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Awareness and Utilization of Artificial Intelligence Tools among Agricultural Education Lecturers within Universities in Enugu State

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Abstract

The study focused on awareness and utilization of AI tools among Agricultural education lecturers within universities in Enugu State. Specifically, it determined: level of awareness; extent of utilization of AI tools among the lecturers, challenges to adoption of the tools by the lecturers; strategies for improving AI utilizationn. The study adopted a survey research design. Area of study was Enugu State. Population comprises all 56 lecturers teaching agricultural education in public universities in the state. Questionnaire was used for data collection. Data were analyzed using mean, standard deviation and t-test at 0.05 level of significance. Findings reveal that lecturers had high awareness, including, in predictive analytics ($\overline{X}$ = 3.24) and Climate forecasting tools ($\overline{X}_g$= 3.10) but low utilization of AI tools in teaching and research such as AI chatbots for queries ($\overline{X}_g$ = 2.10) and AI in research supervision ($\overline{X}_g$= 2.39). Nine challenges to utilization were also identified, including lack of training ($\overline{X}_g$= 3.36) and poor internet connectivity ($\overline{X}_g$= 3.28). Furthermore, 11 strategies for improving AI adoption were identified, including regular AI training/workshops ($\overline{X}_g$= 3.34) and upgrading digital infrastructure ($\overline{X}_g$ = 3.48). The t-test results further revealed no significant difference between the mean responses of male and female lecturers regarding their awareness (t = 0.15–0.86, $p > 0.05$), utilization (t = 0.29–0.71, $p > 0.05$), perceived challenges (t = 0.18–0.57, $p > 0.05$), and strategies for enhancing AI adoption (t = 0.17–0.44, $p > 0.05$).

Keywords: Artificial, Intelligence, Tools, Utilization, Awareness, Adoption, Challenges, Strategies, Lecturers.

Introduction

Artificial Intelligence (AI) is increasingly transforming the landscape of education. AI is not only reshaping the way knowledge is delivered and assessed but is also redefining the roles of teachers and learners in modern classrooms {United Nations Educational, Scientific and Cultural Organization (UNESCO), 2023}. Schleicher (2021), reported that AI technologies, such as adaptive learning platforms, virtual assistants, and data analytics tools, are offering new opportunities for personalized learning and curriculum reform. As agricultural systems grow more complex due to climate change, population growth, and food insecurity, among other things, integrating AI into the education of future agricultural professionals becomes imperative {Food and Agriculture Organization (FAO), 2022}.

Agricultural education in universities serves as a bridge between scientific innovation and sustainable development. It equips individuals with the knowledge, skills, attitudes, and values required for productive agricultural practices (Ejiofor & Nwakile 2016). The integration of AI into agricultural education can also enhance curriculum delivery, improve student engagement, and promote digital agriculture practices (Ghosh & Rathore, 2020). AI tools support activities such as field simulation, automated grading, digital experimentation, and predictive analytics in crop production, livestock management, and agribusiness (Sutcliffe et al., 2021; Nwakile et al., 2022). However, the successful application of these technologies depends largely on lecturers' awareness, preparedness, and competence in their use (Suleman et al., 2023).

Holmes et al. (2022) observed that lecturers are central to educational innovation, and their willingness to adopt AI largely determines its successful integration into academic programmes. Although many lecturers recognize the potential of AI, its practical application in teaching and research remains limited (Zawacki-Richter et al., 2019). This situation has been linked to inadequate institutional support, insufficient professional training, and concerns about technological displacement (Miao et al., 2021). In agricultural education, where conventional teaching methods still prevail, limited exposure to digital technologies may hinder the development of AI-driven learning environments (Nwachukwu et al., 2022).

Globally, universities are increasingly revising policies and curricula to incorporate AI competencies and prepare graduates for future workplaces (OECD, 2020). However, such reforms remain relatively limited in developing countries such as Nigeria (Okoli et al., 2020). Although Nigerian universities have introduced courses related to emerging technologies, their practical integration into agricultural education remains inadequate (Ejiofor et al., 2020). Consequently, the gap between technological advancement and instructional practice continues to widen among agricultural educators (Onah et al., 2023).

Artificial intelligence has become highly relevant to agriculture through applications in smart farming, climate-resilient agriculture, soil analysis, and agricultural robotics (Kamilaris & Prenafeta-Boldú, 2018). Integrating AI tools into agricultural education can help bridge theory and practice by exposing students to real-world digital solutions (Sarker et al., 2023). Nevertheless, effective integration depends on lecturers possessing adequate awareness and skills, as educator digital readiness significantly influences students' exposure to innovation-oriented learning experiences (Olorkor & Gideon, 2024).

In Nigeria, the integration of emerging technologies into teaching is constrained by infrastructural and professional development challenges. Limited access to reliable internet services, digital devices, and educational software reduces lecturers' confidence and competence in using AI tools (Olorkor & Gideon, 2024). Furthermore, the absence of targeted AI training and institutional support slows the pace of digital transformation within agricultural education programmes (Okafor & Nwankwo, 2022). Despite these barriers, interest in AI-enabled solutions for improving teaching effectiveness and productivity continues to grow among agricultural educators (Do, 2025).

The relevance of AI in agricultural education is further reinforced by the demands of the Fourth Industrial Revolution, which requires graduates to possess digital and analytical competencies (Do, 2025). Universities that fail to develop AI capacity among lecturers risk producing graduates who are inadequately prepared for technology-driven agricultural industries (Sarker et al., 2023). As AI applications continue to expand in areas such as climate forecasting, food systems modelling, and supply-chain management, universities need to align teaching practices with emerging industry requirements.

In Enugu State, agricultural education programmes are offered in public universities where lecturers are increasingly exposed to AI-related technologies through research, digital learning platforms, and professional engagements. However, observations indicate that the practical use of AI tools in teaching, assessment, and research supervision remains limited. This may be due to inadequate training opportunities, infrastructural deficiencies, and weak institutional support. Consequently, there is insufficient empirical evidence on the level of awareness and utilization of AI tools among agricultural education lecturers in the state, creating the need for a systematic investigation of the present situation, this study.

Purpose of the Study

The general purpose of this study was to investigate awareness and utilization of artificial intelligence (AI) tools among agricultural education lecturers within universities in Enugu State. Specifically, the study determined:

1. level of awareness of AI tools among agricultural education university lecturers in Enugu State.
2. extent to which agricultural education university lecturers utilize AI tools in instructional delivery in Enugu State.
3. challenges faced by agricultural education university lecturers in adopting AI tools for instructional delivery in Enugu State.
4. possible strategies for improving adoption and utilization of AI tools by agricultural education lecturers in Enugu State

Hypotheses

The following null hypotheses were tested at 0.05 level of significance. There is no significant difference between mean responses of male and female agricultural education lecturers on:

HO_1: their level of awareness of AI tools.

HO_2: their extent of utilization of AI tools for instructional delivery.

HO_3: challenges they face in adopting AI tools for instructional delivery.

HO_4: possible strategies for improving the adoption and utilization of AI tools.

Methodology

Design of the Study: The study adopted a survey research design.

Area of the Study: The area of the study was Enugu State, Nigeria. The state is located in the South-East geopolitical zone and hosts several universities offering agricultural education programmes. The study was conducted in Enugu State, Nigeria, in the South-East geopolitical zone. The state has two public universities offering Agricultural Education programmes: the University of Nigeria, Nsukka (UNN), a first-generation federal university established in 1960, and Enugu State University of Science and Technology (ESUT), a state-owned university established in 1980.

***Population for the Study*:** The population for the study comprised all the 56 lecturers teaching agricultural education in the two public universities within Enugu State, comprising 31 from UNN (18 males and 13 females) and 25 from ESUT (13 males and 12 females). The lecturers possessed varying academic qualifications (majority are PhD holders) and teaching experience, and were actively involved in research. These lecturers are expected to integrate emerging technologies such as Artificial Intelligence (AI) to prepare students for digital agriculture. Due to the manageable size of the population, the entire population was studied. Hence, there was no sample or sampling technique.

***Instrument for Data Collection*:** The instrument for data collection was a structured questionnaire. It was developed based on literature reviewed and specific purposes of the study. The questionnaire consisted of four sections. Section A focused on lecturers' awareness of AI tools while Section B dealt with the extent of utilization of AI tools in agricultural education. Section C dealt with challenges lecturers face in adopting AI tools and Section D focused on possible strategies for improving AI adoption and utilization in agricultural education. All items were rated on a 4-point scale. For Section A (Awareness), the response options were: 4 = Very High, 3 = High, 2 = Low, and 1 = Very Low. For Section B (Utilization), the options were: 4 = Very Great Extent, 3 = Great Extent, 2 = Small Extent, and 1 = Very Small Extent. For Section C (Challenges), the options were: 4 = Major Challenge, 3 = Moderate Challenge, 2 = Minor Challenge, and 1 = Not a Challenge. For Section D (Strategies), the options were: 4 = Very Viable, 3 = Viable, 2 = Slightly Viable, and 1 = Not Viable.

The instrument was validated by three university experts in agricultural education. Fifteen copies of the instrument were pilot tested on 15 agricultural education lecturers from outside the area of the study. Data obtained were analyzed using Cronbach Alpha, which yielded a reliability coefficient of 0.84. This indicates that the instrument was highly reliable for data collection.

***Method of Data Collection*:** Fifty-six copies of the questionnaire were administered by hand to the respondents, comprising 31 male and 25 female lecturers. A total of 54 copies were retrieved (30 copies from male lecturers and 24 copies from female).

***Method of Data Analysis*:** Data were analyzed using mean, standard deviation, and t-test. A cut-off point of 2.50 was adopted as the decision benchmark. For awareness and utilization, mean scores of 2.50 and above were interpreted as High Awareness or Great Extent, while mean scores below 2.50 were interpreted as Low Awareness or Small Extent. For challenges and strategies, mean scores of 2.50 and above were interpreted as Major Challenges or Viable Strategies, while mean scores below 2.50 were interpreted as Minor Challenges or Less Viable Strategies. Standard deviation was used to determine the closeness of respondents' opinions. The t-test was used to test the null hypotheses at the 0.05 level of significance. A null hypothesis was rejected where the p-value was less than or equal to 0.05 and accepted where the p-value was greater than 0.05.

Results

Table 1: Mean Responses, Standard Deviation and t-test Results of Male and Female Lecturers on their Awareness of AI Tools

S/N	AI Tools	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_g$	t	Rem	Dec
1	Machine learning	3.18	0.90	3.02	0.86	3.12	0.72	HA	NS
2	Predictive analytics for crop management	3.28	0.84	3.16	0.80	3.24	0.58	HA	NS
3	AI-based climate forecasting tools	3.12	0.93	3.06	0.89	3.10	0.31	HA	NS
4	Automated soil/moisture analysis systems	2.98	0.87	2.92	0.83	2.96	0.44	HA	NS
5	Natural language processing (NLP)	2.60	0.97	2.46	0.91	2.54	0.86	HA	NS
6	AI in smart irrigation systems	3.08	0.91	3.01	0.87	3.06	0.39	HA	NS
7	Computer vision for plant disease detection	2.90	0.89	2.83	0.85	2.88	0.48	HA	NS
8	AI in livestock behavior tracking	2.70	0.98	2.67	0.92	2.69	0.15	HA	NS
9	AI-based mobile apps for farmer training	2.95	0.86	2.87	0.82	2.92	0.63	HA	NS
10	AI-driven grading/feedback systems	3.03	0.85	2.96	0.81	3.01	0.35	HA	NS

N_1 = Number of male lecturers (31); N_2 = Number of female lecturers (25); $\bar{X}_1$ = Mean of male lecturers; $\bar{X}_2$ = Mean of female lecturers; SD1 = Standard deviation of male lecturers; SD2= Standard deviation of female lecturers; $\bar{X}g$ = Grand Mean; t = t-test results; NS = Not Significant; Rem = Remarks; Dec = Decision; Df = Degree of freedom (54); HA = High Awareness

Table 1 reveals that all ten items had grand mean values ranging from 2.54 to 3.24, indicating a high level of awareness of AI tools among agricultural education lecturers in Enugu State. The t-test results, which ranged from 0.15 to 0.86, were not significant at the 0.05 level, indicating no significant difference between the mean responses of male and female lecturers. Therefore, the null hypothesis was accepted.

Table 2: Mean Responses, Standard Deviation and t-test Results of Male and Female Lecturers on Utilization of AI Tools

S/N	Utilization Practice	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_g$	t	Rem	Dec
	AI tools are used for:								
1	preparing digital farm simulations	2.26	0.99	2.18	0.95	2.22	0.41	LE	NS
2	class assessments	2.41	0.93	2.29	0.89	2.36	0.62	LE	NS
3	Prediction including crop modeling instruction	2.45	0.90	2.33	0.86	2.41	0.58	LE	NS
4	chatbots for student queries	2.14	1.04	2.05	1.00	2.10	0.37	LE	NS
5	computer vision tools in lab sessions	2.52	0.96	2.42	0.92	2.48	0.49	LE	NS
6	incorporating AI topics into lectures	2.61	0.88	2.48	0.84	2.55	0.71	HE	NS

Table 2 Continues

7	supervising research	2.43	0.93	2.34	0.89	2.39	0.44	LE	NS
8	delivering content through AI platforms	2.21	0.91	2.10	0.87	2.16	0.53	LE	NS
9	analytics to track student performance	2.35	0.97	2.20	0.93	2.29	0.67	LE	NS
10	mentoring students	2.47	0.92	2.40	0.88	2.44	0.29	LE	NS
11	voice recognition for lecture delivery	2.23	0.95	2.16	0.91	2.20	0.35	LE	NS

N_1 = 31; N_2 = 25; $\bar{X}_1$ = Mean of male lecturers; $\bar{X}_2$ = Mean of female lecturers; SD_1 = Standard deviation of male lecturers; SD_2= Standard deviation of female lecturers; $\bar{X}_g$ = Grand Mean; t = t-test results; NS = Not Significant; Rem = Remarks; Dec = Decision; Df = Degree of freedom (54); HE = High Extent; LE = Low Extent;

Table 2 reveals that grand mean values for 10 of the 11 items had mean values below 2.50, indicating low utilization of AI tools by agricultural education lecturers in Enugu State, except for incorporating AI topics into lectures, which recorded a high extent of utilization. The t-test results ranged from 0.29 to 0.71 and were not significant at the 0.05 level, indicating no significant difference between the mean responses of male and female lecturers on their extent of AI tool utilization. Therefore, the null hypothesis was accepted.

Table 3: Mean Responses, Standard Deviation and t-test Results of Male and Female Lecturers on Challenges to AI Adoption

S/N	Challenges	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_g$	t	Rem	Dec
1	Lack of training on AI tools	3.38	0.79	3.32	0.75	3.36	0.28	MC	NS
2	Poor internet connectivity	3.30	0.84	3.24	0.80	3.28	0.35	MC	NS
3	Limited access to digital infrastructure	3.42	0.76	3.36	0.72	3.40	0.24	MC	NS
4	Absence of AI content in curriculum	3.18	0.87	3.08	0.83	3.14	0.57	MC	NS
5	Inadequate institutional policy	3.07	0.88	3.02	0.84	3.05	0.31	MC	NS
6	Lack of motivation/incentives	2.84	0.92	2.78	0.88	2.82	0.42	MC	NS
7	Fear of being replaced by AI	2.70	0.97	2.67	0.93	2.69	0.18	MC	NS
8	Time constraints in learning new tools	2.92	0.91	2.83	0.87	2.88	0.49	MC	NS
9	Low digital literacy among colleagues	3.23	0.81	3.17	0.77	3.21	0.33	MC	NS

N_1 = 31; N_2 = 25; $\bar{X}_1$ = Mean of male lecturers; $\bar{X}_2$ = Mean of female lecturers; SD1 = Standard deviation of male lecturers; SD2= Standard deviation of female lecturers; $\bar{X}_g$ = Grand Mean; t = t-test results; NS = Not Significant; Rem = Remarks; Dec = Decision; Df = Degree of freedom (54); MC = Major Challenge

Table 3 reveals that all nine items had mean values ranging from 2.69 to 3.40, which are above the decision benchmark of 2.50, indicating that university lecturers face major challenges in adopting AI tools in agricultural education programmes in Enugu State. The t-test results ranged from 0.18 to 0.57 and were not significant at the 0.05 level, indicating no significant difference between the mean responses of male and female lecturers on the challenges of AI adoption. Therefore, the null hypothesis was accepted.

Table 4: Mean Responses, Standard Deviation and t-test Results of Male and Female Lecturers on Strategies for Enhancing AI Adoption

S/N	Possible Strategies	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}g$	t	Rem	Dec
1	Regular AI training/workshops for lecturers	3.36	0.82	3.30	0.78	3.34	0.32	VS	NS
2	Upgrade digital infrastructure	3.49	0.77	3.45	0.73	3.48	0.21	VS	NS
3	Integrate AI in curriculum	3.32	0.80	3.26	0.76	3.30	0.36	VS	NS
4	Provide institutional incentives	3.04	0.91	3.00	0.87	3.02	0.27	VS	NS
5	Improve internet connectivity	3.43	0.74	3.38	0.70	3.41	0.25	VS	NS
6	Promote inter-departmental collaboration	3.08	0.87	3.03	0.83	3.06	0.41	VS	NS
7	Appoint digital innovation officers	2.93	0.85	2.89	0.81	2.92	0.19	VS	NS
8	Allocate special AI funding	3.20	0.88	3.16	0.84	3.19	0.29	VS	NS
9	Include AI in staff evaluation	2.80	0.90	2.74	0.86	2.78	0.44	VS	NS
10	Launch pilot AI projects in courses	3.16	0.86	3.13	0.82	3.15	0.17	VS	NS
11	Partner with EdTech and AgriTech firms	3.37	0.78	3.34	0.74	3.36	0.23	VS	NS

N_1 = 31; N_2 = 25; $\bar{X}_1$ = Mean of male lecturers; $\bar{X}_2$ = Mean of female lecturers; SD1 = Standard deviation of male lecturers; SD2= Standard deviation of female lecturers; $\bar{X}g$ = Grand Mean; t = t-test results; NS = Not Significant; Rem = Remarks; Dec = Decision; Df = Degree of freedom (54); VS = Viable Strategy

Table 4 reveals that all eleven items had mean values ranging from 2.78 to 3.48, which are above the benchmark of 2.50, indicating that the listed items were viable strategies for improving the adoption and utilization of AI tools in agricultural education programmes in Enugu State. The t-test results ranged from 0.17 to 0.44 and were not significant at the 0.05 level, indicating no significant difference between the mean responses of male and female lecturers on the strategies for improving AI tool adoption and utilization. Therefore, the null hypothesis was accepted.

Discussion of Findings

Table 1 revealed that agricultural education lecturers in Enugu State had a high level of awareness of AI tools, as all the items recorded mean values above the benchmark of 2.50. This implies that the lecturers are familiar with emerging AI applications such as machine learning, predictive analytics, smart irrigation systems, and computer vision for agricultural practices. The finding is consistent with the report of UNESCO (2023), which stated that increasing exposure to digital technologies has significantly improved educators' awareness of AI applications. It also corroborates AlKanaan (2022), who found that pre-service science teachers demonstrated a high level of awareness of AI technologies for teaching and learning. Similarly, Nwakile et al. (2026) reported that TVET educators possessed moderate to high levels of awareness and readiness for AI-supported instruction, although differences existed in their pedagogical competencies. However, the relatively lower awareness of Natural Language Processing and AI in livestock tracking suggests that some specialized AI applications require greater professional exposure. The hypothesis further revealed no significant difference between the mean responses of male and female lecturers, indicating that awareness of AI tools is comparable across gender groups.

Table 2 also revealed that agricultural education lecturers made limited use of AI tools in teaching and research despite their high level of awareness. This indicates that awareness alone does not necessarily translate into classroom application. The finding agrees with Miao et al. (2021), who observed that inadequate infrastructure and limited digital competencies hinder AI utilization in educational institutions. It also supports Okafor & Nwankwo (2022), who identified inadequate training and insufficient technological pedagogical knowledge as major constraints to AI integration in higher agricultural education. Likewise, Olorkor & Gideon (2024) found that although university lecturers expressed positive perceptions towards AI integration, actual utilization remained low because of inadequate institutional support and limited access to digital facilities. The hypothesis further showed no significant difference between the responses of male and female lecturers, suggesting that the low utilization of AI tools is commonly experienced irrespective of gender.

Table 3 indicated that agricultural education lecturers encounter major challenges in adopting AI tools, particularly inadequate training, poor internet connectivity, limited digital infrastructure, and weak institutional support. The finding corroborates Sarker et al. (2023), who reported that inadequate infrastructure and technical capacity remain major obstacles to the adoption of AI technologies in agriculture. It also agrees with Suleman et al. (2023), who found that insufficient training opportunities and resistance to technological change significantly reduce educators' readiness to integrate AI into teaching. Similarly, Food and Agriculture Organization of the United Nations (FAO, 2022) emphasized that successful AI implementation in agriculture requires adequate infrastructure, ethical guidelines, and institutional investment. The hypothesis further revealed no significant difference between the mean responses of male and female lecturers, indicating that these challenges are generally experienced across both groups.

Table 4 revealed that respondents considered regular AI training, improved digital infrastructure, curriculum integration, enhanced internet connectivity, and partnerships with AgriTech and EdTech organisations as viable strategies for improving AI adoption and utilization. The finding supports Do (2025), who emphasized that continuous professional development enhances lecturers' competencies for technology-supported instruction. It also corroborates Holmes et al. (2022), who stressed that institutional support, professional learning opportunities, and enabling policies are essential for the successful implementation of AI in education. Furthermore, Nwakile et al. (2026) recommended continuous capacity building, curriculum reforms, and institutional investment to improve educators' readiness for AI-supported instruction. UNESCO (2023) also emphasized policy alignment, digital infrastructure, and capacity building as critical requirements for sustainable AI integration in education. The hypothesis further showed no significant difference between the responses of male and female lecturers, indicating a common perception regarding the strategies required for effective AI adoption in agricultural education.

Conclusion

The findings of this study revealed that university lecturers in agricultural education programmes in Enugu State possess a high level of awareness of artificial intelligence (AI) tools. However, the extent of their utilization of these tools in instructional and research activities remains low. The study further identified major challenges to AI adoption, including inadequate training, poor infrastructure, and limited institutional support. Nevertheless, viable strategies such as regular training, improved digital infrastructure, curriculum integration, and partnerships with relevant organizations were identified for enhancing AI adoption and utilization. The study also shows that male and female lecturers did not differ significantly in their awareness, utilization, perceived challenges, and suggested strategies regarding AI tools. It can therefore be concluded that although awareness of AI exists among lecturers, its effective utilization is constrained by institutional, infrastructural, and capacity-related factors. Addressing these barriers through deliberate interventions is essential for realizing the potential of AI in agricultural education.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Universities should organize regular AI training and workshops to improve lecturers' competence in the use of AI tools for teaching and research.
2. Agricultural education departments should integrate AI tools into instructional delivery, assessment, and research activities.
3. Government and relevant agencies should provide adequate digital infrastructure, stable internet access, and funding for AI integration.
4. University management should establish AI policies and promote collaboration with AgriTech and EdTech organizations to support AI adoption.

References

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

Do, C. L. T. (2025). Social-emotional development for vocational school students through teaching soft skills: A case study in Vietnam. *TVET@Asia, 25*, 1–15. https://tvet-online.asia/wp-content/uploads/2025/08/TVET@Asia_Issue-25_paper-5-5.pdf

Ejiofor, T.E & Nwakile, T.C. (2016). Revitalizing Technical Vocational Education and Training for Job Creation and National Development through Agricultural Education Programmes in Tertiary Institutions in Nigeria. *Journal of Association of Vocational and Technical Educators of Nigeria, Volume 21* (2), pp. 102 –110.https://avten-edu.org.ng/journal/ index. php/javten/article/view/168

Ejiofor, T.E., Alleh, A. O. & Nwakile, T.C. (2020). Information needs on green economy for self-reliance by agricultural science students in senior secondary schools in the Federal Capital Territory, Abuja. *Journal of Agricultural Education Teachers Association of Nigeria,* 4(1), 190 – 198. https://www.researchgate.net/ publication/358736556

FAO. (2022). *Artificial intelligence: Ethical considerations in agricultural innovation*. Food and Agriculture Organization of the United Nations. https://www.fao.org/3/cb9881en/cb9881en.pdf

Ghosh, R., & Rathore, H. (2020). Role of AI in agricultural education and training: An overview. *International Journal of Agricultural Sciences*, 12(4), 123–130. https://doi.org/10.18805/IJAS.Supp.2020.120

Holmes, W., Bialik, M., & Fadel, C. (2022). *Artificial Intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign. https://curriculumredesign.org/wp-content/uploads/AI-in-Education.pdf

Kamilaris, A., & Prenafeta-Boldú, F. X. (2018). Deep learning in agriculture: A survey. *Computers and Electronics in Agriculture, 147*, 70–90. https://doi.org/10.1016/j.compag.2018.02.016

Miao, F., Holmes, W., Huang, R., & Zhang, H. (2021). *AI and education: Guidance for policy-makers*. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000376709

Nwachukwu, C. U., Onah, F.C., Obijiofor, E.O., Nwankwo, C.U. & Nwakile, T.C. (2020). Effects of multiple teaching methods on academic achievement and interest of primary school pupils in agricultural science in Anambra State. *International Journal of Multidisciplinary and Current Research, 8*, (May/ June, 2020 issue), 415 – 420. Available at http://ijmcr.com/effects-of-multiple-teaching-methods-on-academic-achievement-and-interest-of-primary-school-pupils-in-agricultural-science-in-anambra-state/

Nwakile, T. C., Izuakor, C. F., Omeh, C. B., & Chukwu, D. U. (2026). Readiness of TVET educators for AI-supported instruction: A multi-dimensional assessment of competencies and pedagogical adaption. *TVET@Asia*, 26, 1-20. https://tvet-online.asia/wp-content/uploads/2026/03/TVET@Asia-Issue-26_paper-Nwakile-et-al-1.pdf

Nwakile, T.C., Nwankwo C.U., Ekenta, L.U., Ameh H.I., & Nwokolo E. (2022). Comparative effects of demonstration method and blending learning on academic achievement and interest of agricultural science students in Nsukka Education Zone of Nigeria. *International Journal of Research in Social Science and Humanities (IJRSS), 3*(6), 9–15. https://doi.org/10.47505/IJRSS.2022.V3.6.2

Olorkor, N., & Gideon, N. M. (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. https://ijvocter.com/ijahee/article/view/129

OECD. (2020). *Shaping responsive education systems in a digital age*. OECD Publishing.

Okafor, U. N., & Nwankwo, I. M. (2022). Challenges of adopting digital tools in Nigerian higher agricultural education. *Journal of Digital Education and Technology*, 6(1), 25–34.

Okoli, T. O., Ejiofor, T. E., Ali, C. C. & Nwakile, T. C. (2020). 21st century TVET policies and practices in Nigeria: challenges and enhancement measures. Vocational and Technical Education Journal (VOTEJ), 2 (1), 13 – 21. ISSN: 2734-2697 (Print). https://www.acjol.org/index.php/votej/article/view/365.

Onah, F. C., Nwakile, T. C., Nwankwo, C. U., & Ameh, H. I. (2023). Strategies for enhancing utilization of innovative crop production techniques by households in Kwara State. *Journal of Home Economics Research, 30*(1), 192 – 203. https://journals.heran.org/index.php/JHER/article/view/18/17

Sarker, M. N. I., Wu, M., & Hossin, M. A. (2023). Applications of artificial intelligence in agriculture: A comprehensive review. *Artificial*

Intelligence in Agriculture, 7, 1–13. https://doi.org/10.1016/j.aiia.2023.01.001

Schleicher, A. (2021). *The future of education and skills: OECD education 2030 framework*. OECD. https://www.oecd.org/education/2030-project/

Suleman, Q., Hussain, I., & Ghaffar, A. (2023). Teachers' perceptions and readiness toward artificial intelligence in education. *Education and Information Technologies, 28*, 511–530. https://doi.org/10.1007/s10639-022-11194-w

Sutcliffe, M., MacKrell, D., & Wilson, D. (2021). Using AI to enhance agricultural education: Opportunities and risks. *Computers in Education Journal, 31*(2), 49–63. https://doi.org/10.18260/3-1-115742

UNESCO. (2023). *Education and artificial intelligence: A strategy for transformation*.

Zawacki-Richter, O., Marín, V. I., 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), 1–27. https://doi.org/10.1186/s41239-019-0171-0