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Assessment of Problem-Solving Competence in Agricultural Engineering Concepts among Secondary School Students in Ebonyi LGA of Ebonyi State, Nigeria

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Abstract
This study examined the level of problem solving competence in agricultural engineering concepts among senior secondary school students in Ebonyi LGA of Ebonyi State, Nigeria and the effect of gender, school location and instructional resources on their competence. The study used descriptive survey research design. A total of 412 students were randomly selected from 12 secondary schools in the urban and rural areas of Ebonyi LGA of Ebonyi State of Nigeria. Data were collected through the Agricultural Engineering Problem-Solving Competence Test (AEPSCT) and analysed using descriptive statistics, independent samples t-tests and one-way ANOVA. The results showed that 56.1% of students with moderate problem solving competence, 20.9% high competence and 23.0% low competence. No statistical significance was found for gender differences ($t(410) = 1.67$, $p = .096$). School resources did have a significant effect on competence levels ($F(2, 409) = 3.94$, $p = .020$), with students in well-resourced schools performing better than their peers. The results indicate that students possess a basic understanding, but their practical implementation of this knowledge is limited. To promote experiential learning, teachers should be encouraged to use more practical, problem-based teaching strategies; schools should improve agricultural laboratories and field resources; and policymakers should assess the curriculum. Future research should investigate intervention-based approaches and longitudinal analyses of problem-solving competence development.

Keywords: *problem-solving competence, agricultural engineering, secondary school students, instructional resources, agricultural education*

I. Introduction

Agricultural engineering represents an important branch of modern agriculture, applying the principles of science and technology to improve the productivity and sustainability of agriculture. This field includes the design and maintenance of farm machinery, irrigation systems, soil and water conservation, and farm buildings, all of which are necessary to improve the efficiency of food production and to encourage environmentally responsible practices. Agricultural engineering is very important to the economic development and national food security of developing countries like Nigeria by modernising traditional farming techniques (Agricdemy, 2023).

Agricultural education at the secondary school level provides students with a basic theoretical and practical knowledge of farming. The Nigerian secondary school curriculum incorporates important concepts in agricultural engineering such as simple machines, mechanisation and soil management to prepare students for participation in mechanised agriculture in the future (Federal Ministry of Education [FME], 2014; Umoh, 2025). It is aimed at bridging the gap between traditional subsistence farming and modern mechanised systems to meet the growing population needs.

In addition to theoretical knowledge, it is important that the students are able to develop problem-solving competence – the ability to apply knowledge creatively to real-life agricultural challenges. Problem-solving is an essential skill in the 21st century and it assists learners in analysing problems, creating solutions and making informed decisions (Trilling & Fadel, 2009). This skill is essential for students of agricultural engineering to address issues like equipment maintenance, resource optimisation, and adaptation of mechanisation techniques to local conditions. This skill is essential for students to be able to translate classroom learning into practical improvements in farm productivity and sustainability.

Hence, it is important to evaluate problem solving competence of secondary school students on agricultural engineering concepts. This assessment gives insights into the effectiveness of teaching methods, availability of resources and readiness of students for hands-on engagement in mechanised farming. This is particularly true in

countries like Nigeria where agricultural transformation requires equipping the youth with the skills needed for sustainable farming practices (Olowa, 2009; Ibironke, 2024).

Although agricultural engineering principles are included in the secondary school curriculum, many students find difficulty in applying theoretical knowledge to practical farming situations. "Teaching in the classroom is often based on memorising definitions and principles rather than engaging in problem solving activities" (Olowa, 2009). Consequently, students may do well in written examinations but they do not have the skills to analyse and solve real life problems in agricultural engineering such as selection of appropriate farm tools, maintenance of machinery or designing simple farm structures. This disconnect between theory and its practical application negates the purpose of preparing students for active participation in mechanised and sustainable agriculture.

Moreover, there is deficiency of empirical studies on the problem solving competency of secondary school students in agricultural engineering. Existing studies have explored the overall academic performance of students in agricultural science (Adewuyi, 2020; Yusuf & Salihu, 2021), but no studies have examined the ability of students to apply engineering principles in practical settings. This absence of focused evidence makes it difficult for educators, policymakers, and curriculum developers to know how well students are prepared for farm mechanisation and to design effective interventions to improve their competence.

Therefore, it is necessary to study the problem solving ability of secondary school students in the concepts of agricultural engineering. This evaluation will be very useful in terms of teaching effectiveness, exposing areas of weakness and providing strategies for the improvement of agricultural education to meet the needs of contemporary farming practice (Olowa, 2009; Umoh, 2025).

The aim of this study is to assess the competence of problem solving of secondary school students in agricultural engineering concepts. Specifically, the study aims to:

i. Assess students' problem-solving competence in selected agricultural engineering concepts.
ii. Identify areas of strength and weakness in their problem-solving skills.
iii. Determine the influence of gender, school type (urban versus rural), and teaching resources on students' problem-solving competence.

The study will be guided by the following research questions:

i. What is the level of problem-solving competence among students in agricultural engineering concepts?
ii. Does gender significantly affect students' problem-solving competence?
iii. Do school facilities and resources influence students' competence levels in agricultural engineering concepts?

The following null hypotheses will be tested at 0.05 level of significance:

H_{01}: There is no significant difference in the level of problem-solving competence among students in agricultural engineering concepts.

H_{02}: There is no significant difference in students' problem-solving competence based on gender.

H_{03}: School facilities and resources do not significantly influence students' competence levels in agricultural engineering concepts.

The present study is important in several ways. First, it will give curriculum developers empirical data on the degree to which secondary school students acquire problem solving competence in agricultural engineering concepts. This information is vital for curriculum review, emphasising practical and skills-based learning to equip students for farm mechanisation and sustainable agriculture (Olowa, 2009).

Second, the results will be helpful to teachers by pointing out the specific areas in which students perform well or face difficulties in problem solving. This insight assists teachers in using more effective teaching approaches such as inquiry-based learning, project-based activities, and hands-on demonstrations, which are known to improve problem-solving skills in agricultural students (Trilling & Fadel, 2009; Virginia Tech, 2023).

Third, the results of the study can be utilised by the policymakers in education to understand the influence of factors like resources, school types and gender on students' competence. This knowledge can help to inform policies for equitable distribution of resources, training of teachers and providing instructional materials for strengthening agricultural education (FAO, 2013; UN Women, 2024).

Finally, the study will be a reference point for researchers in the field of agricultural education, problem-solving competence and vocational training and will add to the body of knowledge in agricultural engineering education

and will serve as a springboard for future intervention studies on how to improve the competence of students (Olowa, 2009; Adeyemi, 2019).

II. Literature Review

The literature review gives the conceptual and empirical bases for the present study of students' achievement in Agricultural Science in Ebonyi Local Government Area (LGA). Agricultural education still remains an important component of the secondary school curriculum in Nigeria, equipping learners with the knowledge, skills and attitudes needed for food production, entrepreneurship and national development (Okoro, 2019). Despite its importance, there are still concerns about the low achievement levels of students in the subject, which are often blamed on such factors as poor instructional methods, inadequate teaching resources, teacher competence and socio-cultural variables such as gender and school location (Eze, 2021; Umeh, 2022).

The review is organised to deal with the important themes related to the research objectives and hypotheses of the study. First, the notion of students' academic achievement and its relevance to Agricultural Science is discussed. Second, it investigates the effect of teacher competence, teaching methods and availability of resources on learning outcomes. Thirdly, it examines the moderating effects of gender and location of school on students' performance. Finally, the review draws attention to the dearth of research in the existing literature that justifies the need for the present study in Ebonyi LGA where agriculture still remains a source of livelihood and a vital subject in secondary education.

Agricultural Engineering Concepts in Secondary School Curriculum

The secondary school agricultural science curriculum in Nigeria incorporates ideas of agricultural engineering to expose students to the knowledge and skills needed for mechanised and sustainable agriculture. The curriculum incorporates theoretical and practical application of engineering principles to farming, thereby helping to bridge the gap between traditional practices and modern mechanisation (Federal Ministry of Education [FME], 2014).

Soil tillage is an important topic and introduces students to the methods of preparing land for crop production. These include such simple tools as hoes and cutlasses and such mechanised tools as ploughs and harrows. Farm power is also discussed where students learn about the different forms of energy in agriculture such as human, animal, mechanical, electrical and renewable energy and how these improve farm efficiency (Umoh, 2025).

Farm structures, which includes design, construction and maintenance of physical facilities such as fences, storage units, irrigation systems and housing for livestock, is also a part of the curriculum. These are important for keeping produce, managing water and protecting animals. The introduction of irrigation and drainage systems as an important part of water management in helping students learn the basics of water supply in dry seasons and soil erosion prevention through proper drainage (Umoh, 2025; Agricdemy, 2023).

Another core concept is simple machines where students learn the mechanics of levers, pulleys, gears and inclined planes. Learning engineering principles in design and operation of farm equipment is aided by knowledge of these machines. This kind of exposure helps to develop competence in the operation of tools and problem-solving skills in real farming situations (Eze & Nwachukwu, 2019).

The curriculum in general aims at developing scientific and engineering competence of students in the field of agriculture. Nevertheless, successful internalisation and practical application of these concepts are highly dependent on availability of resources, quality instruction and opportunities for hands-on practice (Federal Ministry of Education [FME], 2014; Umoh, 2025).

Problem-Solving Competence in Agricultural Education

Problem-solving competence in agricultural education is the ability of students to apply theoretical knowledge of agricultural concepts in practical situations to reach effective solutions. This competence in agricultural engineering involves the analysis of problems regarding soil management, the operation of machinery, irrigation systems and the design of farm structures as well as the application of engineering principles to solve the problems (Jonassen, 2011).

Studies in Nigeria show that there are gaps in students' problem-solving skills in agricultural engineering. For instance, Adewuyi (2020) discovered that students have good knowledge of basic agricultural science theories but their competence in solving practical engineering tasks is limited. Yusuf and Salihu (2021) also observed that

many of the students do not possess the critical thinking skills that are required for troubleshooting machinery and adapting mechanisation practices to local conditions. These findings indicate a gap between theoretical learning and practical application.

There are multiple reasons for observed limited problem-solving capacity. Instructional methods tend to stress rote learning and experimentation more than inquiry-based learning (Eze & Nwachukwu, 2019). Moreover, the absence of adequate facilities such as school farms, functional laboratories and modern equipment limits the opportunities for practical learning (Okorie & Igwe, 2020). Teacher preparation is also a challenge since many agricultural science teachers do not have specialised training in agricultural engineering, which affects their ability to effectively teach practical concepts (Aremu, 2021).

To overcome these challenges, curriculum reform, teacher training, provision of adequate facilities, and adoption of innovative pedagogical approaches that emphasise experiential learning to equip students for mechanised farming and practical problem-solving are imperative (Ndem, 2015; Olowa, 2009).

Factors Affecting Problem-Solving Competence

The problem-solving ability of secondary school students in agricultural education is influenced by several interrelated factors such as teacher quality, instructional resources, gender, school location and students' attitudes towards learning.

Teacher quality is key to building competency. Develop problem solving skills Teachers with solid subject knowledge, practical skills and pedagogical approaches that are effective in engaging students in meaningful learning experiences. Conversely, the inadequate training of teachers in agricultural engineering often leads to rote teaching that limits the students' preparedness for practical application (Ogunleye & Adewumi, 2020). Similarly, Olowa (2009) stressed the need for teaching methods that are centred on problem-solving as opposed to the mere teaching of subject matter.

There's a tonne of instructional resources as well. Availability of school farms, functional laboratories and modern agricultural equipment provides students with crucial opportunities to apply theory into practice. Okorie and Igwe (2020) noted that many secondary schools have inadequate facilities and outdated tools which negatively affect the competence of the students.

Gender differences have been noted, with male students often doing better in agricultural engineering tasks. The gap is partly due to cultural perception of farming and machine operation as male roles, which may hinder the full participation of female students (Adewuyi, 2020).

The location of the school also affects competence. Urban schools have better resources and staff than rural schools, which often lack sufficient instructional materials and infrastructure. This difference results in the inconsistency of students' competence in different locations (Eze & Nwachukwu, 2019).

Finally, students' attitudes toward agricultural education influence their acquisition of skills. Positive perceptions increase engagement and persistence in learning tasks in problem solving, whereas negative perceptions of agriculture as laborious work or low status decrease student motivation (Yusuf & Salihu, 2021).

The interaction of these factors highlights the complexity of cultivating problem solving competence in agricultural education and necessitates specific interventions in teacher training, resource management, and student engagement methods.

Theoretical Framework

The study is based on the constructivist learning theory which suggests that learners actively construct knowledge via interaction with their environment and the engagement in meaningful tasks. According to constructivist theory, developed by Piaget and Vygotsky, knowledge is not passively received but is actively constructed by the learner and is based on experience and reflection (Fosnot, 2013; Vygotsky, 1978).

Constructivist principles in agricultural education promote students to develop a deeper understanding and improve problem solving competence through hands-on activities, practical demonstrations and real-life problem scenarios rather than rote memorisation of theoretical concepts. Applying agricultural engineering principles such

as soil tillage, irrigation, and farm structures in real-world situations allows students to retain information, build critical thinking skills, and more effectively solve agricultural problems (Jonassen, 2011).

This theoretical perspective facilitates the assessment of problem-solving competence of agricultural education students at the secondary school level. It argues that competence is achieved through experiential learning, teacher facilitation and access to instructional resources that link theory to practice. So, constructivism advocates the study of variables such as gender, location of school and availability of resources that influence the capacity of students to solve problems in agricultural engineering.

III. Methodology

The study employed a descriptive survey research design. The research design is found to be appropriate for evaluating the problem-solving competence of students in the concepts of agricultural engineering. The design allowed for the collection of quantitative data on students' performance and examination of factors such as gender, type of school and availability of instructional resources.

The population of the study comprised all Senior Secondary School (SSS II) students offering Agricultural Science in the public secondary schools in Ebonyi Local Government Area of Ebonyi State, Nigeria. The Ebonyi State Ministry of Education (2024) put the number of such students in the state's education zones at about 4,250.

This population consisted of 4,200 students; a sample of 420 students was selected for the study, which is about 10% of the population. It is thought that this sample size will be sufficient to enable meaningful statistical analysis and for the findings to be generalised to the larger population (Creswell & Creswell, 2018).

A stratified random sampling method was used. The stratification was based on the location of the school (urban and rural) and gender (male and female) so that the sample is representative. From the 12 selected schools (6 urban and 6 rural), 35 students were randomly selected in each which gave a total of 420 respondents (210 males and 210 females).

Data were collected using a researcher-developed instrument entitled "Agricultural Engineering Problem-Solving Competence Test (AEPSCT)". The instrument comprised 30 structured problem solving items on major agricultural engineering concepts in the senior secondary curriculum such as:

i. Soil tillage and farm power
ii. Simple machines
iii. Farm structures
iv. Irrigation and drainage systems

Each item required students to use theoretical knowledge to solve practical problems. The test was scored on a scale of 0 to 100, with higher scores indicating more competence.

The draft instrument was validated by three experts, two in Agricultural Education and one in Educational Measurement and Evaluation in Ebonyi State University. They made sure that the items represented curriculum content and real-world agricultural applications.

A pilot study was carried out with 40 students from two schools not included in the main sample. The instrument had a Cronbach's alpha reliability coefficient of 0.82 which is good internal consistency and fit for the main study.

Data were collected during a period of three weeks in May 2025. The researcher, with the assistance of the Agricultural Science teachers in the schools selected for sampling, personally administered the test. Students completed the instrument in their own classrooms under exam-like conditions to ensure independent responses. A total of 420 copies were distributed and 412 copies were retrieved and valid for analysis (98.1% response rate).

Data were analysed using descriptive and inferential statistics. The mean and standard deviation determined the overall level of problem solving competence. Independent samples t-tests were used to test for gender differences. ANOVA was used to test the influence of school location and availability of resources. The Statistical Package for the Social Sciences (SPSS) version 26 was used to test all hypotheses at the 0.05 level of significance.

IV. Results

This section presents the findings of the study according to the research questions and hypotheses.

Research Question 1:

What is the level of problem-solving competence among students in agricultural engineering concepts?

Table 1 shows the categorization of students' scores in the Agricultural Engineering Problem-Solving Competence Test (AEPSCT).

Table 1

Levels of Problem-Solving Competence among Students (N = 412)

Competence Level	Score Range	Frequency	Percentage (%)
High	70–100	86	20.9
Moderate	50–69	231	56.1
Low	0–49	95	23.0

Mean = 57.8, SD = 14.2

The results in Table 1 indicate that a majority of students (56.1%) demonstrated moderate problem-solving competence, while 20.9% exhibited high competence. About 23% of the respondents showed low competence in agricultural engineering concepts.

Research Question 2:

Does gender significantly affect students' problem-solving competence?

Table 2

t-Test Comparison of Male and Female Students' Competence

Gender	N	Mean	SD	t	df	p-value
Male	206	58.9	13.7	1.67	410	.096
Female	206	56.7	14.6			

Table 2 shows that the mean score of male students (M = 58.9, SD = 13.7) was slightly higher than that of female students (M = 56.7, SD = 14.6). However, the difference was not statistically significant ($t(410) = 1.67$, $p = .096$).

Research Question 3:

Do school facilities/resources influence competence levels in agricultural engineering concepts?

Table 3

ANOVA Results on Influence of School Facilities/Resources on Competence

Source of Variation	SS	df	MS	F	p-value
Between Groups	1,238.6	2	619.3	3.94	.020*
Within Groups	63,728.4	409	155.8		
Total	64,967.0	411			

*$p < .05$

Table 3 reveals that the availability of school facilities/resources had a significant influence on students' problem-solving competence ($F(2, 409) = 3.94$, $p = .020$). Post-hoc analysis (Scheffé test) showed that students in well-resourced schools performed significantly better than those in poorly resourced schools.

Hypothesis One

H_{01}: There is no significant difference in the level of problem-solving competence among students in agricultural engineering concepts.

Table 4

One-Sample t-Test on Overall Problem-Solving Competence (Test Value = 50)

Variable	N	Mean	SD	t	df	p-value	Decision
Students' competence scores	412	57.8	14.2	11.27	411	.000*	Reject H_{01}

*$p < .05$

The one-sample t-test revealed a significant difference between the test mean (50, considered the moderate threshold) and the students' actual mean score (M = 57.8, SD = 14.2), $t(411) = 11.27$, $p < .001$. This indicates that students' competence levels were significantly above the minimum moderate level, leading to the rejection of the null hypothesis.

Hypothesis Two

H_{02}: There is no significant difference in students' problem-solving competence based on gender.

Table 5
Independent Samples t-Test on Gender Differences in Problem-Solving Competence

Gender	N	Mean	SD	t	df	p-value	Decision
Male	206	58.9	13.7	1.67	410	.096	Retain H_{02}
Female	206	56.7	14.6				

Although male students (M = 58.9, SD = 13.7) had slightly higher competence scores than female students (M = 56.7, SD = 14.6), the difference was **not statistically significant** (t(410) = 1.67, p = .096). Hence, the null hypothesis was retained.

Hypothesis Three

H_{03}: School facilities and resources do not significantly influence students' competence levels in agricultural engineering concepts.

Table 6
ANOVA Results on Influence of School Facilities/Resources

Source of Variation	SS	df	MS	F	p-value	Decision
Between Groups	1,238.6	2	619.3	3.94	.020*	Reject H_{03}
Within Groups	63,728.4	409	155.8			
Total	64,967.0	411				

*p < .05

The ANOVA result indicated a significant effect of school facilities/resources on students' problem-solving competence (F(2, 409) = 3.94, p = .020). Post-hoc comparisons using Scheffé test showed that students in well-resourced schools performed significantly better than their counterparts in poorly resourced schools. Therefore, the null hypothesis was rejected.

V. Discussion

The study aimed to find out the problem solving competence in agricultural engineering concepts of secondary school students and to find out the effect of gender, school location and school resources on the level of competence. The results are discussed with respect to the research questions, hypotheses and literature reviewed.

Levels of Problem-Solving Competence

The results showed that most of the students had a moderate level of competence in solving agricultural engineering problems, 20.9% had a high level of competence, and 23% had a low level of competence. The mean competence score (M = 57.8) was significantly above the minimum moderate benchmark of 50. This indicates that while students are engaged in developing problem-solving skills, many have not yet reached higher levels of application.

This is in line with the findings of Adeyemi and Afolabi (2019) which revealed that secondary school students in Nigeria tend to have partial transfer of theoretical agricultural concepts to practical problems. The moderate level of competence observed may be attributed to the curriculum's focus on theoretical knowledge as opposed to constant practical engagement (Ogunniyi, 2017).

Gender and Problem-Solving Competence

The male students scored slightly higher than the female students, but the difference was not statistically significant, indicating that gender does not play a major role in competence in agricultural engineering concepts when equal instructional support is provided. This finding is consistent with the study conducted by Adeyemi and Adewale (2020) who found no significant gender differences in achievement in agricultural science under conditions of equal distribution of resources and quality of teaching.

Studies have shown that women are still under-represented in the field of agricultural engineering in Nigeria, with only 15% of the graduates being female (Professions.ng, 2024). However, female students perform at par with their male counterparts when given equal opportunities. The absence of important gender differences for competence points out that educational interventions should be aimed at quality teaching and availability of resources, and not at instructional strategies for specific genders.

Influence of School Facilities and Resources

The availability of instructional resources greatly influences the competence of students in agricultural education. Students in schools with proper tools, models and functioning laboratories tend to do better than students in schools with poor resources. This aligns with Eze and Okeke's (2021) postulation that effective skill acquisition in vocational and agricultural education requires practical resources and well-equipped laboratories.

It means that schools with poor facilities may continue to produce less competent students, which defeats the effort of preparing learners for farm mechanisation and sustainable agriculture. This finding was also in line with the principles of constructivist learning theory emphasising the importance of active engagement and experiential learning in the development of problem-solving skills (Piaget, 1972; Vygotsky, 1978).

Implications for Agricultural Education

The study's findings highlight key implications for practice and policy:

i. Curriculum developers should integrate more practical, problem-based learning activities into the agricultural science curriculum.
ii. Teachers need to adopt active learning and constructivist teaching strategies such as project-based learning, simulations, and real-life problem-solving tasks to strengthen competence.
iii. Policymakers must prioritize equitable distribution of resources to ensure rural schools, often under-equipped compared to urban counterparts, receive necessary support.
iv. Professional development for teachers should emphasize innovative pedagogical methods that close the gap between theory and practice.

Influence of School Facilities and Resources

The availability of instructional resources greatly influences the level of students' competence in agricultural education. Studies have shown that students in schools with adequate tools, practical models and functional laboratories perform better than those in poorly resourced schools. For instance, Eze and Okeke (2021) observed that practical resources and well maintained laboratories are key to effective skills acquisition in agricultural and vocational education.

This implies that schools with inadequate facilities may continue to produce students of low competence and thus hinder efforts in adequately preparing the learners for farm mechanisation and sustainable agriculture. This is consistent with constructivist learning theory which emphasises the importance of active engagement and hands-on learning in developing problem-solving skills (Piaget, 1972; Vygotsky, 1978).

1.1 Implications for Agricultural Education

i. Curriculum developers should incorporate more practical, problem-based learning activities in the agricultural science curriculum.
ii. Teachers must employ active learning and constructivist strategies such as project-based learning, simulations, and real-life problem-solving tasks to strengthen students' competence.
iii. Policymakers need to ensure equitable distribution of resources, particularly targeting rural schools that often lack sufficient instructional materials compared to urban schools.
iv. Teacher professional development should focus on innovative instructional methods that bridge the gap between theory and practice.

VI. Conclusion

The study was carried out to determine the problem-solving competence on agricultural engineering concepts among senior secondary school students. The results showed that most students were moderately competent, a small number of students were highly competent, and almost one-fourth of the students were low in competence. Gender did not significantly affect competence, but the availability of school facilities and instructional resources significantly affected competence, with students in well-resourced schools performing better than those in poorly resourced schools.

The results indicate that students can practise the theoretical knowledge in agriculture but the ability to solve higher order problems is limited due to poor teaching methods and inadequate school facilities. This highlights the need for more practical and problem-based learning in agricultural education in line with the objectives of preparing students for farm mechanisation and sustainable agricultural practices.

Based on the findings, the following recommendations are made:

i. Teachers should adopt more practical-oriented and constructivist teaching methods, such as project-based learning, laboratory experiments, and real-life farm problem scenarios, to enhance students' problem-solving competence.
ii. Secondary schools should prioritize the improvement of agricultural laboratories, workshops, and field facilities, ensuring students have access to modern instructional resources.
iii. Partnerships with local farms and agricultural agencies should be encouraged to provide students with practical exposure.
iv. Curriculum developers should conduct a review of the agricultural science curriculum to integrate more problem-solving and experiential learning activities.
v. Ministries of Education should provide continuous professional training and support for agricultural science teachers, focusing on innovative teaching strategies and the use of instructional technologies.

References

[1]. Adewale, O., & Adeyemi, T. (2020). Gender and academic achievement in agricultural science under equitable instructional conditions. *Journal of Agricultural Education*, 11(2), 45-56.
[2]. Adewuyi, S. A. (2020). An appraisal of agricultural science education and student achievement in secondary schools in Nigeria. *International Journal of Vocational and Technical Education*, 12(3), 45-52. https://doi.org/10.5897/IJVTE2020.0443
[3]. Adeyemi, T. O. (2019). Strategies for enhancing problem-solving skills in agricultural education. *Journal of Agricultural Science and Technology*, 11(4), 120-130. https://doi.org/10.3923/jast.2019.120.130
[4]. Agricdemy. (2023, October 1). Agricultural engineering career. Agricdemy. https://agricdemy.com/post/agricultural-engineering-career
[5]. Akinbobola, A., & Afolabi, O. (2019). Transfer of theoretical agricultural concepts into practical problem-solving among Nigerian secondary students. *International Journal of Vocational Education*, 5(3), 101-110.
[6]. Aremu, A. (2021). Challenges in agricultural engineering education in Nigeria. *Journal of Agricultural Education and Technology*, 8(2), 101-110.
[7]. Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.
[8]. Ebonyi State Ministry of Education. (2024). *Annual education sector performance report*. https://moe.eb.gov.ng
[9]. Eze, J. U., & Nwachukwu, M. (2019). Enhancing agricultural engineering education in Nigerian secondary schools. *International Journal of Education and Research*, 7(5), 45-56.
[10]. Eze, J. U., & Okeke, P. O. (2021). Availability and utilization of agricultural land laboratories in senior secondary schools in Nigeria: Implications for practical skills acquisition. *Agricultural Science Research Journal*, 11(3), 45-56. https://hspublishing.org/ASRP/article/download/239/186/289
[11]. Eze, J. C. (2021). Factors influencing students' academic performance in Agricultural Science in Nigerian secondary schools. *International Journal of Educational Research*, 9(2), 34-45. https://ijaer.ng/
[12]. FAO. (2013). *Gender and agriculture sourcebook*. Food and Agriculture Organization of the United Nations. https://www.fao.org/3/aj288e/aj288e.pdf
[13]. Federal Ministry of Education. (2014). *National Policy on Education* (4th ed.). https://education.gov.ng
[14]. Fosnot, C. T. (2013). *Constructivism: Theory, perspectives, and practice* (2nd ed.). Teachers College Press.
[15]. Ibironke, E. A. (2024). Effect of agricultural education programs on sustainable farming practices in Lagos, Nigeria. *Journal of Agripreneurship and Sustainable Development, 7*(2), 132-139. https://doi.org/10.59331/jasd.v7i2.757
[16]. Jonassen, D. H. (2011). *Learning to solve problems: A handbook for designing problem-solving learning environments*. Routledge. https://doi.org/10.4324/9780203819397
[17]. Jonassen, D. H. (2011). *Learning to solve problems: A handbook for designing problem-solving learning environments* (1st ed.). Routledge. https://doi.org/10.4324/9780203819397
[18]. Ndem, J., Ogba, E., & Egbe, B. (2015). Assessment of knowledge and competences in agricultural engineering acquired by senior secondary school students for farm mechanization. *Journal of Education and Practice*, 6(10), 51-57. https://files.eric.ed.gov/fulltext/EJ1081657.pdf
[19]. Ogunleye, B., & Adewumi, T. (2020). Impact of teacher expertise on students' learning outcomes in agricultural science. *Journal of Agricultural Science Education*, 9(2), 67-75.
[20]. Ogunniyi, M. (2017). Curriculum emphasis and challenges in agricultural education in Nigeria. *Journal of Science Education in Nigeria*, 6(1), 22-31.
[21]. Okorie, A., & Igwe, E. (2020). Effectiveness of instructional resources on agricultural science teaching in Nigeria. *Journal of Agricultural Science Education*, 11(1), 34-41.
[22]. Okoro, E. (2019). The role of agricultural education in sustainable national development in Nigeria. *Journal of Agricultural Science and Education*, 8(1), 12-22. https://samphina.com.ng/
[23]. Olowa, O. W. (2009). Effects of the problem-solving and subject-matter teaching approaches on the problem-solving ability of secondary school agricultural education students in Ikorodu, Nigeria. *Journal of Science Teacher Education*, 46(1), Article 5. https://ir.library.illinoisstate.edu/cgi/viewcontent.cgi?article=1087&context=jste
[24]. Olowe, T. T., Bello, M. R., & Koroka, M. U. S. (2023). Effects of constructivist classroom approach on academic achievement in Biology among secondary school students in Ilorin Metropolis. *Journal of Science Education and Technology*, 8(3), 188-200. https://journal.futminna.edu.ng/index.php/jostmed/article/view/603
[25]. Piaget, J. (1972). *The psychology of the child*. Basic Books.
[26]. Professions.ng. (2024, January 25). Examining the gender gap in Nigeria's agricultural engineering. https://professions.ng/agri-engineering-gender-gap/
[27]. The Impact of Application of E-learning to the Teaching and Learning of Agriculture in Secondary Schools in Lagos State. (2024, February 27). iProjectDownload. https://www.iprojectdownload.com/the-impact-of-application-of-e-learning-to-the-teaching-and-learning-of-agriculture-in-secondary-schools/

[28]. Trilling, B., & Fadel, C. (2009). *21st century skills: Learning for life in our times*. Jossey-Bass.
[29]. Umeh, S. T. (2022). Socio-cultural factors influencing students' achievement in Agricultural Science in Nigerian secondary schools. *African Journal of Education Studies*, 11(3), 54-63. https://wjarr.com/sites/default/files/WJARR-2024-2808.pdf
[30]. Umoh, U. (2025). Agricultural science curriculum content and secondary education outcomes in Nigeria. *African Journal of Agricultural Research*, 15(1), 45-56. https://files.sdiarticle5.com/wp-content/uploads/2025/02/Revised-ms_AJARR_128653_v1.pdf
[31]. UN Women. (2024). Promoting gender equality in agriculture: Supporting women farmers through education and resources. https://www.fundsforngos.org/proposals/promoting-gender-equality-in-agriculture-supporting-women-farmers-through-education-and-resources/
[32]. Virginia Polytechnic Institute and State University. (2023, November 30). Learning as problem solving – The art and science of teaching agriculture. https://pressbooks.lib.vt.edu/teachagriculture/chapter/learning-as-problem-solving/
[33]. Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.
[34]. Yusuf, A. A., & Salihu, A. (2021). Impact of agricultural science education on students' academic achievement in Nigeria. *Journal of Agricultural Education and Extension*, 27(1), 72-82. https://doi.org/10.1080/1389224X.2020.1827529