

Artificial Intelligence Literacy as a Predictor of Readiness for Digital Agriculture among Agricultural Education Students in Colleges of Education in South-East Nigeria

Dr. Owo Emmanuel Ozuma¹

Abel Charles Izuchukwu²

Adu Chukwuebuka Jeremiah

^{1,2,3} Department of Agricultural Education, Federal College of Education (Technical) Isu.

DOI: <https://doi.org/10.5281/zenodo.22979480>

Abstract

The study examined artificial intelligence (AI) literacy and readiness for digital agriculture among Agricultural Education students in Colleges of Education in South-East Nigeria. A correlational survey design was adopted. The population comprised 585 Agricultural Education students, from which 210 students were selected through proportionate sampling across Abia, Anambra, Ebonyi, Enugu and Imo States. Data were collected using a researcher-developed 35-item Artificial Intelligence Literacy and Digital Agriculture Readiness Questionnaire (AILDARQ). The instrument measured AI knowledge, AI skills, AI application competence, AI ethical awareness, digital agriculture knowledge and awareness, digital technology confidence, and adoption readiness. The instrument was validated by experts in Agricultural Education, Educational Technology, and Measurement and Evaluation, and its overall internal consistency yielded a Cronbach's alpha coefficient of 0.82. Mean and standard deviation were used to answer the research questions, while Pearson Product-Moment Correlation was used to test the hypothesis at the 0.05 level of significance. The findings showed that students had a high level of AI literacy ($M = 2.65$, $SD = 0.53$) and a high level of readiness for digital agriculture ($M = 3.04$, $SD = 0.49$). A moderate positive and statistically significant relationship existed between AI literacy and readiness for digital agriculture ($r = 0.467$, $p < 0.0001$). The null hypothesis was rejected. The study concluded that AI literacy was positively associated with readiness for digital agriculture among the students. It recommended systematic integration of AI literacy, practical digital agriculture activities, ethical AI use, and technology-supported agricultural learning into Agricultural Education programmes.

Keywords: Agricultural Education, artificial intelligence literacy, digital agriculture, digital technology, readiness, students

Introduction

The increasing application of digital technologies is transforming agricultural production, information management, decision-making and extension services, thereby creating new competency requirements for students preparing for agricultural professions. Digital agriculture involves the application of digital technologies to agricultural activities and can include mobile applications, artificial intelligence (AI), sensors, data systems and other technologies that support the generation, analysis and use of agricultural information. As agriculture becomes increasingly technology-driven, Agricultural Education programmes are expected to prepare students not only with conventional agricultural knowledge but also with the competencies required to understand and use emerging digital technologies effectively. Evidence from Nigeria indicates that students are becoming increasingly receptive to agricultural digital technologies, although their awareness and actual use of specific applications may remain limited. For example, Akinyemi et al. (2024) found low awareness and use of selected smartphone applications for crop protection among agricultural students, despite generally favourable perceptions and readiness to use such technologies. This suggests that preparing students for digital agriculture requires attention to both technological competence and readiness to engage with emerging technologies.

Artificial intelligence is particularly important within this transformation because AI systems can support the processing of large volumes of information, pattern recognition, prediction, classification and decision-making. In agriculture, these capabilities can be applied to areas such as crop and disease identification, agricultural forecasting, precision agriculture, farm management and extension services. The increasing presence of AI consequently makes AI literacy an important component of contemporary agricultural education. Chiu et al. (2024) explained that AI literacy encompasses knowledge and understanding of AI, while AI competency extends beyond knowledge to the ability to apply AI appropriately and beneficially. Thus, students preparing for agricultural careers need to understand what AI is, recognise its applications, use relevant AI tools and critically evaluate AI-generated information rather than merely having access to digital devices.

The importance of these competencies is reinforced by the UNESCO AI Competency Framework for Students. Miao et al. (2024) identified four dimensions of AI competency: human-centred mindset, ethics of AI, AI techniques and applications, and AI system design. These dimensions are organized across three levels of progression understand, apply and create and emphasize responsible use, critical judgment and meaningful engagement with AI. These competencies are relevant to Agricultural Education because future agricultural educators are likely to encounter AI-supported tools in both teaching and agricultural practice. Consequently, Agricultural Education students require not only general awareness of AI but also the capacity to apply AI-related knowledge within authentic agricultural contexts and to evaluate its outputs responsibly.

The need for AI literacy is also evident in teacher education. Sperling et al. (2024), in a scoping review of 34 studies, found that AI literacy was an emerging research area in teacher education and that the literature addressed theoretical, practical and ethical forms of knowledge. The authors further observed that teachers' practical knowledge was relevant to the adoption of digital resources and the integration of AI-related educational technologies. Similarly, Ayanwale et al. (2024) examined AI literacy among pre-service teachers and found significant relationships between understanding AI and several dimensions of AI-related engagement, including use, detection, ethics, creation and problem-solving. These studies indicate that AI literacy is becoming an important component of preparing future educators for technology-rich professional environments.

Within Agricultural Education, however, AI literacy must be considered alongside students' readiness to engage with digital agricultural technologies. Readiness refers in this study to students' knowledge and awareness of digital agriculture, confidence in using digital technologies and willingness to adopt appropriate technologies. The relationship between knowledge, confidence and technology acceptance can be explained partly through the Technology Acceptance Model (TAM). Davis (1989) proposed that perceived usefulness and perceived ease of use are important determinants of users' acceptance of information technology. Applied to Agricultural Education, students who possess relevant knowledge and skills may be better positioned to understand the usefulness of digital agricultural technologies and develop

confidence in engaging with them. Nevertheless, readiness may also be influenced by access to infrastructure, previous experience, training, internet connectivity and institutional support.

Empirical evidence demonstrates why the distinction between readiness and actual use is important. Akinyemi et al. (2024) reported that agricultural students had favourable perceptions and high readiness to use smartphone applications for crop protection, yet awareness and actual use of specific applications were low. Their findings indicate that willingness to use digital technologies does not necessarily mean that students have acquired the practical experience required for actual adoption. This distinction provides a basis for examining whether broader AI literacy is associated with readiness for digital agriculture. If students understand AI, possess relevant skills and can critically evaluate AI-generated information, they may be better prepared to engage with digital agricultural technologies; however, such an association needs to be established empirically rather than assumed.

The existing literature provides useful evidence on AI literacy and digital agricultural technology separately, but there remains limited empirical evidence specifically concerning Agricultural Education students in Colleges of Education in South-East Nigeria. Ayanwale et al. (2024) examined AI literacy among pre-service teachers, while Akinyemi et al. (2024) investigated awareness, perceptions and readiness concerning smartphone applications among agricultural students. However, the relationship between AI literacy and readiness for digital agriculture among Agricultural Education students in Colleges of Education remains insufficiently established. This gap is important because these students are being prepared for professional roles in which they may be expected to teach agriculture, support agricultural extension and participate in technology-enabled agricultural activities. The present study therefore examines the level of AI literacy, the level of readiness for digital agriculture and the relationship between the two constructs among Agricultural Education students in Colleges of Education in South-East Nigeria.

Statement of the Problem

The increasing use of AI and digital technologies in agriculture has created new competency requirements for Agricultural Education students. Future agricultural educators are expected to understand emerging technologies, evaluate digital information and apply appropriate

technologies to agricultural teaching, learning and practice. However, possessing access to digital devices does not necessarily mean that students possess the knowledge, skills, ethical awareness and confidence required for effective digital agricultural engagement. Evidence from Nigeria has shown that students can express high readiness toward agricultural digital technologies while having limited awareness and actual experience with specific applications (Akinyemi et al., 2024).

The limited empirical evidence linking AI literacy with digital agriculture readiness among Agricultural Education students therefore constitutes a research problem. While previous studies have established the importance of AI literacy among pre-service teachers and have examined students' awareness and perceptions of agricultural digital technologies, little is known about the level of AI literacy among Agricultural Education students in Colleges of Education in South-East Nigeria and its relationship with their readiness for digital agriculture. This gap limits the empirical basis for designing Agricultural Education programmes that effectively prepare students for technology-supported agricultural practice. The present study consequently examined the level of AI literacy, the level of readiness for digital agriculture and the relationship between the two variables.

Purpose of the Study

The purpose of the study is to examine artificial intelligence literacy and readiness for digital agriculture among Agricultural Education students in Colleges of Education in South-East Nigeria. Specifically, the study seeks to:

1. Determine the level of AI literacy among Agricultural Education students in Colleges of Education in South-East Nigeria; and
2. Determine the level of readiness for digital agriculture among Agricultural Education students in Colleges of Education in South-East Nigeria.

Research Questions

The following research questions guide the study:

1. What is the level of AI literacy among Agricultural Education students in Colleges of Education in South-East Nigeria?
2. What is the level of readiness for digital agriculture among Agricultural Education students in Colleges of Education in South-East Nigeria?

Hypothesis

The following null hypothesis is tested at the 0.05 level of significance:

H₀: There is no significant relationship between AI literacy and readiness for digital agriculture among Agricultural Education students in Colleges of Education in South-East Nigeria.

Methodology

Research Design

The study adopted a correlational survey design. The design was appropriate because the study measured AI literacy and readiness for digital agriculture as they existed among the students and determined the statistical relationship between the two variables without manipulating either variable.

Population and Sample

The population comprised 585 Agricultural Education students in Colleges of Education across the five states of South-East Nigeria. A sample of 210 students was selected using proportionate sampling. The sample allocation was determined using the formula:

$$n_i = (N_i/N) \times n$$

where n_i represented the sample allocated to each state, N_i represented the population of students in each state, N represented the total population, and n represented the total sample size.

State	Population	Percentage	Sample
Abia	100	17.1	36
Anambra	116	19.8	42
Ebonyi	96	16.4	34

Enugu	152	26.0	55
Imo	121	20.7	43
Total	585	100.0	210

Instrument for Data Collection

Data were collected using a researcher-developed Artificial Intelligence Literacy and Digital Agriculture Readiness Questionnaire (AILDARQ). The questionnaire contained 35 substantive items organized into two sections. The AI literacy section contained 20 items covering AI knowledge, AI skills, AI application competence and AI ethical awareness. The digital agriculture readiness section contained 15 items covering digital agriculture knowledge and awareness, digital technology confidence and adoption readiness.

The AI literacy items were rated on a four-point scale of Very High Extent (4), High Extent (3), Low Extent (2) and Very Low Extent (1). The readiness items were rated Strongly Agree (4), Agree (3), Disagree (2) and Strongly Disagree (1). A criterion mean of 2.50 was adopted. Mean scores of 3.25–4.00 were interpreted as Very High, 2.50–3.24 as High, 1.75–2.49 as Low and 1.00–1.74 as Very Low.

Validity and Reliability

The instrument was subjected to validation by experts in Agricultural Education, Educational Technology, and Measurement and Evaluation. Their observations were used to improve the clarity, relevance and adequacy of the items. The internal consistency of the instrument was determined using Cronbach's alpha, which produced an overall reliability coefficient of 0.82. The coefficient indicated satisfactory internal consistency for the study.

Data Analysis

Mean and standard deviation were used to answer the two research questions because the questions sought to determine the levels of AI literacy and readiness for digital agriculture. Pearson Product-Moment Correlation was used to test the hypothesis at the 0.05 level of significance because the hypothesis examined the relationship between the two variables. The null hypothesis was rejected when the probability value was less than 0.05 and retained when it was greater than 0.05.

Results

Research Question 1

What is the level of AI literacy among Agricultural Education students in Colleges of Education in South-East Nigeria?

Table 1: Mean and Standard Deviation of AI Literacy

Variable	N	Mean	SD	Decision
AI Literacy	210	2.65	0.53	High

Table 1 showed that the 210 students obtained a mean AI literacy score of 2.65 and a standard deviation of 0.53. The mean fell within the criterion range of 2.50–3.24 and was therefore interpreted as High. The result indicated that the students reported a relatively high level of AI knowledge, skills, application competence and ethical awareness.

Research Question 2

What is the level of readiness for digital agriculture among Agricultural Education students in Colleges of Education in South-East Nigeria?

Table 2: Mean and Standard Deviation of Readiness for Digital Agriculture

Variable	N	Mean	SD	Decision
Readiness for Digital Agriculture	210	3.04	0.49	High

Table 2 showed that the students recorded a mean readiness score of 3.04 and a standard deviation of 0.49. The mean fell within the criterion range of 2.50–3.24 and was therefore interpreted as High. The result indicated that the students reported high levels of digital agriculture knowledge and awareness, digital technology confidence and adoption readiness.

Test of Hypothesis

H₀: There is no significant relationship between AI literacy and readiness for digital agriculture among Agricultural Education students in Colleges of Education in South-East Nigeria.

Table 3: Pearson Product-Moment Correlation between AI Literacy and Readiness for Digital Agriculture

Variables	N	r	p-value	Decision
AI Literacy and Readiness for Digital Agriculture	210	0.467	<0.0001	Significant

Table 3 showed a Pearson correlation coefficient of 0.467 with a probability value of $p < 0.0001$. The coefficient represented a moderate positive relationship between AI literacy and readiness for digital agriculture. Since the probability value was less than the 0.05 level of significance, the null hypothesis was rejected. Thus, a statistically significant positive relationship existed between AI literacy and readiness for digital agriculture among the students.

Discussion

AI Literacy of Agricultural Education Students

The first finding showed that Agricultural Education students had a high level of AI literacy ($M = 2.65$, $SD = 0.53$). The finding suggested that, based on their responses, the students' possessed relatively high levels of AI knowledge, skills, application competence and ethical awareness. This result was consistent with the broader conceptualization of AI literacy by Chiu et al. (2024), who explained that AI literacy involves knowledge and skills for understanding AI, while responsible and confident application extends this literacy toward AI competency. The finding was also consistent with UNESCO's (2024) AI Competency Framework for Students, which emphasized foundational AI knowledge, application skills, ethical awareness and critical judgment as important components of meaningful engagement with AI.

The present finding agreed particularly with Ayanwale et al. (2024), who examined AI literacy among 529 pre-service teachers in a Nigerian university and found that understanding AI significantly predicted positive outcomes involving AI use, detection, ethics, creation and problem-solving. The agreement may be explained by the similarity in the educational status of the respondents. Both studies involved students preparing for professional roles in education, although the present study focused specifically on Agricultural Education students in Colleges of Education. The finding also agreed with Sperling et al. (2024), whose review identified

theoretical, practical and ethical knowledge as important components of AI literacy in teacher education.

However, the finding differed from the evidence reported by Akinyemi et al. (2024), who found very low awareness of selected smartphone applications for agricultural crop protection among students in South-West Nigeria. Less than 8% of respondents were aware of specific applications for pest identification, disease diagnosis and weather forecasting, while less than 4% had used such applications. The difference could be explained by the constructs measured. The present study measured broad AI literacy, including knowledge, skills, application competence and ethical awareness, whereas Akinyemi et al. focused on awareness and actual use of particular agricultural smartphone applications. Therefore, the present finding indicates high self-reported general AI literacy but does not imply that the students had extensive experience with all specialized agricultural AI applications.

Readiness for Digital Agriculture

The second finding showed that Agricultural Education students had a high level of readiness for digital agriculture ($M = 3.04$, $SD = 0.49$). The finding indicated that students generally reported high levels of digital agriculture knowledge and awareness, confidence in using digital technologies and willingness to adopt appropriate digital technologies. This result is important because readiness represents a student's preparedness and willingness to engage with digital technology, although it does not necessarily indicate established patterns of actual technology use.

The finding agreed with Akinyemi et al. (2024), who found a high level of readiness among agricultural students to use smartphone applications for crop protection. Their respondents recorded a mean readiness score of 4.45 on a five-point scale despite having low awareness and limited actual use of specific agricultural applications. The agreement suggests that Agricultural Education and agricultural students may express considerable willingness to engage with digital agricultural technologies even when their practical exposure remains limited.

The finding was also consistent with the Technology Acceptance Model proposed by Davis (1989), which identified perceived usefulness and perceived ease of use as important determinants of technology acceptance. Students who perceive digital agricultural technologies as useful and manageable may therefore be more prepared to engage with them. Nevertheless, the present finding differed from the low awareness and usage levels reported by Akinyemi et al. (2024). The difference reinforces the distinction between readiness and actual adoption. A student may be willing and confident to use a technology without having had sufficient access, training, infrastructure or opportunity to use it.

The finding therefore suggests that the high readiness reported by the students represents an important foundation for digital agriculture education, but institutions should provide practical experiences that enable students to convert readiness into demonstrated competence. This is particularly important because digital agriculture requires not only willingness to use technology but also appropriate technical knowledge, critical judgment and contextual agricultural skills.

Relationship between AI Literacy and Readiness for Digital Agriculture

The third finding established a moderate positive and statistically significant relationship between AI literacy and readiness for digital agriculture ($r = 0.467$, $p < 0.0001$). The result indicated that students with higher AI literacy tended to report higher readiness for digital agriculture. The rejection of the null hypothesis provided statistical evidence that the two variables were significantly associated in the sample.

The finding was consistent with Ayanwale et al. (2024), who found significant relationships among dimensions of AI literacy and AI-related outcomes among Nigerian pre-service teachers. Their findings demonstrated that understanding AI was associated with outcomes involving AI use, detection, ethics, creation and problem-solving. The present result therefore provides additional Nigerian evidence that AI-related knowledge and competence are associated with students' preparedness to engage with technology.

The finding was also consistent with the conceptual position of Chiu et al. (2024), who distinguished AI literacy from AI competency while noting their strong relationship. Their framework indicates that knowledge and skills provide an important basis for confident and beneficial application of AI. This provides a reasonable theoretical explanation for the present finding: students who understand AI and report greater competence in using it may also be more prepared to engage with digital technologies in agricultural contexts.

However, the present finding should be distinguished from the evidence of Akinyemi et al. (2024), whose respondents demonstrated high readiness but low awareness and actual use of specific agricultural smartphone applications. Their finding suggests that readiness does not automatically translate into actual technology adoption. The difference may arise because the present study examined the relationship between AI literacy and readiness, whereas Akinyemi et al. (2024), examined awareness, usage and perceptions of specific agricultural applications. The two studies therefore addressed different stages of technology engagement.

The present correlation should also not be interpreted as evidence that AI literacy caused readiness for digital agriculture. The correlational design established association rather than causation. Other factors, including access to digital devices, internet connectivity, previous technology experience, institutional support, training and perceived usefulness, may also influence students' readiness. The moderate size of the correlation further indicates that AI literacy was related to readiness but did not account for all possible differences in students' preparedness.

Conclusion

The study found that Agricultural Education students in Colleges of Education in South-East Nigeria reported a high level of AI literacy and a high level of readiness for digital agriculture. The study also established a moderate positive and statistically significant relationship between AI literacy and readiness for digital agriculture. These findings indicated that students who reported higher AI literacy also tended to report higher readiness for digital agricultural engagement. The result was consistent with recent evidence highlighting the importance of AI knowledge, practical competence and ethical awareness in technology-related education.

However, the findings should be interpreted alongside evidence showing that readiness does not necessarily translate into actual technology use. Nigerian agricultural students have previously demonstrated high readiness to use digital agricultural applications despite limited awareness and practical use of particular technologies (Akinyemi et al., 2024). Consequently, strengthening AI literacy should be accompanied by opportunities for practical digital agriculture experiences, adequate infrastructure and curriculum-based technology integration.

Recommendations

Based on the findings, the following recommendations were made:

1. AI literacy should be systematically integrated into Agricultural Education programmes. Colleges of Education should incorporate AI knowledge, practical AI skills, application competence, critical evaluation and ethical AI use into relevant Agricultural Education courses.
2. Students should receive practical digital agriculture training. Agricultural Education programmes should provide opportunities for students to use appropriate AI-supported agricultural applications, digital extension tools, agricultural data systems and other relevant technologies.
3. Colleges of Education should provide adequate digital infrastructure. Reliable internet connectivity, appropriate digital devices, software and technical support should be made available to facilitate meaningful engagement with digital agriculture.
4. Practical agricultural problems should be used in AI-related learning activities. Students should be required to apply AI and digital technologies to authentic problems involving crop production, animal production, agricultural extension, farm management and agricultural information services.
5. Ethical and critical AI use should be emphasized. Students should be trained to verify AI-generated agricultural information, recognize errors and bias, protect personal data, acknowledge appropriate sources and exercise human judgment when using AI-generated recommendations.
6. Teacher educators should strengthen students' confidence through guided practice. Demonstrations, projects, field-based activities and supervised digital agriculture tasks should be

incorporated into Agricultural Education programmes so that students can translate their reported readiness into practical competence.

7. Further research should examine actual digital technology performance. Future studies should complement self-reported measures of AI literacy and readiness with practical performance assessments to determine whether reported competence corresponds with students' demonstrated ability to use AI and digital agricultural technologies.

References

- Akinyemi, A. O., Ibitunde, I. O., Adediran, A., & Akerele, D. (2024). Awareness and perception on the use of smartphone applications for crop protection among undergraduate students in Southwestern Nigeria. *Discover Agriculture*, 2, Article 79. <https://doi.org/10.1007/s44279-024-00079-2>
- Ayanwale, M. A., Sanusi, I. T., Adelana, O. P., Aruleba, K. D., & Oyelere, S. S. (2024). Examining artificial intelligence literacy among pre-service teachers for future classrooms. *Computers and Education Open*, 6, 100179. <https://doi.org/10.1016/j.caeo.2024.100179>
- Chiu, T. K. F., Ahmad, Z., Ismailov, M., & Sanusi, I. T. (2024). What are artificial intelligence literacy and competency? A comprehensive framework to support them. *Computers and Education Open*, 6, 100171. <https://doi.org/10.1016/j.caeo.2024.100171>
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340. <https://doi.org/10.2307/249008>
- Miao, F., Shiohira, K., & Lao, N. (2024). AI competency framework for students. UNESCO.
- Sperling, K., Stenberg, C.-J., McGrath, C., Åkerfeldt, A., Heintz, F., & Stenliden, L. (2024). In search of artificial intelligence (AI) literacy in teacher education: A scoping review. *Computers and Education Open*, 6, 100169. <https://doi.org/10.1016/j.caeo.2024.100169>
- UNESCO (2024) must appear in the reference list, and the correct bibliographic form is AI competency framework for students, by Miao, Shiohira, and Lao, published by UNESCO in 2024