

Data in Table 3 reveals mean values that fall within 3.14 to 3.93 on a 4-point Likert Scale, which is above 2.50 average. This implies that majority of the lecturers of Agricultural Education perceived the following barriers to the integration of AI technologies into Agricultural Education: lack of technical infrastructure (e.g., hardware, software) [$\bar{x}$: 3.71, *S*: 0000], initial costs associated with AI technology acquisition [$\bar{x}$: 3.88, *S*: .0016], shortage of funding and resources [$\bar{x}$: 3.50, *S*: 0001], resistance from fellow educators [$\bar{x}$: 3.65, *S*: .0021], lecturers' lack of training [$\bar{x}$: 3.80 *S*: .0006], concerns about data privacy and security [$\bar{x}$: 3.56, *S*: .0011], displacement of traditional

teaching methods [$\bar{x}$: 3.77, *S*: .0000], lack of students' awareness and understanding of AI [$\bar{x}$: 3.40, *S*:.0015], regulatory and compliance issues [$\bar{x}$: 3.88, *S*: .0032], difficulty finding AI-based educational resources [$\bar{x}$: 3.96, *S*: .0018], resistance from students preferring traditional methods [$\bar{x}$: 3.70, *S*: .0024], challenges related to the ethical use of AI [$\bar{x}$: 3.43, *S*: .0013], lack of institutional support and policies [$\bar{x}$: 3.14, *S*: .0045], and time and effort required for planning and implementation [$\bar{x}$: 3.93, *S*: .0000]. In addition, the responses showed very low to moderate standard deviations, ranging from .0000 to .0045. This implies that there is a strong consensus or consistency among the responses of the respondents on barriers to integrating emerging AI technologies into Agricultural Education.

Discussion of Major Findings

The findings of this explorative investigation reveals that greater percentage [44.29%] of lecturers in Agricultural Education demonstrated a complete lack of awareness of the integration of AI technologies into Agricultural Education, while 24.06% were slightly aware, 17.5% displayed a moderate level of awareness and 8.86%. This finding is in tandem with the study by Zawacki-Richter *et al.* (2019) which indicated that the level of awareness among lecturers on AI applications is relatively low. This suggests that there is a need for increased capacity building of lecturers on AI technologies in Agricultural Education. Similarly, Alkanaan (2022) also found that there was a low level of awareness among pre-service science teachers on AI technologies in science education. Additionally, evidence from the study by Xu & Ouyang (2022) highlighted the challenge of integrating diverse AI techniques and complex educational elements to meet instructional and learning needs. The study argued that lecturers may face challenges in implementing AI technologies in their teaching practices, which could be attributed to a lack of awareness and training. Contrary to the findings of this study and corresponding evidence from similar studies (Zawacki-Richter *et al.*, 2019; Alkanaan, 2022; Xu & Ouyang (2022), findings from a study by Olatoye *et al.* (2022) showed a moderately high level of awareness among vocational and technical education lecturers. This suggests that the level of awareness may vary across different disciplines and contexts. However, among lecturers of Agricultural Education, there is a need for increased awareness and training in this area.

The researchers observed through this study that majority of Agricultural Education lecturers perceived the potential of integrating AI technologies into Agricultural Education. These perceived potentials included improving program efficiency, enhancing educational content, offering personalized learning experiences, tailoring content to individual needs, and enhancing assessment methods. In agreement with these findings, Guerra (2023) argue that AI-driven tools offer a range of benefits, including personalized learning, real-time assessment, and data-driven insights, enhancing the overall educational experience. Similarly, according to Attaran *et al.* (2018), three primary AI software applications in education include personal tutors (personalized learning), intelligent assistance for collaborative learning, and intelligent virtual reality. With regards to the finding on its potentials to improving assessment methods, Simhadri & Swamy (2023) asserted that when AI is applied in education, it can assess and provide immediate feedback, enabling continuous evaluation of student progress, departing from traditional stop-and-test methods. More so, these scholars noted that Algorithms can accurately predict a student's likelihood of failing an assignment or withdrawing from a course. Additionally, this study also found that AI technologies are perceived by lecturers as a way to bridge the gap between theory and practice by fostering activities, simulate real-world scenarios, and prepare students for the evolving agricultural industry. This indicates that there is recognition of the value of AI in advancing agricultural

education. In in agreement with these findings, evidence from other literature show that AI technologies can elevate student engagement by creating interactive, personalized, and immersive learning environments (Malik, Tayal & Vij, 2019; Chen, Chen & Lin, 2020). Thus, AI-supported classrooms was found to have resulted in higher engagement levels and greater student achievement compared to traditional classrooms (Blikstein, 2016). More so, Guerra, (2023) further opined that AI technologies have the potential to address diverse learning needs and styles, making education more inclusive, automate administrative tasks, allowing educators to focus on teaching and research.

Generally, AI is perceived as a valuable asset for advancing agricultural education. However, findings of this study indicated that majority of Agricultural Education lecturers perceived various barriers to the integration of AI technologies into Agricultural Education. These barriers included concerns about the lack of technical infrastructure (e.g., hardware and software) and initial costs associated with acquiring AI technology, shortage of funding and resources, resistance from fellow educators, their own lack of training, data privacy and security issues, displacement of traditional teaching methods, and the lack of students' awareness and understanding. Other perceived barriers included regulatory and compliance issues, difficulty finding AI-based educational resources, resistance from students who prefer traditional methods, challenges related to the ethical use of AI, lack of institutional support and policies, and the time and effort required for planning and implementation. Some of these findings are consistent with the evidence shown by some literature, such as educators' lack of awareness and understanding (Lin *et al.*, 2022), limited technological infrastructure (Mobayo *et al.*, 2021), inadequate skills and knowledge, institutional and attitudinal factors, and ethical considerations (Popenici & Kerr, 2017). These barriers highlight the complex challenges that need to be addressed in order to effectively integrate AI technologies into Agricultural Education.

Conclusion

This exploratory study highlights lecturers' level of awareness, perceived benefits, and barriers on the integration of AI technologies into Agricultural Education. The study reveals that a significant number of surveyed lecturers have limited awareness of AI technologies, reflecting a broader trend of low AI awareness among educators. Despite the observed low-level awareness, a positive trend emerges as the majority of Agricultural Education lecturers recognize the potential advantages of integrating AI technologies in improving educational programs in Agricultural Education. These benefits include enhancing program efficiency, educational content, personalizing learning experiences, tailoring content to individual needs, and more effective assessment methods. This recognition is in line with existing literature, emphasizing the advantages of AI-driven tools in enhancing the overall educational experience. Moreover, AI technologies are seen as valuable assets that bridge the gap between theory and practice, fostering real-world simulations and preparing students for the evolving agricultural industry. However, the study also uncovers several perceived barriers to integrating AI technologies into Agricultural Education. These barriers encompass technical infrastructure limitations, initial acquisition costs, financial constraints, resistance from peers, inadequate training, data privacy and security concerns, displacement of traditional teaching methods, and students' limited awareness and understanding of AI. Additionally, regulatory and compliance challenges, difficulty in finding AI-based educational resources, student resistance to AI methods, ethical dilemmas, lack of institutional support and policies, and the time and effort required for planning and implementation were identified as significant barriers.

Recommendations

Based on the findings of this study, the researchers recommends the following:

1. Government and University administrators should organize a comprehensive training and capacity building programs for these lecturers, especially within the context of Agricultural Education. This includes providing workshops, courses, and resources to enhance their awareness and skills in AI.
2. Government should invest in the necessary technological infrastructure, including hardware and software, to support the integration of AI technologies into the curriculum.
3. Lecturers should also focus on raising students' awareness and understanding of AI technologies to ensure they can effectively engage with AI-enhanced learning.
4. University administrators should establish clear institutional policies and guidelines for the ethical use of AI technologies in education, ensuring data privacy and security concerns are adequately addressed.
5. Government and university administrators should encourage collaboration among educators, researchers, and industry experts to harness AI technologies' full potential in Agricultural Education.

References

Ahngar, T. A., Bahar, F. A., Singh, L., Bhat, M. A., Singh, P., Mahdi, S. S., Bhat, T. A., Rashid, Z., Lone, B. A., Raja, W., Saad, A. A., & Ahmad, L. (2022). Artificial intelligence in agriculture, applications, benefits, and challenges: A review. *The Pharma Innovation Journal, 11*(3), 1407-1414.

AlKanaan, H. (2022). Awareness regarding the implication of artificial intelligence in science education among pre-service science teachers. *International Journal of Instruction, 15*(3), 895-912. https://doi.org/10.29333/iji.2022.15348a

Alreshidi, E. (2019). Smart sustainable agriculture (ssa) solution underpinned by internet of things (iot) and artificial intelligence (ai). International Journal of Advanced Computer Science and Applications, 10(5). https://doi.org/10.14569/ijacsa.2019.0100513

Bailey J. (2023). AI in Education. *Technology* 23(4). Available at: https://www.educationnext.org/a-i-in-education-leap-into-new-era-machine-intelligence-carries-risks-challenges-promises/

Büching C, Mah D-K, Otto S, Paulicke P, Hartmann EA (2019) *Learning analytics an Hochschulen. In: Wittpahl, V. (eds) Künstliche Intelligenz.* Springer Vieweg, Berlin, Heidelberg, https://doi.org/10.1007/978-3-662-58042-4

Chan, Cecilia & Tsi, Louisa. (2023). The AI Revolution in Education: Will AI Replace or Assist Teachers in Higher Education?. https://www.researchgate.net/publication/370469331_The_AI_Revolution_in_Education_Will_AI_Replace_or_Assist_Teachers_in_Higher_Education/citation/download

Chen, L., Chen, P., & Lin, Z. (2020). Artificial Intelligence in Education: A Review. *IEEE Access, 8*, 75264–75278. https://doi.org/10.1109/ACCESS.2020.2988510

Chen, X., Xie, H., Zou, D., & Hwang, G.-J. (2020). Application and theory gaps during the rise of Artificial Intelligence in Education. Computers and Education. *Artificial Intelligence, 1*, 100002–. https://doi.org/10.1016/j.caeai.2020.100002

Cukurova, M., Kent, C., & Luckin, R. (2019). Artificial intelligence and multimodal data in the service of human decision-making: a case study in debate tutoring. *British Journal of Educational Technology, 50*(6), 3032-3046. https://doi.org/10.1111/bjet.12829

Dara, R., Fard, S., & Kaur, J. (2022). Recommendations for ethical and responsible use of artificial intelligence in digital agriculture. *Frontiers in Artificial Intelligence, 5*. https://doi.org/10.3389/frai.2022.884192

Dara, R., Fard, S., & Kaur, J. (2022). Recommendations for ethical and responsible use of artificial intelligence in digital agriculture. *Frontiers in Artificial Intelligence, 5.* https://doi.org/10.3389/frai.2022.884192

Dinrifo, R. R., Alonge, A. F., Audu, J., & Adegbenjo, A. O. (2022). A Review of the Applications of Artificial Intelligence in Agriculture: Prospects and Challenges in Nigeria. *Journal of Agricultural Engineering and Technology 27*(2). https://www.researchgate.net/publication/370683604A

Eli-Chukwu, N. (2019). *Applications of Artificial Intelligence in Agriculture: A Review*. https://doi.org/10.5281/zenodo.3370594

Gandhi, M., Kamdar, J., & Shah, M. (2020). Preprocessing of non-symmetrical images for edge detection. *Augmented Human Research*, *5*, 1-10.

George T. (2023). *Exploratory Research, Definition, Guide, & Examples.* Available: https://www.scribbr.com/methodology/exploratoryresearch/#:~:text=Exploratory%20research%20investigates%20research%20questions,previously%20studied%20phenomenon%20takes%20place.

Goksel, N. & Bozkurt, A. (2019). *Artificial Intelligence in Education: Current Insights and Future Perspectives.* In S. Sisman-Ugur & G. Kurubacak (Eds.), Handbook of Research on Learning in the Age of Transhumanism (pp.224-236). IGI Global.

Guerra, A. (2023, July 06). *The Future Benefits of Artificial Intelligence for Students.* Retrieved from https://urbeuniversity.edu/blog/the-future-benefits-of-artificial-intelligence-for-students

Gupta, G., Abrol, V., & Pradhan, S. (2023). *Smart farming: boosting crop management with svm and random forest.*. https://doi.org/10.21203/rs.3.rs-3160171/v1

Kundalia, K., Patel, Y., & Shah, M. (2020). Multi-label movie genre detection from a movie poster using knowledge transfer learning. *Augmented Human Research*, *5*, 1-9.

Lin, X., Chen, L., Chan, K., Peng, S., Chen, X., Liu, J., … & Hu, Q. (2022). Teachers' perceptions of teaching sustainable artificial intelligence: a design frame perspective. *Sustainability, 14*(13), 7811. https://doi.org/10.3390/su14137811

Lin, X., Chen, L., Chan, K., Peng, S., Chen, X., Liu, J., … & Hu, Q. (2022). Teachers' perceptions of teaching sustainable artificial intelligence: a design frame perspective. Sustainability, 14(13), 7811. https://doi.org/10.3390/su14137811

Malik, G., Tayal, D. K., & Vij, S. (2019). *An Analysis of the Role of Artificial Intelligence in Education and Teaching.* In P. K. Sa, S. Bakshi, I. K. Hatzilygeroudis & M. N. Sahoo (Eds.), Recent Findings in Intelligent Computing Techniques, 407–417. Springer Singapore Pte. Limited. https://doi.org/10.1007/978-981-10-8639-7_42

Mobayo, J., Aribisala, A., Yusuf, S., & Belgore, U. (2021). The awareness and adoption of artificial intelligence for effective facilities management in the energy sector. *Journal of Digital Food Energy & Water Systems, 2*(2). https://doi.org/10.36615/digitalfoodenergywatersystems.v2i2.718

Nguyen, N. (2023). *Opportunities and Challenges of AI in Higher Education*. Retrieved from https://feedbackfruits.com/blog/opportunities-and-challenges-of-ai-in-higher-education

Olatoye, A., Salami, S., Olore, R., & Adepoju, A. (2022). Awareness of vocational and technical education lecturers in utilising the emerging technology posed by covid-19 pandemic.

Journal of Vocational Education Studies, *5*(1), 139-151. https://doi.org/10.12928/joves.v5i1.5867

Pistilli MD, Arnold KE (2010) In practice: Purdue Signals: mining real-time academic data to enhance student success. *About Campus 15*(3):22–24. https://doi.org/10.1002/abc.20025

Popenici, S. and Kerr, S. (2017). Exploring the impact of artificial intelligence on teaching and learning in higher education. *Research and Practice in Technology Enhanced Learning, 12*(1). https://doi.org/10.1186/s41039-017-0062-8

Renz, A., Krishnaraja, S., & Gronau, E. (2020). Demystification of Artificial Intelligence in Education – How much AI is really in the Educational Technology? *International Journal of Learning Analytics and Artificial Intelligence for Education (iJAI), 2*(1), 14–30. https://doi.org/10.3991/ijai.v2i1.12675

Sanders, C., Mayfield-Smith, K., & Lamm, A. (2021). Exploring twitter discourse around the use of artificial intelligence to advance agricultural sustainability. *Sustainability*, *13*(21), 12033. https://doi.org/10.3390/su132112033

Sedgwick, P. (2013). Convenience sampling. *Bmj*, *347*.

Seo, K., Tang, J., Roll, I., et al. (2021). The impact of artificial intelligence on learner–instructor interaction in online learning. *International Journal of Educational Technology in Higher Education*, *18*(54). https://doi.org/10.1186/s41239-021-00292-9

Simhadri, N., & Swamy, T.N.V.R. (2023). *Awareness among teaching on AI and ML applications based on fuzzy in the education sector at USA.* Soft Computing. https://doi.org/10.1007/s00500-023-08329-z

Syeda, I., Alam, M., & Illahi, U. (2021). Advance control strategies using image processing, uav and ai in agriculture: a review. World Journal of Engineering, 18(4), 579-589. https://doi.org/10.1108/wje-09-2020-0459

Talaviya, T., Shah, D., Patel, N., Yagnik, H., & Shah, M. (2020). Implementation of artificial intelligence in agriculture for optimization of irrigation and application of pesticides and herbicides. *Artificial Intelligence in Agriculture*, 4, 58-73. https://doi.org/10.1016/j.aiia.2020.04.002

ThinkML Team. (2022). *Potential use of Robotics in Education System.* ThinkML. https://thinkml.ai/potential-use-of-robotics-in-educationsystem/#:~:text=Anthony%20Sheldon%3B%20A%20British%20education,lead%20the%20transfe r%20of%20knowledge

UNESCO (2021). AI and education: Guidance for policy-makers. France, UNESCO.

Xu, W. and Ouyang, F. (2022). The application of ai technologies in stem education: a systematic review from 2011 to 2021. *International Journal of Stem Education, 9*(1). https://doi.org/10.1186/s40594-022-00377-5

Xu, W. and Ouyang, F. (2022). The application of ai technologies in stem education: a systematic review from 2011 to 2021. *International Journal of Stem Education, 9*(1). https://doi.org/10.1186/s40594-022-00377-5

Zawacki-Richter, O., Marín, V., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators?. *International Journal of Educational Technology in Higher Education, 16*(1). https://doi.org/10.1186/s41239-019-0171-0

Zawacki-Richter, O., Marín, V., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators?.

International Journal of Educational Technology in Higher Education, 16(1). https://doi.org/10.1186/s41239-019-0171-0

Zawacki-Richter, O., Marín, V., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators?. *International Journal of Educational Technology in Higher Education, 16*(1). https://doi.org/10.1186/s41239-019-0171-0