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Challenges of Teaching and Learning Agricultural Science in Public Secondary Schools: A Threat to Food Security in Kaduna Metropolis, Nigeria

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Abstract

This study assessed the perceptions of Agricultural Science teachers regarding emerging challenges in teaching the subject in Kaduna metropolis in 2024. Using a descriptive survey, data were collected through structured questionnaires from 103 teachers across 40 public secondary schools, focusing on socioeconomic factors and teaching challenges. Most respondents were married (76%), female (54.3%), aged 31-40 (51.1%), and half held a B.Sc. Ed degree, with 25% having 11-15 years of teaching experience. Significant challenges identified included inadequate instructional materials (mean=3.13), insufficient ICT infrastructure (mean=2.95), lack of funding (mean=3.35), and low student interest and attitude (mean=2.72), highlighting issues such as infrastructural decay, limited digital resources, and poor funding. Seventeen improvement strategies were identified. The study recommended prioritising the renovation and upgrading of essential facilities (laboratories, libraries), provision of ICT resources, sufficient farm tools, better teacher remuneration, and regular training through workshops and conferences.

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Background to the Study

Globally, agriculture is an essential aspect of human life as it has facilitated man's knowledge of his environment as well as basic needs for food, shelter, and clothing. The concentration on the oil boom has today resulted in the steady decline of previously rich agricultural output in Nigeria (Onipede *et al*., 2021). Nigeria, being a developing country, requires consensus, effective, and purposeful agrarian science in secondary schools to meet the food demand of the estimated ≥200 million people. Possibly, this is why Agricultural Science was made a compulsory vocational subject in the primary and secondary school curriculum, and recently upgraded to trade subjects (Federal Republic of Nigeria, 2013; Newton & Hamisa, 2023). Such policies and developed curricula were made to ensure self-reliance for beneficiaries (Omodara *et al*., 2024). However, the government's massive investment in finance, policies, and curriculum development does not reflect in practice and training in agriculture and agricultural education, respectively

Presently, the academic performance of students does not predict the hope of fulfilling agricultural policy expectations (Onwunali *et al*., 2024a) despite its critical role in the education landscape, local economy, and livelihoods. Several challenges have been implicated in jeopardising teaching and learning the subject. Among others, inadequate infrastructure and instructional materials are significant barriers, impacting both the delivery and quality of teaching. Schools often struggle with insufficient facilities and resources, which consequently affect students' engagement and learning outcomes (Olaniyan & Okemakinde, 2023). Studies have shown that the availability of adequate and modern facilities in schools significantly enhances students' engagement, comprehension, and retention of complex concepts (Olayemi *et al*., 2023; Akinwale & Ogunleye, 2023)

Furthermore, the current integration of Information and Communication Technology (ICT) is paramount considering the current digital age, driven by technological proficiency in teaching and learning agricultural science (Nguyen & Huynh, 2023; Onwunali *et al*., 2024b); however, it is fraught with difficulties. Teachers frequently encounter obstacles in utilising ICT facilities due to inadequate experience, insufficient technical support, and outdated equipment (Adebayo & Ojo, 2022). Hence, making it difficult to incorporate modern teaching tools and resources that could enhance learning experiences (Ojo & Oyetunde, 2023; Asare & Boateng, 2024). Therefore, fostering a positive attitude towards ICT through awareness campaigns and success stories to schools that have access to regular and reliable electricity and internet connectivity will facilitate teachers' and students' digital application in schools (Adomi & Kpangban, 2019; Olatoye & Adekoya, 2021), particularly in rural environments.

Government sources, private sector partnerships, and donor agencies fund schools. However, limited funding has been reported to significantly exacerbate the challenges of procuring essential and modern instructional materials/equipment (laboratory tools, agricultural machinery, and technology-based resources), the implementation of innovative teaching strategies, and the provision of practical learning opportunities for

students (Aliyu & Bakare, 2024; Johnson & Patel, 2024). In the absence of these critical resources, teachers struggle to deliver hands-on experiences, creating a gap between theoretical knowledge and practical application (Nigerian Education Policy Review, 2014). Shortage of funds also forces teachers to rely on outdated or improvised materials, which affects comprehensive delivery, curriculum engagement, teaching methodologies, and innovations in agricultural science (Ineye-Briggs, 2023; Lucky, 2024). Other consequences include overcrowded classrooms, insufficient support services, inadequate individual attention to students, discouraged offer of supplementary educational programs as well as demoralised extracurricular programs, field trips, and industry partnerships that enrich students' learning experiences. (Nigerian Education Policy Review, 2014; Federal Ministry of Agriculture and Rural Development, 2022; Eze, 2024).

Students' interest and attitudes in Agricultural Science significantly influenced educational outcomes (Onwunali *et al*., 2022). Research has shown that positive interest and attitude enhanced engagement, motivation, participation and overall academic performance, whereas poor interest exhibited a significant effect (Nyemiemo, 2023). Poor interest is often associated with the perception that agriculture is a less relevant, less glamorous, and less career-oriented field. Other perceptions are that agriculture is difficult/tedious, uninteresting and associated with inadequate instructional methods or lack of support (Achagwa *et al*., 2023; Oluwole & Ogunleye, 2024). Therefore, multifaceted strategies like integrating hands-on learning experiences, showcasing the real-world applications of Agricultural Science, linking the subject to broader career opportunities, fostering a supportive and interactive learning environment, curriculum enhancement and teacher professional development are essential for sustainable improvement of students' interest and attitudes in Agricultural Science (Smith & Thompson, 2023; Ogunyemi & Adeyemo, 2023; Johnson & Miller, 2023).

Challenges in teaching and learning Agricultural Science in Nigerian secondary schools significantly impact food security. Poor teaching quality, inadequate facilities, and lack of practical exposure affect students' interest, competence, and food production. Many schools lack qualified teachers with sufficient pedagogical training, culminating in ineffective delivery of the curriculum and poor student performance (Eniafe & Owoseni, 2023; Ibrahim, 2024). Inadequate resources such as farm tools, demonstration plots, and instructional materials limit hands-on learning and undermine skill acquisition (Abubakar, 2023). Consequently, students graduate without practical experience, resulting in a lack of readiness to engage in productive farming activities and a shortage of skilled young farmers. Farmers, from low productivity, inadequate infrastructure, and insufficient capital incentives, benefited from science if it had been effectively delivered (Ojo, 2024). The failure to adequately teach agricultural science in secondary schools significantly impacts the poor development of a skilled agricultural workforce and impedes national food security (Iliya *et al*., 2025).

Statement of the Problem

The statement of the problem emphases the need for a comprehensive approach to improve Agricultural Science education in secondary schools due to evidence of poor

student performance and low tertiary enrollment in the subject. In Kaduna metropolis, these issues are particularly pertinent. The recent study conducted in Kaduna confirmed persistent challenges such as inadequate infrastructure, lack of modern instructional materials, insufficient ICT equipment, chronic under-funding, and poor student interest as factors directly linked to the low attainment in Agricultural Science highlighted in national examinations like the West African Examination Council (Onwunali *et al*., 2024a; Omodara *et al*., 2024).

The negative societal perception of Agricultural Science as a tedious subject with limited career prospects (Onwunali *et al*., 2022) further discourages student enrollment in both secondary and tertiary institutions within Kaduna. To address these local challenges, the study in Kaduna metropolis aimed to identify underlying problems and propose practical solutions, such as upgrading school facilities, integrating ICT resources, increasing funding, and fostering positive student attitudes. These strategies are crucial for reversing negative trends, improving learning outcomes, and encouraging greater participation in Agricultural Science across Kaduna metropolis.

Specific Objectives of the Study

The following specific research objectives guided the study:

1. To determine socioeconomic characteristics of the Agricultural Science teachers in Kaduna metropolis,
2. To identify challenges of infrastructure and instructional materials in teaching and learning Agricultural Sciences, Kaduna metropolis
3. To examine challenges in the application and utilization of ICT facilities in teaching Agricultural Sciences, Kaduna metropolis,
4. To assess the challenges of funding on the teaching and learning of Agricultural Science, Kaduna metropolis,
5. To identify factors responsible for poor students' interest and attitudes in learning Agricultural Science and
6. To determine strategies for enhancing the teaching and learning of Agricultural Science in Kaduna metropolis.

Research Questions

The following research questions guided the study:

1. What are the demographic characteristics of teachers that influence teaching and learning in Agricultural Science?
2. What are the challenges of infrastructure and instructional materials in teaching and learning of Agricultural Science?
3. What are the challenges in the application and utilization of ICT facilities in teaching and learning of Agricultural Science?
4. What are the challenges of funding teaching and learning in Agricultural Science?
5. What are the factors responsible for poor students' interest and attitudes in teaching and learning Agricultural Science?
6. What are the strategies for enhancing the teaching and learning of Agricultural Science in Kaduna metropolis?

Materials and Methods

Research Design

A descriptive survey research design was used to purposely distribute the instrument to a population of one hundred and three (103) teachers in the forty (40) registered public secondary schools in Kaduna metropolis. Census sampling was adopted for the study because the number of teachers was within a manageable limit. Information on the number of schools was confidentially obtained from the Kaduna Schools Management Board. In contrast, the number of teachers was determined by visiting all the registered schools in the metropolis.

A closed structured questionnaire comprised of 69 items was designed in a four (4) point rating scale as Strongly Agreed (SA), Agreed (A), Disagreed (D) and Strongly Disagreed (SD), and used for data collection. Corresponding values of 4, 3, 2, and 1 were assigned to each rating, respectively. The instrument was divided into socioeconomic characteristics and sections of different challenges (infrastructure and instructional materials, ICT, school funding, interest and attitude of students and strategies of improvement). It was subsequently validated by three experts from the Federal University of Education, Zaria. A trial test was conducted using twenty (20) randomly selected teachers from secondary schools in Zaria to determine the reliability of the instrument, which yielded a high coefficient value of 0.88 using Cronbach's Alpha.

Data Analysis

Data on socioeconomic characteristics was subjected to descriptive statistics of per cent and mean, while the challenges and strategies of amendment data were subjected to mathematical techniques, called Challenge Confrontation Index (CCI) and Strategy Confrontation Index (SCI), amended from Onwunali *et al*. (2024b); as follows;

ICI = [ISA x 4] + [IA x 3] + [ID x 2] + [ISD x 1]

Where;
ICI = Infrastructure Confrontation Index
SA = Strongly Agree
A = Agree
D = Disagree
SD = Strongly Disagree

InCI = [InSA x 4] + [InA x 3] + [InD x 2] + [InSA x 1]

InCI = ICT Confrontation Index
SA = Strongly Agree
A = Agree
D = Disagree
SD = Strongly Disagree

SFCI = [SFSA x 4] + [SFA x 3] + [SFD x 2] + [SFSD x 1]

SFCI = School Funding Confrontation Index
SA = Strongly Agree
A = Agree
D = Disagree
SD = Strongly Disagree

IACI = [IASA x 4] + [IAA x 3] + [IAD x 2] + [IASD x 1]

IACI = Interest and Attitude Confrontation Index
SA = Strongly Agree
A = Agree
D = Disagree
SD = Strongly Disagree

SCI = [SSA x 4] + [SA x 3] + [SD x 2] + [SSD x 1]

Where;
SCI = Strategy Confrontation Index
SA = Strongly Agree
A = Agree
D = Disagree
SD = Strongly Disagree

Thereafter, standard deviation (SD) was used to determine levels of teachers' consensus agreement on the challenged and strategy means variations. A low standard deviation indicates strong consensus and significance, while a high SD suggests more varied or diverse opinions, implying a moderate to low significance mean. A Benchmark of ≥2.5 determined significant levels of item means. All the data analysis was performed using the Statistical Package for Social Science (SPSS) 23.

Results and Discussion

The socioeconomic characteristics (Table 1) of the teachers were dominated by married (76%) female teachers (54.3%) within the age range of 31-40 (51.1%), indicating that most teachers were young and energetic for teaching activities. The preponderance of females in the city was likely attributed to a lack of infrastructural amenities, including accessible roads, inadequate social amenities, and insecurity in the rural environment. Consequently, the posting of daughters and high-ranking female servants was a significant issue. Field experience also revealed that privileged women influence their postings to remain in the metropolis, under the guise of insecurity and reducing transportation costs. The domination of B.Sc Ed. (50.0%) degree in agricultural education implied that the teachers were qualified and experts in the field, given their teaching experience of 11-15 years (25.0%). Results confirmed the middle-aged nature of the

teachers, both male and female. Similarly, reports have shown that the majority of agricultural science teachers were young and married with teaching experience of 6-10 years, and had requisite qualifications of B.Sc (Ed.); however, they were dominated by males (Ikeoji, 2018; Onwunali *et al*., 2024b).

Table 1: Socioeconomic Characteristics of Agricultural Science Teachers in Kaduna Metropolis, 2024

S/No.	Items		Frequency	Percentage
1	Sex	Male	42	45.7
		Female	50	54.3
2	Age	20-30	1	1.1
		31-40	47	51.1
		41-50	40	43.1
		51-60	4	4.3
3	Marital Status	Single	19	20.7
		Married	70	76.0
		Widow	3	3.3
4	Qualification	NCE	10	10.9
		B.Sc	23	25.0
		B.Sc Ed.	46	50.0
		M.Sc	5	5.4
		M.Sc Ed	5	5.4
5	Teaching Experience	1-5	13	14.1
		6-10	19	20.7
		11-15	23	25.0
		16-20	17	18.5
		21-25	14	15.2
		26-30	06	6.5

Results (Table 2) revealed a grand mean of 3.13 and CI of 273.6 (1-420), indicating that teachers agreed on the inadequacy of infrastructure and instructional materials. The Standard Deviation (SD) varied from 0.51 to 0.90, indicating a range of variation in teachers' consensus agreement on the adequacy of infrastructure. However, an inadequate number of classrooms and small-sized classes gave a relatively low mean (2.2), and corresponding high SDs of 0.88 and 0.90, respectively. Suggesting divergent teachers' opinions and the implied availability of such infrastructures. In other words, the number and size of classrooms do not constitute an impediment or challenge to teaching and learning the subject. The availability was associated with the recent government renovation of schools in the state. In contrast, the dilapidated laboratory, inadequate farm tools, equipment, and machines (3.5), as well as the inadequate school garden for farm practical's and the inadequate power supply (3.4), posed significant challenges to the effective teaching and learning of Agricultural Science. Teachers' broad and diverse consensus opinion on the deficiencies is reflected in the relatively low SD (Table 2).

Earlier, Olaniyan and Okemakinde (2023) reported the detrimental impact of outdated laboratory facilities and insufficient resources for practical agriculture, while Adeoye and Popoola (2013) reported that the impact of classroom size influenced relatively less learning compared to other infrastructures. Consistent with inadequate equipment and library, Akinwale and Ogunleye (2023) reported the need for up-to-date resources and well-maintained libraries. The contrary opinions on the number and availability of classroom sizes clearly showed that teaching quality and curriculum relevance are also significant aspects of teaching and learning agriculture (Smith *et al*., 2024). Hence, there is a need to provide adequate and sustainable agricultural Science infrastructure in schools to enhance teaching and improve students' learning outcomes in Kaduna Metropolis.

Table 2: Challenges on Infrastructure and Instructional Materials in Kaduna Metropolis, 2024

S/No	Challenges	CI	$\bar{x}$	SD	Remarks
1	Dilapidated laboratory	312	3.5	0.59	Agreed
2	Inadequate farm tools, equipment, machine	312	3.5	0.61	Agreed
3	Inadequate school garden for farm practical	314	3.4	0.61	Agreed
4	Inadequate power supply	313	3.4	0.63	Agreed
5	Lack of government monitoring	317	3.4	0.62	Agreed
6	Inadequate equipment and chemicals	301	3.3	0.51	Agreed
7	Dilapidated and poorly equipped libraries	303	3.3	0.54	Agreed
8	Lack of farm for field practical	300	3.3	0.69	Agreed
9	Lack of security for farm and others facilities	304	3.3	0.57	Agreed
10	Inadequate teaching materials (specimens, charts, posters).	292	3.2	0.60	Agreed
11	Inadequate maintenance of facilities	291	3.2	0.63	Agreed
12	Lack of store for safe keeping of materials	285	3.1	0.67	Agreed
13	Lack of maintenance culture by the staff	239	2.6	0.79	Agreed
14	Inadequate number of classrooms	203	2.2	0.88	Disagreed
15	Small-sized classrooms	199	2.2	0.90	Disagreed
	Grand Total	**273.53**	**3.13**		

Source: CI = Confrontation Index, SD = Standard Deviation, $\bar{x}$ = Mean

Results (Table 3) showed a CI grand mean of 271.9 (1-420), which gave an average mean of 2.95. The result indicated strong consensus agreement among teachers, implying poor application of ICT in teaching and learning Agricultural Science. The mean variations (2.4 to 3.8) and SD (0.42 to 0.70) reflected substantial agreement on the severity of the problems. Specifically, teachers' consensus opinions were firm in inadequate computers, printers, scanners, and photocopiers (3.8), inadequate power supply (3.3), lack of ICT laboratory (3.2) and poor internet facilities, network and services (3.2), hence constitute significant challenges in the integration of ICT in teaching and learning of agriculture. The

relatively low and insignificant mean (2.4) and higher SD (0.70) indicated divergent opinions, implying that teachers were more conversant with internet browsing on their handsets rather than the school computer facilities.

Studies supported that inadequate ICT resources and unreliable power supply critically hindered practical technology usage in educational settings (Okwudishu, 2022; Adegboye & Abimbola, 2021). The low standard deviation of 0.42 for inadequate ICT equipment indicated a high level of agreement and aligned with the fact that lack of essential ICT tools, *inter alia*, is a primary barrier to practical teaching and learning (Olatoye & Adekoya, 2021; Onwunali *et al*., 2024; Modara *et al*., 2025). The relatively high SD (0.70) on teachers' competence in internet browsing confirmed the divergent opinions among teachers and created the variations, possibly due to differing experiences or expectations regarding teachers' ICT skills (Nguyen & Huynh, 2023). Therefore, the study suggested an urgent need to improve ICT infrastructure and training of Agricultural Science teachers.

Table 3: Challenges to the use of Information and Communication Technology in Kaduna Metropolis, 2024

S/No	Challenges	CI	$\bar{x}$	SD	Remarks
1	Inadequate computers, printers, scanners, photocopiers among others.	348	3.8	0.42	Agreed
2	Inadequate power supply	304	3.3	0.51	Agreed
3	Poor internet facilities, network and service	298	3.2	0.62	Agreed
4	Lack of ICT laboratory	294	3.2	0.52	Agreed
5	Incompetence in word processing (typing and printing)	268	2.9	0.56	Agreed
6	Inadequate experience of teachers in the use of Excel	261	2.8	0.61	Agreed
7	Inadequate number of ICT skilled teachers	244	2.7	0.65	Agreed
8	Teachers' incompetent skills in ICT applications	239	2.6	0.67	Agreed
9	Inadequate experience of teachers in PowerPoint usage	240	2.6	0.69	Agreed
10	Incompetence of teachers' internet browsing	223	2.4	0.70	Disagreed
	Grand Total	**271.9**	**2.95**		

Source: CI = Confrontation Index, SD = Standard Deviation, $\bar{x}$ = Mean

On funding, the results in Table 4 showed a grand CI of 308.6 (1-420) and an average mean of 3.35, indicating strong teachers' consensus agreement on the 10 identified challenges. Although means (3.1 to 3.5) and SD (0.48 to 0.68) varied, results revealed indigent funding, particularly in field trips, laboratory chemicals and specimen (3.5). Other pressing areas include funds for instructional materials, motivation of teachers and students, and farm tools and machinery (3.4), as well as teachers' salaries/wages (3.1).

The strong teachers' consensus on the challenges underscores the urgent need to improve funding for Agricultural Science education, particularly in areas such as school inspections and financial incentives for teachers, as the current salaries and wages appear unsustainable.

Previously, Adebayo and Ojo (2022) reported insufficient funding and financial instability as impeding factors in the education sector, particularly as it concerns teacher motivation and resource availability. A relatively low standard deviation of 0.48 in inadequate funding for school inspection and monitoring indicated a strong and high level of agreement among teachers. It aligned with Johnson and Peters (2023), who reported regular school inspections as a prerequisite to ensuring quality education.

The higher standard deviation of 0.68 in unsustainable teachers' salaries and wages indicated more varied opinions. However, since salary issues may be more context-dependent and subjective, the diversity may be due to varying experiences and the fact that financial instability affects staff retention and teaching effectiveness (Aliyu & Bakare, 2024). The strong consensus suggests an urgent need to address funding challenges in Agricultural Science education.

Table 4: Challenges on the Funding of Agricultural Science Teachers in Kaduna Metropolis, 2024

S/No	Challenges	CI	$\bar{x}$	SD	Remarks
1	Shortage of funds for chemicals and Agricultural science specimens	320	3.5	0.54	Agreed
2	Inadequate funds to organise field trips/excursions	320	3.5	0.50	Agreed
3	Inadequate funds to purchase instructional materials	316	3.4	0.52	Agreed
4	Insufficient financial motivation of teachers	313	3.4	0.57	Agreed
5	Lack of money to buy farm tools and machinery	316	3.4	0.52	Agreed
6	Lack of administration impress for Agricultural science	303	3.3	0.58	Agreed
7	Lack of support to young farmers club activities	302	3.3	0.60	Agreed
8	Inadequate funds for regular farm exhibitions and show	305	3.3	0.49	Agreed
9	Inadequate funds for school inspection and monitoring	303	3.3	0.48	Agreed
10	Unstable teachers' salaries and wages	288	3.1	0.68	Agreed
	Grand Total	**308.6**	**3.35**		

Source: CI = Confrontation Index, S.D = Standard Deviation, $\bar{x}$ = Mean

Results (Table 5) revealed a grand CI value of 248.72 (1-420), corresponding to an average mean of 2.72. Results significantly indicated that the 11 identified challenges were responsible for the poor students' interest and attitude toward the subject. However, variations in means (2.1-3.2) and SD (0.58-0.91) indicated levels of significance and consensus agreement of teachers on the challenges. Consequently, there was a strong consensus among teachers regarding several key issues like poor home background and parental perception (3.2), lack of students' interest in the young farmers' club, poor attitude to practical work activities, lack of counselling, and unwillingness to pursue a career in agriculture (2.9). Such items constituted and influenced students' interest and attitude. Contrarily, incompetent subject teachers and gender preference were not strong factors in influencing students' interest and attitude towards Agricultural science.

Recently, Ogunyemi and Adeyemo (2023) reported that students' engagement and practical experience improved interest and achievements in agricultural science. The poor attitudes to farm work and practicals align with studies by Ajayi and Olatunji (2021), who reported the pervasive behaviour of students' disengagement in agricultural practices. The high SD of 0.91 for incompetent Agricultural Science teachers implied heterogeneity in teachers' performance regarding the effectiveness and qualifications, associated with varying local experiences in school environments and regional educational policies (Nwankwo & Eze, 2022). The findings highlighted an urgent need to change students' attitudes towards the subject, particularly in increasing participation in hands-on learning and sustainable monitoring of teacher preparation and evaluation.

Table 5: Challenges of poor interest and attitudes of students in Kaduna Metropolis, 2024

S/N	Challenges	CI	$\bar{x}$	S.D	Remark
1	Home background and parental perception in Agricultural Science	274	3.2	0.68	Agreed
2	Lack of interest in young farmers club activities	272	2.9	0.67	Agreed
3	Poor attitudes to farm work and practical's	265	2.9	0.58	Agreed
4	Unwillingness of students to take up career in agriculture	263	2.9	0.67	Agreed
5	Lack of students counselling for career in Agriculture	270	2.9	0.67	Agreed
6	Low interest in classroom teaching (theory)	258	2.8	0.76	Agreed
7	Poor students' performance in Agricultural Science examination	249	2.7	0.72	Agreed
8	Students' truancy to Agricultural Science classes	243	2.7	0.73	Agreed
9	Unwilling attitudes of students to Agricultural Science	234	2.5	0.79	Agreed
10	Teachers' preference for male students over female students in Agricultural Science	214	2.3	0.82	Disagreed
11	Incompetent Agricultural Science teachers	194	2.1	0.91	Disagreed
	Grand Total	**248.72**	**2.72**		

Source: CI = Confrontation Index, S.D = Standard Deviation, $\bar{x}$ = Mean

A strong consensus agreement of teachers (Table 6) was evident with a grand CI of 290.59 (1-420), corresponding to an average mean of 3.17. Such a positive response implied that the 17 identified strategies are necessary for effective teaching and learning of Agricultural Science. However, means (2.1-3.3) and SD (0.60-0.88) varied, suggesting varied levels of significance in the strategies based on teachers' perception. Consequently, the provision of functional farms, adequate farm tools and machinery, financial motivation of teachers, training and retraining of teachers, incorporation of ICT into the Agricultural programme, and availability of ICT facilities in the schools significantly (3.3) dominated strategies for improving teaching and learning in agriculture. Hence, highlighting the essential need for practical facilities in learning experiences and outcomes in Agricultural Science. The relatively low mean (2.9) and high SD (0.88) observed in the provision of well-equipped and spacious classrooms indicate diverse opinions among teachers, possibly due to the recent government renovation of schools; however, this may require further attention or discussion among stakeholders.

The strong agreement on the importance of practical facilities aligns with Ogunyemi and Adeyemo (2023), who emphasised that hands-on experience is crucial for effective agricultural education. Abubakar (2023) and Onyendi (2019) reported the need for training and retraining of teachers for effective teaching of concepts like equipment maintenance and improvisation of farm material where necessary. Reports have shown

that the availability status of school farm facilities does not significantly influence students' level of acquisition of agricultural skills (Robert *et al.*, 2024). The opinion on well-equipped and spacious classrooms was supported by Adebayo and Ojo (2022); however, they explained the complexities involved in achieving uniform standards across schools. Therefore, effective integration of strategies that will combine practical experience and the diverse needs related to classroom resources is paramount.

Table 6: Strategies for Improvement of Agricultural Science in Secondary Schools in Kaduna Metropolis, 2024

S/N	Challenges	CI	$\bar{x}$	SD	Remark
1	Functional and convenient Agricultural Science farm for practical	300	3.3	0.60	Agreed
2	Adequate farm tools and machines to ease students' work	300	3.3	0.67	Agreed
3	Financial motivation of teachers (e.g Hazard allowance)	299	3.3	0.69	Agreed
4	Regular agricultural workshop and conferences for Agricultural science	301	3.3	0.66	Agreed
5	ICT training on Agricultural Science packages and programme	302	3.3	0.71	Agreed
6	Availability of ICT facilities in the secondary schools	306	3.3	0.74	Agreed
7	Training and retraining of teachers to enhance knowledge	294	3.2	0.72	Agreed
8	Regular supply of electricity to facilitate ICT teaching	294	3.2	0.75	Agreed
9	Regular agricultural exhibition, farm show, quiz, competition and seminars for students	297	3.2	0.69	Agreed
10	Effective careers guidance and counsellors for students	290	3.2	0.72	Agreed
11	Regular school inspection by the Ministry of Education	284	3.1	0.83	Agreed
12	Provision of well-equipped Agricultural Science laboratory	281	3.1	0.83	Agreed
13	Regular teacher-students class ratio	281	3.1	0.74	Agreed
14	Sufficient administration fund for Agriculture	285	3.1	0.75	Agreed
15	Sustainable salary structure fund for Agriculture	279	3.0	0.80	Agreed
16	Recruitment of enough and qualified Agricultural Science teachers	279	3.0	0.75	Agreed
17	Availability of well-equipped and spacious classrooms	268	2.9	0.88	Agreed
	Grand Total	**290.59**	**3.17**		

Source: CI = Confrontation Index, S.D = Standard Deviation, $\bar{x}$ = Mean

Conclusion

The study identified key challenges facing the teaching and learning of Agricultural Science in Kaduna State metropolis, including poor infrastructure, inadequate instructional materials, insufficient ICT resources, funding deficits, and low student interest. Addressing these gaps is crucial for fostering a supportive learning environment, enhancing effective teaching, encouraging technology use, and engaging students, all of which are vital factors for food security. The research emphasis that inadequate funding remains a significant barrier, highlighting the importance of sustained investment, especially for school inspectors, teacher incentives, and skill retention. To overcome these issues, a comprehensive approach is needed to improve infrastructure, provide adequate resources, and motivate teachers. Such measures are essential for advancing effective Agricultural Science education in Kaduna metropolis and, by extension, across Nigeria.

Recommendations

Based on the findings, the study made the following recommendations;

1. The government should prioritise the renovation and upgrading of critical infrastructure, such as laboratories and libraries, and ensure the availability of adequate farm tools and equipment.
2. Educational stakeholders (Governments, NGOs and Private organisations) should incorporate and implement comprehensive professional development programs through effective integration of technology and ICT competence into the Agricultural Science curriculum.
3. Governments and educational stakeholders should, as a matter of urgency, secure increased and sustainable funding for effective teaching of Agricultural Science and, by extension, secure food security.
4. Given the variation in teachers' opinions regarding salaries and competence, there is a need for the State Government to review teachers' salaries upwards, and facilitate training and retraining programmes to enhance teachers' performance for effective teaching and learning.
5. School management should prioritise the establishment and maintenance of functional Agricultural Science farms and provide practical facilities to facilitate hands-on learning and increase students' interest and attitude towards the subject.
6. The Kaduna State government, through the Ministry of Education and school managements, should not only improve on available school farm facilities but also generate means of improving the level of access, adequacy and utilisation of the school farm to ensure practical teaching of Agriculture for skill acquisition.

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