International Journal of
Entrepreneurial Development, Education and Science Research
p-ISSN: 2360-901X | e-ISSN: 2360-9028

IJEDESR

February, 2026
Vol. 9, No. 1

Pedagogical Barriers in Agricultural Science Education: Evidence from Public Secondary Schools in Kaduna State, Nigeria

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Article DOI:
10.48028/iiprds/ijedesr.v9.i1.05

Abstract

The study investigated the key challenges constraining the teaching and learning of Agricultural Science in public secondary schools in Kaduna State. Guided by five research questions and corresponding hypotheses, it adopted a survey design involving all 187 Agricultural Science teachers across 81 registered public secondary schools in Zaria, Sabon Gari, and Kaduna metropolis. Data were collected using a 69-item structured questionnaire on a 4-point rating scale. Descriptive statistics (mean and standard deviation) were used to answer the research questions, while Analysis of Variance (ANOVA) tested the hypotheses at $p \leq 0.05$ level of significance. Findings showed that infrastructural decay, poor use and application of information and communication technology, underfunding, and students' poor interest and negative attitudes were major barriers. There were significant differences in ICT challenges (p = 40.96> 0.05), funding (p = 13.87>0.05), and student interest and attitude (p = 4.829>0.05), but not in infrastructural challenges (p = 1.317< 0.05). For improvement strategies, ANOVA yielded p = 86.75> 0.05), indicating strong and significant agreement among teachers, particularly in Zaria. The study concluded that inadequate infrastructure and instructional materials, limited ICT integration, poor funding, and low student interest significantly impede effective Agricultural Science education in the area, underscoring the need for urgent, coordinated intervention by government and other stakeholders.

Keywords:
Agricultural Science education, Teaching and learning challenges, Infrastructure and instructional materials, Information and communication technology, School funding constraints, Students' interest, Attitude

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Background to the Study

Education is seen as a key to national development and cannot be achieved without sustainable investment in human capital through teaching and learning (Obeng *et al*., 2024). Investment on education for skilled human resource is a *sine qua non* to the actualization of any country's development in various prospects of life. It is also a well-known notion that the level of education in a country is positively linked to the country's potential technological advancement, a key determinant of economic growth, as quality education is needed for national development (Agrawal & Teotia, 2015). For these reasons, a substantial share of most nations' resources is invested in education (Kpolovie *et al*., 2011). Agricultural Science plays a pivotal role in shaping the economic and socio-cultural future of Nigeria, given the country's agrarian-based economy and the strategic importance of agriculture for food security, job creation, and poverty alleviation (FAO, 2019; World Bank, 2020).

Agricultural science is a branch of science that deals with growing crops and rearing of domestic animals for the benefits of man and raw materials for the industries (Ndem, 2013) and among other things includes the tilling of the soil, cultivation and harvesting of any Agricultural commodity, and practices performed by a farmer on a farm as an incident to or in conjunction with other farming operations which may include the manufacturing or processing of farm products (Ibrahim *et al*., 2019; Ugo & Obiyai, 2021). Agricultural science plays a significant role in promoting self-reliance and employment generation for economic development in Nigeria. In secondary schools, the subject is designed not only to foster interest and foundational knowledge in agricultural sciences but also to prepare students with practical skills needed for both immediate application and future academic or vocational pursuits (Akanmu *et al*., 2016). The Federal Republic of Nigeria through its National Policy on Education (2013) streamlined the objectives of Agricultural Science to include: encouragement of students in the use of their hands; the appreciation for the dignity of labour; familiarity with biological processes thereby instilling rationality in the students; increasing self-sufficiency and self-reliance in food production, as well as enhancing students interest in producing part of their food needs and improve their diet and thus minimize the cost of feeding.

The curriculum is envisioned to transcend mere theoretical exposition by providing students with hands-on experiences that will enhance agricultural productivity and innovation, thus cultivating a new wave of skilled and motivated agricultural professionals. However, the realization of these objectives is often restricted by a multitude of persistent challenges (Oguwche & Nwokedzi, 2020; Innocent-Ene *et al*., 2022). These barriers range from infrastructure, societal attitudes and funding undermining both the pedagogical process and learning outcomes. As Nigeria aims to modernize its agriculture and boost youth engagement, understanding these impediments is essential for effective policy formulation and implementation toward educational reform and agricultural development.

Statement of Problem

This study justification is based on interconnected grounds. Agricultural Science plays a vital role in promoting skills development, food security, and youth employment in Nigeria, yet in Kaduna State there are clear indications of poor student performance, low interest, and limited practical competence, suggesting that the subject is not achieving its intended vocational and developmental goals in secondary schools. At the same time, although various reports have pointed to problems such as dilapidated infrastructure, weak ICT integration, chronic underfunding, and low student motivation, there is a lack of empirical work that examines these constraints together, compares them across different locations within Kaduna State, and shows how strongly each factor affects teaching and learning.

In practice, interventions by policymakers and school managers are designed without robust, context-specific evidence on whether the most critical gaps lie in infrastructure, ICT, funding, or student attitudes, which often leads to fragmented or unsustainable efforts. By systematically identifying and analysing these constraints, and by capturing teachers' perceptions of feasible strategies for improvement, this study provides grounded, actionable evidence. Such evidence can guide state and local governments, school administrators, and development partners in prioritizing and sequencing interventions that can genuinely strengthen Agricultural Science education and make it more relevant, engaging, and practice-oriented for secondary school students in Kaduna State.

Specific Objectives

1. To determine teachers' perceptions of infrastructural and instructional material constraints to the teaching and learning of Agricultural Science in public secondary schools in Kaduna State.
2. To examine the challenges associated with the availability and use of information and communication technology (ICT) for teaching and learning Agricultural Science across the three locations.
3. To assess the extent to which funding-related issues hinder effective teaching and learning of Agricultural Science in public secondary schools in Kaduna State.
4. To identify the factors related to students' interest and attitude that constrain their participation and performance in Agricultural Science.
5. To ascertain the strategies perceived by teachers as effective for improving the teaching and learning of Agricultural Science in public secondary schools in Kaduna State.

Research Questions

The following questions guided the study:

1. To what extent do teachers perceive infrastructural and instructional material constraints as hindering the teaching and learning of Agricultural Science in public secondary schools in Kaduna State?
2. What challenges do teachers encounter in the availability and use of information

and communication technology (ICT) for teaching and learning Agricultural Science across the three locations?

3. How do funding-related issues affect the effective teaching and learning of Agricultural Science in public secondary schools in Kaduna State?
4. What factors related to students' interest and attitude constrain their participation and performance in Agricultural Science?
5. What strategies do teachers perceive as effective for improving the teaching and learning of Agricultural Science in public secondary schools in Kaduna State?

Hypotheses

The study tested the following null hypotheses at ≤0.05 level of significance:

Ho_1: There is no significant difference in teachers' perceptions of infrastructural and instructional material constraints to the teaching and learning of Agricultural Science across the three locations in Kaduna State.

Ho_2: There is no significant difference in the challenges associated with the availability and use of information and communication technology (ICT) for teaching and learning Agricultural Science across the three locations.

Ho_3: There is no significant difference in the extent to which funding-related issues hinder the effective teaching and learning of Agricultural Science in public secondary schools across the three locations.

Ho_4: There is no significant difference in the factors related to students' interest and attitude that constrain their participation and performance in Agricultural Science across the three locations.

Ho_5: There is no significant difference in teachers' perceptions of the effectiveness of proposed strategies for improving the teaching and learning of Agricultural Science in public secondary schools across the three locations.

Materials and Method

Description of the Study Area

The investigation was carried out in Zaria metropolitan city, comprising Zaria and Sabon Gari Local Government Areas (LGAs), and Kaduna metropolis. The two zones are cosmopolitan, dominated by farmers and traders, with several primary, secondary and tertiary institutions that attract migration of people from various ethnic groups in Nigeria and beyond. However, based on speculations, socioeconomic characteristics of parents, school, teachers and students in Kaduna metropolis tend to be better compared to Zaria and Sabon Gari LGAs.

Zaria lies between longitude 07.44^0 and 8^0 East and latitude 11.07^0 and 12^0 North, covering land area of 300 square kilometers, with an estimated population of approximately 736,000. Sabon Gari lies between longitude 7° and 8° East and latitude 10° and 12° North with average altitude of 675*masl*, covering land area of approximately 600km^2 on a projected population of 725,069 that grows at the rate of 3.2% annually (National Population Commission, NPC and National Bureau of Statistics, NBS, 2016; Kaduna Agricultural Development Agency, 2020; Alabi *et al*., 2021). Kaduna Metropolis is in

north-western Nigeria, in the central part of Kaduna State. Geographically, it lies at approximately 10.52° North latitude and 7.43° East longitude. In terms of direction within Nigeria, Kaduna Metropolis is situated North of the Federal Capital Territory, Abuja, South of Zaria, East of Niger State and West of parts of Plateau and Bauchi States. Within Kaduna State, the metropolis occupies the central corridor along the Kaduna River, serving as an administrative, commercial, and educational hub that links the northern and southern parts of the state.

Research Design

The study adopted a survey research design. The population of the study compromised of the 187 Agricultural Science teachers in the 81 registered public secondary schools in the two senatorial zones. Field observation revealed 17 registered public schools and 15 agricultural teachers in Zaria, 24 registered schools and 69 teachers in Sabon Gari, 40 schools and 103 agricultural science teachers in Kaduna metropolis. The entire population of schools and teachers were used for the investigation as the number of schools and teachers were manageable within the scope of the research. Information on the number of schools was obtained from the schools' zonal board and complimented by surveys by the schools to confirm number of agricultural science teachers in each school before the investigation.

The instrument used for data collection was close structured questionnaire, comprising perceived challenges affecting teaching and learning of Agricultural Science. Such challenges bothered infrastructure and instructional materials, use of Information Communication Technology, school funding, poor interests and negative attitudes of students. The instrument comprised of 69-item designed in a 4-point rating scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD), and assigned values of 4, 3, 2 and 1, respectively. The instrument was validated by three experts from Federal University of Education, Zaria. Observations of the experts in terms of language, sentence and spelling were incorporated before the pretest that yielded reliability coefficient value of 0.88 using Cronbach Alpha.

Data Analysis

Data was subjected to descriptive statistics (frequency and mean) and mathematical technique adopted from Onwunali *et al*. (2024), while the analysis of variance (ANOVA) at $p \leq 0.05$ was used to test hypotheses. A mean benchmark of ≥ 2.5 determined the decision for the significance of challenges and strategies. Means < 2.5 was termed not significant and was regarded as a minor challenge or strategy. Standard deviation was used to determine consensus agreement of teachers' perception on the challenges and strategies. All the analyses were carried out using Statistical Package for Social Science (SPSS) version 23.

Results and Discussions

Infrastructure and Instructional Materials

Results in Table 1 showed ground means of 3.11, 3.03 and 2.95 for Zaria, Sabon Gari and

Kaduna Metropolis, respectively, indicating that inadequate infrastructures and instructional materials, except for number and size of classrooms in the three locations that recorded means below the benchmark, particularly in Zaria and Kaduna. Teachers' consensus agreement using standard deviation on the items in challenges of inadequate infrastructures and instructional materials were relatively high in Sabon Gari (SD = 0.32) and Kaduna Metropolis (SD = 0.42), compared to the diverse option in Zaria (0.76). However, despite the variations, $p = 1.317 < 0.05$, and implied that, there were no significant differences in teachers' perception. Hence the null hypothesis that there is no significant difference between infrastructure challenges in the three locations is accepted.

Generally, dilapidated laboratories, inadequate laboratory equipment and chemicals, poorly equipped libraries, inadequate school gardens and inadequate teaching materials dominated challenges across the locations and undermines students' practical engagement in the field. Earlier, Ibrahim (2014) reported that inadequate instructional materials and demonstration farms negatively affected student motivation and limited opportunities for experiential learning, hence shifting the subject from hands-on activity to theoretical teaching. Possibly why reports revealed poor students' skills acquisition (Innocent-Ene *et al*., 2022; Eziamaka *et al*., 2023). These infrastructures are necessary for the realization of philosophy establishing Agricultural Science as a vocational subject in secondary school.

Table 1: Perception of teachers on infrastructure and instructional materials barriers in the North and central senatorial zones of Kaduna State

S/N	Items	ZRX (x)	SD	SBG (x)	SD	KDM (x)	SD
1	Dilapidated laboratories	3.37	0.59	3.26	0.81	3.50	0.59
2	Inadequate equipment and chemicals	3.67	0.80	3.29	0.71	3.30	0.51
3	Dilapidated and poorly equipped libraries	3.73	0.74	3.20	0.85	3.30	0.54
4	Inadequate number of classrooms	2.07	0.88	2.58	0.99	2.20	0.88
5	Small sized classrooms	1.53	0.64	2.35	1.03	2.20	0.90
6	Inadequate teaching materials (specimen, charts, posters)	3.87	0.35	3.09	0.84	3.20	0.60
7	Inadequate school garden for farm practical	2.53	1.06	3.14	1.07	3.40	0.61
8	Inadequate farm tools, equipment and machines	3.93	0.26	3.35	0.84	3.50	0.61
9	Inadequate power supply for supporting teaching facilities	3.27	1.03	3.39	0.83	3.40	0.63
10	Lack of store for safekeep of instructional materials	2.60	0.91	3.17	0.89	3.10	0.67
11	Lack of farm for practical	3.40	0.74	2.94	1.01	3.30	0.69
12	Lack of government monitoring to assess infrastructural decay	3.40	0.74	3.09	0.90	3.40	0.62
13	Lack of security for farms and other facilities	3.87	0.35	3.17	0.91	3.30	0.57
14	Inadequate maintenance of facilities for teaching	3.13	0.99	2.93	0.86	3.20	0.63
15	Lack of maintenance culture by the staff	2.07	0.88	2.48	0.98	2.60	0.79
	Grand Mean	3.11^{NS}	0.76	3.03^{NS}	0.32	2.95^{NS}	0.42

Source: ZRX = Zaria, SBG = Sabon Gari, x = mean, SD = Standard Deviation, p = 1.317<0.05, NS = not significant

Information and Communication Technology

Table 2 revealed that $p = 40.96 > 0.05$, and implied significant difference among the means across the locations. Results also showed that Zaria (3.04) and Kaduna (2.95) significantly experienced more ICT challenges compared to Sabon Gari (2.28), however the teacher agreement on the items were higher in Kaduna (0.40) and diverse in Zaria (0.73) and Sabon Gari (0.53). The significant difference in means rejected the null hypothesis that there are no significant differences in ICT challenges across the three locations. Similarly, all the challenging items were perceived to constitute impediment in the use of ICT in teaching and learning agricultural science in secondary schools, except for inadequate experience of teachers to internet browsing, which yielded means below the benchmark of <2.40. followed by teachers' incompetent skills in ICT application (2.29) in Sabon Gari.

The variation reflects uneven distribution of ICT resources such as computers, reliable internet, and power supply across the schools in the three locations. In Nigeria, integration of ICT into the educational system remains "at low ebb" due to poor policy implementation, inadequate power supply, inadequate personnels in word processing, excel packages' power point usage and limited internet bandwidth. Many schools lack both the infrastructure and the skilled personnel needed to utilize computers, multimedia, or relevant educational software, despite the growing role of technology in modern agricultural practices (Onwunali *et al*., 2024). Where available, ICT adoption is restricted by erratic power supply, limited funding, and negative attitudes toward technological innovation among older teachers. The mere supply of hardware is insufficient, qualified personnel and sustainable maintenance remains paramount in the utilization of ICT as a tool in teaching agricultural science (Adomi & Kpangban, 2010).

Table 2: Perception of teachers on Information and Communication Technology barriers in the North and central senatorial zones of Kaduna State

S/N	Items	ZRX (x)	SD	SBG (x)	SD	KDM (x)	SD
1	Inadequate computers, printers, scanners, photocopiers	3.87	0.52	3.52	0.74	3.8	0.42
2	Inadequate power supply	3.73	0.80	3.46	0.85	3.3	0.51
3	Teachers' incompetent skills in ICT application	3.47	0.52	2.29	0.96	2.6	0.67
4	Inadequate number of ICT skilled teachers	3.93	0.26	2.59	0.97	2.7	0.65
5	Poor internet facilities, network and service	2.53	0.92	3.32	0.76	3.2	0.62
6	Incompetence in word processing (typing & printing)	2.73	1.03	2.78	0.95	2.9	0.56
7	Low experience of teachers in use of excel for calculation	2.93	1.16	2.43	0.95	2.8	0.61
8	Inadequate experience of teachers in power point usage	3.00	0.65	2.36	0.87	2.6	0.69
9	Incompetence of teacher's internet browsing	1.60	0.74	2.13	0.95	2.4	0.70
10	Lack of ICT laboratory	2.60	1.12	3.30	0.99	3.2	0.52
	Grand Mean	3.04[a]	0.73	2.28[b]	0.53	2.95[a]	0.40

Source: ZRX = Zaria, SBG = Sabon Gari, x = mean, SD = Standard Deviation, p = 40.96>0.05**, LSD (0.05) = 0.62, a and b = mean ranking

Challenges of Funding

Table 3 showed deficit in funding across the three locations and also revealed that location significantly influenced funding of schools in Kaduna State. Across the three locations, p = 13.87< 0.05 implied that Kaduna Metropolis (3.35) experienced higher funding challenges followed by Sabon Gari with mean of 3.22, while Zaria (3.03) comparatively recorded significantly the least mean. As such, the null hypothesis that there was no significant difference in funding of schools is rejected. Results of the standard deviation (Table 3) also revealed that, the consensus agreement; 0.12 and 0.11 on the items among teachers Sabon Gari and Kaduna, respectively were relatively higher

compared to Zaria (0.76) with diverse agreement. However, issues of administrative impress, support for young farmers club activities and funds for school inspection and monitoring were not major challenge in Zaria, unlike in Kaduna and Sabon Gari with significant means of >3.0, indicating a severe and broad-based perception of funding deficits. This result is in line with Ibrahim (2014) reported inadequate funding as a fundamental problem obstructing instructional delivery and the capacity for research and innovation in secondary school Agricultural Science. Inadequate funding is a pervasive issue affecting nearly every aspect of institutional support required for quality Agricultural Science education. Insufficient funds directly hinder the procurement of farm inputs, equipment, and instructional materials, and limit the ability to sponsor teachers for further training or pay competitive salaries.

Table 3: Perception of teachers on funding barriers in the North and Central Senatorial zones of Kaduna State

S/N	Items	ZRX (x)	SD	SBG (x)	SD	KDM (x)	SD
1	Inadequate funds to purchase instructional materials	3.80	0.56	3.30	0.75	3.4	0.52
2	Lack of administrative impress for Agricultural Science	2.27	1.10	3.09	0.76	3.3	0.58
3	Unsuitable teachers' salaries and wages	3.00	1.07	3.07	0.94	3.1	0.68
4	Shortage of funds for chemicals & Agricultural Science specimen	3.80	0.41	3.25	0.76	3.5	0.54
5	Lack of support for young farmers club activities	2.27	1.10	3.14	0.79	3.3	0.60
6	Insufficient financial motivation of teachers	3.87	0.35	3.30	0.75	3.4	0.57
7	Inadequate funds for regular farm exhibition & show	3.47	0.92	3.39	0.69	3.3	0.49
8	Inadequate funds to organize field trips/excursion	3.47	0.91	3.28	0.66	3.5	0.50
9	Inadequate funds for school inspection and monitoring	1.73	0.80	3.03	0.80	3.3	0.48
10	Lack of money to buy farm tools and machinery	2.67	0.98	3.32	0.74	3.4	0.52
	Grand Mean	3.03[b]	0.76	3.22[ab]	0.12	3.35[a]	0.11

Source: ZRX = Zaria, SBG = Sabon Gari, x = mean, SD = Standard Deviation, p = 13.87>0.05**, degree of freedom = 173, LSD (0.05) = 0.21, a and b = mean ranking

Challenges of Poor Student Interest

Results (Table 4) showed poor students' interest and negative attitude to agriculture across the three locations, with a minimum mean of 2.67 in Sabon Gari. Results p = 4.829< 0.05, also revealed a significance of location to students' interest and attitude, where Zaria (2.98) significantly differentiated with Sabon Gari and Kaduna Metropolis with means of

2.67 and 2.72, respectively. The variation in means rejected the null hypothesis that there was no significant difference in student interest and attitude to agricultural science across the three locations. Teachers' consensus agreement also followed a similar trend where consensus was high in Sabon Gari (0.33) and Kaduna (0.29), and diverse in Zaria (0.67).

Teachers' incompetency was never a challenge across location, but preference for male students constituted a challenge in Sabon Gari. Furthermore, students' truancy to Agricultural Science classes constituted significant challenge in Sabon Gari and Kaduna and not in Zaria, implying that student's interest and attitude vary with location. Generally, low interest in classroom teaching (theory), lack of interest in young farmers club activities, poor attitudes to farm work and practical, unwilling attitude of students, and Lack of students counseling dominated the major barriers to students' participation in Agricultural Science across location.

Numerous studies have linked student attitudes to perceptions of career viability and curriculum relevance. Adejoh *et al*. (2016) reported that career choice and perception of career prospects strongly shape learners' attitude toward the subject. Where Agricultural Science is taught as an abstract and as theoretical discipline with minimal linkage to real-world applications, students are often discouraged and subsequently disengage. Reports have also shown discouraging parental influence on their wards on the perception that agriculture lacks prestige or socioeconomic value compared to other disciplines. Such societal bias is reinforced whenever agricultural practical are deployed as punishments, fostering further disinterest in the subject among students (Egunsola & Abdulmumini, 2018; Joshua & Egunsola, 2024).

Table 4: Perception of teachers on poor interest and attitude of students' barriers in the North and Central Senatorial zones of Kaduna State

S/N	Items	ZRX (x)	SD	SBG (x)	SD	KDM (x)	SD
1	Low interest in classroom teaching (theory)	3.40	0.83	2.80	0.90	2.8	0.76
2	Lack of interest in young farmers club activities	2.67	0.98	2.70	0.77	2.9	0.67
3	Poor attitudes to farm work and practical	3.67	0.72	2.93	0.83	2.9	0.58
4	Unwilling attitude of students to Agric. Science	3.87	0.35	2.65	0.89	2.5	0.79
5	Teachers' preference for male students to females in Agricultural Science	2.47	0.99	2.57	1.05	2.3	0.82
6	Home background and parental perception in Agric. Science	2.67	0.98	2.87	0.73	3.2	0.68
7	Poor students' performance in Agric. Science examinations	3.27	0.88	2.61	0.83	2.7	0.72
8	Unwillingness of students to take up careers in Agriculture	2.93	0.88	2.86	0.79	2.9	0.67
9	Students' Truancy to Agricultural Science classes	2.13	0.83	2.70	0.77	2.7	0.73
10	Lack of students counseling for careers in Agricultural Science	3.80	0.56	2.91	0.84	2.9	0.67
11	Incompetent Agricultural Science teachers	1.93	1.16	1.75	0.91	2.1	0.91
	Grand Mean	2.98[b]	0.67	2.67[a]	0.33	2.72[a]	0.29

Source: ZRX = Zaria, SBG = Sabon Gari, x = mean, SD = Standard Deviation, p = 4.829>0.05**, degree of freedom = 173, LSD (0.05) = 0.21, and b = mean ranking

Strategies for Improvement

Table 5 showed that the 17 proposed strategic items were significant across the locations, however with varied ground means that were highly perceived paramount in Zaria (3.70) compared to Sabon Gari and Kaduna that yielded 3.34 and 3.17, respectively. Statistical analysis using ANOVA revealed that $p = 86.75 < 0.05$, confirming that the mean variation was significantly difference. Hence, the null hypothesis that there was no significant difference between the perceived strategies is rejected. The relatively low standard deviation across location 0.31, 0.14 and 0.12 for Zaria, Sabon Gari and Kaduna, respectively implied high consensus agreement on teachers' perception on the strategies to improve teaching and learning of the subject in Kaduna State. However, sustainable salary structure and regular payment, manageable teacher student ratio, recruitment of enough and qualified Agricultural Science teachers, adequate farm tools and machines for practical, regular school inspection and in-service training for teachers through regular workshops and conferences *inter alia* dominated solutions to improve the barriers.

Empirical evidence has shown adoption of experiential teaching, application of different teaching methods, use of relevant instructional tools, teacher management and ration, and appropriate instructional methods as veritable strategy for student's skill acquisition in secondary schools (Yaro *et al*., 2016; Umar *et al*., 2024, Ogunjobi & Idowu, 2024). Danladi *et al*. (2024) reported the need for diverse, learner-centered methods in fostering competencies and students' interest in agriculture. Implementing these strategies, alongside targeted investment in infrastructure and ICT, offers a coherent roadmap to revitalizing Agricultural Science education in study area, even beyond. (Onwunali *et al*., 2024).

Table 5: Perception of teachers on strategies for improvement teaching and learning of Agricultural Science public secondary schools in the North and Central Senatorial zones of Kaduna State

S/N	Items	ZRX (x)	SD	SBG (x)	SD	KDM (x)	SD
1	Regular school inspection by the ministry of education	3.87	0.35	3.29	0.84	3.1	0.83
2	Provision of well-equipped Agric. Science laboratory	3.53	0.61	3.29	0.93	3.1	0.83
3	Availability of well-equipped and spacious classroom	3.93	0.26	3.28	0.96	2.9	0.88
4	Required teacher student class ratio	3.93	0.26	2.97	0.91	3.1	0.74
5	Functional and convenient Agric. Science farm for practical	3.73	0.59	3.36	0.91	3.3	0.60
6	Adequate farm tools and machines to ease students work	3.87	0.35	3.35	0.89	3.3	0.67
7	Sufficient administrative fund for agriculture	3.93	0.26	3.30	0.83	3.1	0.75
8	Sustainable salary structure and regular payment	4.00	0.00	3.57	0.70	3.0	0.80
9	Financial motivation of teachers	3.87	0.35	3.49	0.80	3.3	0.69
10	Recruitment of enough and qualified Agric. Science teachers	3.80	0.41	3.39	0.81	3.0	0.75
11	Training and retraining of teachers to enhance knowledge	3.47	0.92	3.48	0.74	3.2	0.72
12	Regular Agricultural workshop and conferences for teachers	3.80	0.41	3.42	0.79	3.3	0.66
13	ICT training on Agric. Science packages and program	3.73	0.59	3.20	0.92	3.3	0.71
14	Regular supply of electricity	3.87	0.35	3.28	0.84	3.2	0.75
15	Availability of ICT facilities in the secondary schools	3.67	0.88	3.26	0.87	3.3	0.74
16	Regular agricultural exhibition, farm show, quiz, competition and seminars for students	2.93	1.16	3.48	0.72	3.2	0.69
17	Effective career guidance and counselor for students	3.00	0.93	3.39	0.73	3.2	0.72
	Grand Mean	3.70[a]	0.31	3.34[b]	0.14	3.17[b]	0.12

Source: ZRX = Zaria, SBG = Sabon Gari, x = mean, SD = Standard Deviation, p = 86.75>0.05** LSD (0.05) = 0.35, a and b = mean ranking

Conclusion

The findings of this study revealed that the teaching and learning of Agricultural Science in public secondary schools across Zaria, Sabon Gari, and Kaduna Metropolis are constrained by multifaceted and interrelated challenges. In terms of infrastructure and

instructional materials, teachers across the three locations expressed similar perceptions, with no significant difference. Dilapidated laboratories, inadequate equipment and chemicals, poorly equipped libraries, insufficient farm tools, weak maintenance culture, and irregular power supply were dominant barriers. These deficiencies undermine the practical orientation of Agricultural Science as a vocational subject and limit students' opportunities for experiential learning and skill acquisition.

Furthermore, significant locational differences established in ICT challenges, funding deficits, student interest, and perceived improvement strategies indicated variation in the barriers, with ICT-related barriers more pronounced in Zaria and Kaduna Metropolis than in Sabon Gari. Reflecting uneven distribution of digital infrastructure, inadequate ICT-skilled personnel, and unreliable electricity supply. Funding limitations emerged as a major impediment to effective Agricultural Science education, with the most severe challenges reported in Kaduna Metropolis, followed by Sabon Gari and Zaria. Inadequate financial resources have constrained the provision of instructional materials, farm inputs, teacher incentives, and field-based learning opportunities. These shortages have further aggravated existing infrastructural deficiencies and hindered meaningful curriculum delivery.

There were also notable differences in students' interest and attitudes toward Agricultural Science across the three locations. Although low interest was common, students in Zaria exhibited comparatively stronger negative attitudes than those in Sabon Gari and Kaduna Metropolis. Limited enthusiasm for theoretical instruction, poor engagement in practical activities and young farmers' clubs, insufficient career guidance, and prevailing societal perceptions about agriculture significantly contributed to students' disengagement. Teachers, however, strongly agreed on measures necessary to rejuvenate the subject. They emphasized sustainable remuneration, recruitment of qualified personnel, improved teacher–student ratios, functional school farms and laboratories, enhanced ICT facilities, regular supervision, and ongoing professional development as essential strategies for sustainable improvement.

Recommendations

Based on the findings, the following recommendations were made

1. Education authorities should prioritize sustained investment in functional laboratories, libraries, school gardens, and farm tools, ensuring that facilities are not only provided but also regularly maintained and upgraded to support meaningful practical work in Agricultural Science.
2. Government and school managers should expand ICT infrastructure and provide continuous, hands-on training for Agricultural Science teachers, so that available devices, software, and connectivity are effectively integrated into lesson delivery rather than remaining underutilized.
3. Stakeholders should strengthen and ring-fence budgetary allocations for Agricultural Science, with clear provisions for instructional materials, field trips, exhibitions, and teacher development, while improving transparency

and timeliness in disbursement to reduce chronic resource gaps.

4. Schools should adopt more experiential, learner-centred approaches, such as school farms, clubs, exhibitions, and career talks while engaging parents and communities to reshape perceptions of agriculture as a viable, dignified, and rewarding career pathway for students.

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