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Cultivating Excellence: A Holistic Framework for Optimizing Student Learning, Curriculum, and Assessment Integration in Agricultural Science Education in Nigeria

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Agricultural science education is vital for Nigeria's economy and food security, yet traditional educational methods often fail to equip students with the practical skills and knowledge needed in the agricultural industry. This paper presents the Holistic Agricultural Science Learning and Assessment Framework (AgriHOLIST), a comprehensive model designed to optimize student learning through the integration of curriculum and assessment. Drawing from constructivism, experiential learning theory, and authentic assessment principles, this framework fosters a student-centered, experiential, and industry-relevant approach to education. The researchers synthesized insights from 46 research articles sourced from Google Scholar and the Directory of Open Access Journals (DOAJ) to develop the AgriHOLIST framework. Constructivism emphasizes active student engagement and knowledge construction, while experiential learning theory highlights the importance of practical experiences such as internships, fieldwork, and simulations. Authentic assessment principles ensure that evaluations reflect real-world applications, enhancing students' critical thinking and problem-solving skills. The findings from the study indicate that the AgriHOLIST framework addresses key challenges in agricultural science education by bridging the gap between theoretical knowledge and practical application. The framework's holistic approach enhances student engagement, retention, and practical skill development, aligning educational outcomes with industry needs. Stakeholder collaboration, including educators, policymakers, and industry professionals, is essential for the successful implementation of this framework. In conclusion, the AgriHOLIST framework offers a transformative approach to agricultural science education in Nigeria, preparing students for the demands of the agricultural industry and contributing to sustainable development and food security.

Keywords: *Agricultural science education, Curriculum integration, Holistic Approach, Industry Relevance, Stakeholder Collaboration*

1.0 Introduction

Agricultural science education is of paramount importance in Nigeria, as the country relies heavily on its agriculture sector for economic growth and food security (Innocent-Ene et al., 2022). To ensure that students are well-prepared for the industry's evolving challenges, it is crucial to enhance their learning outcomes (Osagiede & Alordiah, 2024a; Islam, 2021). Traditional approaches that focus solely on theoretical knowledge are insufficient for providing a meaningful learning experience (Baker et al., 2012).

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This paper proposes the "Holistic Agricultural Science Learning and Assessment Framework (AgriHOLIST)" by synthesizing insights from various studies. The framework aims to integrate curriculum design and assessment to promote student engagement, knowledge retention, and practical skill application. By adopting a holistic approach, educators can develop agricultural science curricula that meet industry standards and foster critical thinking and problem-solving skills. This framework provides actionable guidelines for enhancing agricultural science education in Nigeria.

1.1 Problem Statement

In Nigeria, agricultural science education is crucial, but current approaches fall short in preparing students for real-world challenges. The gap between theory and practical skills hinders students' ability to apply their learning effectively, impacting their competency and readiness for the workforce.

1.2 Purpose

The primary purpose of this paper is to present a comprehensive framework—AgriHOLIST—that optimizes the integration of student learning, curriculum development, and assessment in agricultural science education.

1.3 Objectives

The specific objectives are:

i. To identify the theoretical foundations supporting holistic curriculum and assessment integration.
ii. To examine the limitations and challenges currently faced in agricultural science curriculum development.
iii. To underscore the significance of integrating assessment strategies that reinforce experiential learning.
iv. To provide practical recommendations for implementing the AgriHOLIST framework to enhance student learning outcomes.

1.4 Theoretical framework

Constructivism, a prominent theory of learning, posits that students actively construct their own knowledge by engaging with their environment and making connections between new information and their existing knowledge. According to Nakelet et al. (2017), constructivist principles are essential for fostering student-cantered learning environments where students take an active role in their education. This theory supports the idea that students learn best when they are involved in the educational process, creating their own understanding and taking responsibility for their learning.

The constructivist approach advocates for learning activities that promote cooperation, analytical thinking, and problem-solving skills. By integrating these activities, educators create an environment that fosters deep learning and significant comprehension. This approach ensures that

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students are not passive recipients of knowledge but active participants who engage with content, collaborate with peers, and apply their learning in meaningful ways.

According to David Kolb's experiential learning theory learning is a continuous process that involves four stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation. This cyclical process emphasizes the importance of firsthand experiences in the learning journey (Baker et al., 2012). Salam (2019) highlights that experiential learning allows students to actively engage in practical experiences such as internships, fieldwork, and simulations. These opportunities enable students to apply theoretical knowledge in real-world contexts, reflect on their experiences, and develop a deeper understanding of the subject matter. By incorporating experiential learning into the conceptual framework, educators provide students with valuable experiences that enhance comprehension, retention, and practical application of agricultural concepts.

Authentic assessment principles focus on evaluating students' abilities to apply their knowledge and skills in real-world scenarios. Singh (2019) notes that authentic assessments, such as performance-based tasks, projects, and simulations, are more reflective of professional practice than traditional exams and quizzes. These assessments require students to demonstrate critical thinking, problem-solving, and decision-making skills.
The theoretical framework of constructivism, experiential learning, and authentic assessment principles forms the foundation for the agricultural science education. These theories inform the design and implementation of curriculum and assessment strategies that are student-cantered, experiential, and aligned with real-world applications.

2.0 Literature review

2.1 Assessment integration in agricultural science education

Summative assessments, such as exams and quizzes, are often the primary focus of traditional assessment methods in agricultural science education. At the end of a lesson, these tests determine the knowledge and comprehension of the students. These methods have benefits, but they also have disadvantages. One disadvantage is that they assess information regurgitation and rote recall rather than the application of knowledge and critical thinking skills. Furthermore, past assessments did not accurately capture the complexity of actual agricultural situations since they occasionally used closed-ended questions with predefined answers (Johanns et al., 2017).
Furthermore, if summative assessments are the only ones utilised, pupils do not obtain ongoing feedback during the learning process. Due to this lack of feedback, students struggle to identify their areas of weakness and adjust their learning strategies. Assessment approaches that go beyond standard procedures must be used to provide a more thorough assessment of students' learning (Marks et al., 2021; Ugoma et al., 2021; Alordiah & Agbajor, 2014).

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2.2 Significance of integrating assessment throughout the learning process

Assessment plays a crucial role in agricultural science education, and it should be integrated into every step of the learning process. Formative assessment provides ongoing guidance and feedback to students, allowing teachers to identify strengths and weaknesses and make necessary adjustments for improved learning outcomes (Osagiede, 2023; Bok et al., 2013). Authentic assessments, such as fieldwork and case studies, enable students to apply their knowledge and problem-solving skills in real agricultural settings, fostering critical thinking and creativity (Tsortanidou, 2019).

Incorporating assessment throughout the learning process also increases student engagement and enthusiasm. By involving students in self-evaluation and peer evaluation activities, they develop metacognitive skills and take responsibility for their learning, reflecting on their progress (Osagiede & Alordiah. 2024b; Dahal et al., 2022). Furthermore, using a variety of assessment methods, including written assignments, presentations, portfolios, and hands-on demonstrations, allows teachers to gather comprehensive evidence of students' learning, providing individualized support and guidance (Bok et al., 2013).

Overall, integrating assessment into agricultural science education goes beyond traditional assessment techniques and addresses their limitations. By incorporating formative assessments, authentic assessments, self-assessment, and peer assessment, teachers can provide continuous feedback, enhance comprehension, promote student involvement, and gather diverse learning data. This approach improves the overall educational process and equips students with the necessary tools to succeed in the agriculture industry.

2.3 Strategies for effective assessment integration

There are a few tactics that can be used to successfully include assessment in agricultural science education. These tactics seek to provide an extensive and significant evaluation procedure that surpasses conventional techniques. Throughout the learning process, students receive constant feedback and assistance via formative assessment tools. Class discussions, concept mapping activities, tests, and peer review sessions are some of these strategies. Teachers can keep an eye on their students' development, pinpoint areas that need work, and offer timely interventions when they use formative assessment. This enables students to modify their methods of learning and gain a deeper comprehension of agricultural ideas (Barry et al., 2018).

With the use of authentic assessment techniques, students can showcase their knowledge, skills, and problem-solving aptitude in real-world agricultural scenarios. Case studies, fieldwork projects, research assignments, and industrial internships are a few examples of these techniques. Teachers can examine their students' capacity to apply theoretical knowledge to real-world problems by including them in realistic assessments (Osagiede,2023). Genuine evaluations encourage the development of transferable skills, critical thinking, and creativity—all of which are necessary for success in the agriculture industry (Ballesteros, 2021).

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Active learning and peer participation are encouraged via collaborative and peer assessment methods. Through group projects, peer evaluations, and presentations, instructors can foster cooperation, communication, and the growth of teamwork abilities in their pupils. Students can give comments and review the work of their peers through peer evaluation, which helps them take ownership of and be accountable for their learning. By strengthening their capacity to evaluate both their own and other people's work, these methods help students gain a deeper comprehension of agricultural ideas (Evans et al., 2018).

The use of technology in agricultural science education can greatly improve assessment procedures. Interactive assessments, such as virtual simulations, online quizzes, and multimedia presentations, can be made using digital tools, online platforms, and multimedia resources. Additionally, teachers can monitor students' progress, give timely comments, and analyse assessment results for ongoing improvement thanks to technology. Assessment may become more effective, accessible, and interesting by utilising technology to gather a variety of evidence of students' learning (Ndibalema, 2021).

Performance-based evaluations use practical assignments or projects to gauge students' knowledge and aptitude. This could include assignments like creating and carrying out experiments, going on field research, or creating sustainable farming plans in agricultural science classes. Performance-based evaluations offer a more thorough picture of students' abilities since they show how they apply their knowledge in real-world situations. These tests measure critical thinking, problem-solving, and decision-making skills—all of which are vital in the agriculture industry—in addition to technical proficiency (Ralston, 2015).

Constant monitoring and feedback entails evaluating students' work frequently and giving them timely feedback to help them learn. This tactic makes sure that assessment is a continuous procedure as opposed to a one-time occurrence. Teachers can keep an eye on students' comprehension and correct any misconceptions or knowledge gaps by utilising a variety of techniques, including informal evaluations, check-ins, and observations in the classroom. Instant feedback allows teachers to direct students' learning paths, make concepts clear, and assist students in making the necessary corrections. Throughout the agricultural science education process, a supportive environment that fosters growth and development is created via ongoing monitoring and feedback (Hiralaal, 2015).

3.0 Methods

This study employs a systhesis research design (Wyborn et al., 2018), utilizing insights from 46 research articles sourced from Google Scholar and the Directory of Open Access Journals (DOAJ). By integrating diverse perspectives and findings from existing literature, the synthesis approach aims to develop a comprehensive framework for enhancing student learning, curriculum, and assessment integration in agricultural science education.

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3.1 Data collection

The data collection process was conducted meticulously and systematically, ensuring the inclusion of relevant and high-quality research articles. A search strategy was developed using specific keywords and implemented in Google Scholar and DOAJ to access a wide range of peer-reviewed and open access content (Alordiah et al., 2023; Martín-Martín et al., 2018). The articles were selected based on predetermined inclusion criteria, resulting in 46 articles that were thoroughly analyzed to ensure a comprehensive representation of perspectives and findings in the field of agricultural science education.

3.2 Data analysis

The analysis of the selected articles followed a thematic synthesis approach to explore curriculum and assessment integration in agricultural science education. Key themes related to this topic were identified through a thorough reading of the articles. The analysis focused on understanding theoretical foundations, practical challenges, and effective strategies for integration. The findings were synthesized to develop the AgriHOLIST framework, which provides practical guidelines for educators and policymakers to enhance student learning outcomes through integrated curriculum and assessment strategies.

3.3 Validity and reliability

Several measures were taken to ensure the validity and reliability of the findings and the proposed framework. Firstly, the preliminary framework and findings were subjected to peer review by three experts in agricultural science education. Their feedback was instrumental in refining and strengthening the framework. Additionally, the use of multiple sources of data allowed for the triangulation of findings, enhancing the reliability of the conclusions drawn. Reflexivity was also maintained throughout the research process by critically reflecting on potential biases and assumptions that could influence the analysis and interpretation of the data.

3.4 Ethical considerations

While this study did not involve primary data collection involving human subjects, ethical considerations were adhered to by ensuring proper citation and acknowledgment of all sources used in the study. This adherence to ethical standards ensures the integrity and credibility of the research.

4.0 Results and Discussion

The Framework and Components of the Conceptual Framework: curriculum planning and assessment to be successfully integrated into agricultural science education, a strong conceptual framework must be developed. This framework describes the essential elements required for a thorough and successful educational experience, acting as a guiding structure.

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4.1.1 Integration of curriculum planning and assessment

The conceptual framework's central idea is the combination of assessment and curriculum development. This element highlights how instruction and assessment are seamlessly connected. Education professionals can guarantee that assessments fairly gauge students' comprehension and application of agricultural topics by coordinating learning objectives with assessment techniques. With this integration, learning can occur more purposefully and cohesively, with assessment acting as a tool for growth and learning rather than as a stand-alone evaluation.

4.1.2 Alignment with industry needs and societal demands

Curriculum and evaluation should reflect industry and social demands to effectively educate students for employment in agriculture. This part makes sure that the learning process is current, pertinent, and sensitive to the changing demands of the business. The skills, knowledge, and abilities that are in high demand can be addressed in the curriculum by educators by incorporating feedback from professionals in the field. This congruence gives students the tools they need to have a significant influence in the agricultural area while also improving their employability.

4.1.3 Incorporation of experiential and real-world learning

The conceptual framework's incorporation of experiential and real-world learning opportunities is essential. Through the provision of experiential learning opportunities, including internships, fieldwork, and industry collaborations, educators can effectively bridge the gap that exists between theory and practice. Through the application of their knowledge in practical settings, students can gain practical skills and a greater comprehension of agricultural ideas. Students' motivation and engagement are raised by experiential and real-world learning opportunities because they foster a feeling of relevance and purpose.

4.1.4 Integration of Interdisciplinary Perspectives

The incorporation of interdisciplinary views highlights the value of interdisciplinary cooperation and the investigation of various points of view. This element acknowledges the multifaceted nature of agricultural science and how it interacts with other academic fields like biology, chemistry, economics, and environmental science (Pauley et al., 2019). Teachers may provide pupils with a comprehensive grasp of agricultural issues and foster creative thinking by introducing multidisciplinary viewpoints into the curriculum and evaluation process. When tackling complicated agricultural challenges, this integration encourages innovation, critical thinking, and the capacity to consider other viewpoints.

A dynamic and all-encompassing learning environment can be established in agricultural science education by integrating these elements into the conceptual framework. Students will be prepared with the skills, knowledge, and competencies needed to succeed in the agricultural sector thanks to the integration of curriculum planning and assessment, alignment with industry needs and societal demands, incorporation of experiential and real-world learning, and integration of interdisciplinary perspectives. The basis for an education that equips students with the opportunities and challenges of a career in agriculture is laid by this framework.

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4.1.5 Holistic Agricultural Science Learning and Assessment Framework (AgriHOLIST)

Table 1: The Holistic Agricultural Science Learning and Assessment Framework (AgriHOLIST)

Components of the Conceptual Framework	Theoretical Underpinnings	Description	Implementation Strategies	Assessment Methods
Integration of curriculum planning and assessment	Constructivism and student-centered learning	This component emphasizes the seamless connection between curriculum planning and assessment.	- Collaborative curriculum development with input from educators, industry professionals, and stakeholders.	- Formative assessments such as class discussions, group projects, and self-reflection activities.
Alignment with industry needs and societal demands	Experiential learning theory	This component ensures that the curriculum and assessment align with the evolving needs of the agricultural industry and the demands of society.	- Regular communication and partnerships with industry experts to identify current and future industry needs.	- Performance-based assessments such as internships, case studies, and industry-driven projects.
Incorporation of experiential and real-world learning	Authentic assessment principles	This component emphasizes the integration of experiential and real-world learning experiences into the curriculum.	- Engage students in hands-on activities, field trips, and industry visits.	- Authentic assessments such as portfolios, presentations, and real-world simulations.
Integration of interdisciplinary perspectives		This component highlights the importance of integrating interdisciplinary perspectives into the curriculum and assessment.	- Collaborative planning and teaching across disciplines.	- Cross-disciplinary projects and assessments that require integrating knowledge from multiple fields.

4.1.6 Integration of curriculum planning and assessment

Constructivism and student-centred learning theories support the framework's integration of curriculum development and assessment, which is a crucial component. The statement underscores the ease of connection between curriculum design and student progress evaluation. By carefully matching curriculum preparation with targeted learning outcomes and evaluation strategies, this strategy creates a smooth and effective learning environment for students. To integrate this component, teachers can use collaborative approaches to curriculum building. This means that during the planning stage, stakeholders, educators, and business professionals must be included. By including a variety of viewpoints, the curriculum may be tailored to meet both the needs of the students and the requirements of the agricultural industry as a whole. The assessment methods

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used in this component are based on formative assessments, which gauge students' comprehension and ongoing growth. Through the use of assessment strategies including group projects, self-reflection activities, and class discussions, teachers can gain quick feedback and make curriculum modifications.

4.1.7 Alignment with industry needs and societal demands

Because the curriculum and evaluation methods in agricultural science education are aligned with industry and societal expectations, they remain up-to-date and flexible in response to the ever-changing demands of both. This section is based on the theoretical underpinnings of experiential learning theory, which emphasises the need to apply information in practical settings and gain hands-on experience. To put this component into practice, collaborations and ongoing communication with industry specialists are required. This enables educators to stay up to date on changing challenges, technological advancements, and market trends. Instructors can update the curriculum and incorporate industry guidance to properly satisfy these objectives. Exams that are performance-based are used to determine how prepared students are for the workforce. Students can apply their knowledge and skills in practical settings through these assessments, which include industry-driven projects, case studies, and internships. By evaluating their performance in scenarios taken from real life, teachers can determine whether or not their pupils are ready for the demands of the farm industry.

4.1.8 Incorporation of experiential and real-world learning

The integration of experiential and real-world learning is a fundamental component of the framework, which is backed by the ideas of genuine assessment. It emphasises the importance of bringing real-world experiences and useful applications into the classroom to provide students with a greater comprehension of agricultural principles and help them develop the skills they need. Students must take part in hands-on activities, field trips, industry visits, and other experiential learning strategies to put this component into effect. By giving students the chance to participate in experiential learning, educators can enhance their understanding and application of agricultural information. The primary focus of the assessment procedures for this component is on real evaluations that extend beyond testing. Students can demonstrate their ability to apply their knowledge and skills in practical settings by using assessment tools like presentations, portfolios, and real-world simulations. These exams provide a more accurate and comprehensive evaluation of students' competency in real-world scenarios. By fusing experiential and real-world learning, teachers create a dynamic and engaging learning environment that links theory and practice. This component ensures that students have a deeper comprehension of agricultural concepts and practical skills through real exams and practical experiences.

4.1.9 Integration of interdisciplinary perspectives

The framework's incorporation of diverse viewpoints is a crucial component that encourages students to approach difficult agricultural problems from a range of angles and collaborate across disciplines. To implement this component, educators may use collaborative planning and cross-disciplinary instruction. Teachers can help students develop interdisciplinary thinking and provide

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them with a comprehensive understanding of agricultural concerns by combining knowledge from different fields. Assessment options for this component include tests and cross-disciplinary projects that require students to synthesise information from other fields. These assessments promote critical thinking, collaboration, and the application of interdisciplinary perspectives to the practical solving of agricultural problems. By incorporating multidisciplinary perspectives, teachers prepare students to tackle complex agricultural issues that require a deep understanding of the subject. This component provides students with the resources they need to handle the range of issues that can emerge in the agricultural field while also assisting them in developing their problem-solving skills.

4.2 Discussion

The integration of constructivism, experiential learning theory, and authentic assessment principles within the AgriHOLIST framework has demonstrated the potential to significantly enhance agricultural science education in Nigeria. A strong conceptual framework that directs curriculum development and assessment integration is crucial for maximising student learning in agricultural science education. A holistic approach recognises the link between curriculum development and assessment integration. It emphasises the need to coordinate learning objectives, instructional strategies, and evaluation approaches to deliver a cogent and meaningful learning experience. By integrating curriculum design and assessment, teachers may ensure that the material being taught is accurately measured and that the results align with the curriculum (Karuguti et al., 2017).

The conceptual framework also highlights how important it is to align agricultural science curricula with the evolving needs of both the industry and society at large. This link ensures that the curriculum considers the problems that the agriculture sector will face in the future. By staying up to date with industry advances and social needs, educational courses may give students the knowledge, abilities, and competencies they need to succeed in the workforce and promote the agriculture sector's sustainable development (Innocent-Ene et al., 2022).

Another crucial element of the framework is the provision of opportunities for experiential and real-world learning. By providing students with opportunities for hands-on learning beyond the classroom, such as internships, fieldwork, and practical projects, teachers may bridge the gap between theory and practice. With this immersive method, students may apply their knowledge, improve their problem-solving skills, and gain a deeper understanding of the complexities of the agricultural world (Chorazy, 2019).

The framework also emphasises the importance of including diverse perspectives in agricultural science education. Teachers should incorporate interdisciplinary teaching approaches into their curricula once they have a thorough understanding of the connections between agriculture and other academic disciplines, such as biology, chemistry, economics, and environmental studies. Students have a more thorough understanding of agricultural science and are better prepared to tackle difficult agricultural challenges from a variety of angles thanks to this integration (Ijaz, 2021).

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By using this conceptual framework, agricultural science teachers may create a classroom environment that maximises student learning. Through the integration of interdisciplinary perspectives, experiential and real-world learning, curriculum planning and evaluation, and alignment with industry needs, and societal demands, students receive a comprehensive education that prepares them for success in the agricultural sector.

Current challenges and limitations in curriculum planning

The effective delivery of agricultural science education faces various barriers and limitations in curriculum design. One significant challenge is the rapid changes occurring in the agricultural sector. The traditional approach to curriculum development often lags these advancements, resulting in outdated curriculum content (Wilkes, 2019). Additionally, the lack of coordination and collaboration among stakeholders involved in curriculum construction leads to inconsistencies in learning outcomes and objectives. To address this, creating a cooperative environment that promotes communication and engagement among educators, legislators, business leaders, and community members is essential (Lombardi, 2021).

To ensure that agricultural science programs meet the needs of the industry and society, curricula must reflect technological advancements, environmental concerns, and market trends (Metawa et al., 2022). Additionally, aligning curricula with social expectations allows for the inclusion of subjects such as food security, sustainable agriculture, and environmental stewardship. This prepares students to be ethical and responsible members of society while contributing to the growth of agriculture and society as a whole (Çatal, 2018).

Overcoming these challenges requires the implementation of key strategies in curriculum development. Conducting a needs assessment is a crucial first step, involving input from industry experts, educators, students, and other stakeholders. This assessment helps identify the specific skills, knowledge, and competencies required for students in the agriculture sector (Evans et al., 2018). Defining core competencies and establishing clear learning objectives ensures that the curriculum is focused and aligned with expectations (Joyner, 2016).

Given the dynamic nature of the agriculture sector, curricula need to be flexible and adaptable. Transdisciplinary and modular elements can provide the necessary flexibility to respond to changing industry needs and student interests (Dill-McFarland, 2021). Incorporating cutting-edge teaching techniques, such as problem-based learning, project-based learning, experiential learning, and digital tools, enhances student engagement and prepares them for challenges in the agricultural sector (Budd et al., 2014).

Advantages of integrating assessments and curriculum planning by use of holistic approach

Adopting a comprehensive approach to curriculum development and assessment integration in agricultural science education offers several advantages. Firstly, it increases student motivation and involvement. According to Kowitlawakul (2017), students who are enthusiastic and engaged

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in their studies take an active role in their education, leading to a better understanding of agricultural concepts and improved academic achievement.

Secondly, a comprehensive approach improves knowledge retention and application. Integrating various assessment techniques, such as formative assessments, genuine assessments, and performance-based assessments, provides students with numerous opportunities to apply their knowledge and abilities in real-world scenarios (Pawlina, 2015). This practical approach reinforces their understanding of agricultural principles and enhances their capacity to apply that knowledge effectively.

Furthermore, a comprehensive curriculum design and assessment process fosters the development of critical thinking and problem-solving abilities, which are crucial for success in the agriculture industry. The integration of collaborative and genuine assessment techniques promotes critical thinking, information analysis, and creative problem-solving among students in an agricultural context (Drake & Reid, 2018). By challenging students to apply their knowledge and skills in challenging situations, these assessments nurture their critical thinking, creativity, and flexibility, preparing them to overcome future obstacles in their employment (Rodríguez, 2019).

Lastly, a comprehensive strategy for curriculum development and assessment integration ensures compliance with industry standards and enhances students' employability. Performing needs assessments and incorporating industry input into the curriculum, teachers can ensure that students possess the knowledge, skills, and competencies required by employers in the agriculture industry (Ferns, 2016). Students gain practical experience through assessments that replicate real-world agricultural circumstances, immediately applying their skills to the job. This alignment with industry standards equips students for successful careers in agriculture and improves their employability.

Implementation challenges and intervention

The successful implementation of the framework faces challenges, notably overcoming resistance to change. Stakeholders and educators may be hesitant to embrace new ideas and practices. To address this, it is crucial to effectively communicate the advantages of the framework and foster a culture of adaptability. Clearly articulating how the framework enhances student outcomes and aligns with educational objectives can help overcome objections. Engaging stakeholders in the decision-making process and addressing their concerns can enhance buy-in and promote a sense of ownership. Implementing a comprehensive change management plan, involving professional development opportunities, stakeholder engagement, and transparent communication, is critical for success.

Educators may require training and development to effectively utilize the framework. Providing access to professional development programs and training sessions on innovative evaluation techniques, technology integration, and pedagogy is essential. Ongoing support and mentorship should be offered to help educators overcome implementation challenges. Establishing a robust

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training and development program, including coaching sessions, seminars, and workshops, will equip educators with the necessary knowledge and skills to deliver high-quality education.

Infrastructure and additional resources may be necessary to support the intended learning experiences and evaluation techniques of the framework. Conducting a thorough assessment of existing resources and identifying any gaps is imperative. Seeking funding opportunities, collaborating with other educational institutions, and forming partnerships with industry stakeholders can help secure the required resources. Developing a well-planned resource allocation strategy will ensure a smooth deployment process.

Stakeholder involvement and collaboration are crucial for successful implementation. Engaging teachers, administrators, students, parents, business professionals, and community members early in the process fosters a sense of ownership and ensures the framework aligns with their goals and needs. Collaboration throughout the implementation phase can provide valuable insights, specialized knowledge, and support. Establishing effective communication channels and actively seeking input and suggestions from stakeholders is essential. Building strong partnerships with industry professionals and community organizations will enhance the relevance and effectiveness of the framework.

The AgriHOLIST framework revolutionizes agricultural science education by offering a comprehensive and systematic approach. It integrates interdisciplinary viewpoints, experiential learning, industry alignment, curriculum development and evaluation, and curricular integration. This framework ensures that students receive a well-rounded and relevant learning experience. By implementing the AgriHOLIST paradigm, teachers can create engaging lessons that align with learning outcomes, promoting student motivation, engagement, and retention. The framework emphasizes authentic assessment techniques to measure real-world application of knowledge and skills, fostering critical thinking and problem-solving abilities. It also advocates for curriculum alignment with industry and societal objectives, enhancing students' employability and success in the labor market. Through collaboration and knowledge sharing, the AgriHOLIST framework promotes continuous development and relevance in agricultural science education.

5.0 Conclusion and recommendations

In conclusion, this study has successfully optimized student learning, curriculum integration, and assessment practices in agricultural science education in Nigeria. The Holistic Agricultural Science Learning and Assessment Framework (AgriHOLIST) offers a comprehensive approach that aligns with industry demands and fosters practical learning. By integrating interdisciplinary perspectives, experiential learning, and real-world application, educators can enhance student engagement, knowledge retention, critical thinking, and industry readiness. However, challenges such as resistance to change, the need for professional growth, infrastructure, and stakeholder collaboration must be addressed for successful implementation. Overall, the AgriHOLIST framework holds great potential for advancing agricultural education and preparing students for Nigeria's evolving agricultural landscape.

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To optimize agricultural science education in Nigeria the study recommends adoption of Holistic Agricultural Science Learning and Assessment Framework (AgriHOLIST) by teachers integrate interdisciplinary perspectives, align with industry demands, and incorporate practical learning. Additionally, researchers and curriculum planners should regularly evaluate the implementation of the AgriHOLIST framework to make necessary modifications and maintain program relevance. It is critical to foster collaboration between stakeholders, industry experts, and educators for curriculum alignment with industry needs and societal demands while allocating sufficient resources for experiential learning and investing in lab space and equipment.

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Conflict of interests

The authors declare no conflict of interest in the conduct of this study

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