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Determination of Technical and Pedagogical Enhancement Needs of Secondary School Agricultural Science Teachers in Zaria Educational Zone, Kaduna State, Nigeria.

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Abstract

The study evaluated Agricultural Science teachers' competency in teaching. Survey research design was adopted in the distribution of a structured questionnaire that comprised technical and pedagogical skills areas. The instrument was validated, and a pilot study that yielded reliability coefficient value of 0.87, using Cronbach Alpha was established. A population of 50 teachers were used in the randomly selected public and private schools. Data were subjected to confrontation index on 4-point rating scale, means and need gap analysis. Results revealed positive gaps in Animal, Crop, and Soil science skills, indicating teachers' improvement needs Agricultural Engineering showed a zero gap and implied improvement not needed. In contrast, the negative gaps in Agricultural Economics and Extension, Planning, Implementing, and Evaluating skills proved the competence of teachers, hence do not need improvement. However, some skills in Animal, Crop, Agricultural Engineering, Agricultural Extension, Soil Science, Planning, and Implementation of instructions gave mixed positive and negative results, unlike in evaluating instructions, where teachers exhibited proficient skill. Generally, teachers performed better in pedagogy than in technical skills. The significant correlation coefficient ($p \leq 0.05$) in Animal Production, Agricultural Engineering, Soil Science, and Evaluating skills indicated wider gaps between teachers' needs and performance. Hence, there is a need for training and retraining of teachers in technical skills, through pre-service and in-service programs, workshops, seminars, and conferences sponsored by stakeholders. Subsequently, for a thorough and general exploration of teachers' technical and pedagogical skills, replication of the study using an extended sample size will compliment the study.

Keyword: Agricultural Science Teachers, Skill Acquisition, Competency, Improvement needs, Kaduna.

INTRODUCTION

Agriculture has been a vital and integral component of poverty alleviation and economic development of several developing countries. Food and Agriculture Organization of the United Nations (FAO) reported that the sector stands out in the economic development of sub-Saharan Africa (SSA) countries with about 52% job creation (World Bank, 2020). Nigeria supports over 75 % of the population through food supply, generation of local and foreign exchange as well as employment *inter alia* (Ndomi, 2018; Ekezie, 2020). However, the output in training, practice and production are not commensurate with huge government finance and other stakeholders' investment in the sector (Shimave *et al*., 2013; Onwunali *et al*., 2022). Hence plunging Nigeria into high inflation with consequent poverty and hunger, to the extent that an average person feeds on less than one US dollar per day. In the training sector of Agricultural Science, teaching and learning in Nigeria Secondary Schools have been associated with numerous challenges (Ajeyalemi, 2005). Such challenges among others, are incompetent teachers, poor teaching methods, poor interest and attitude, inadequate facilities, and non-compliance with policies, culminating in poor students' achievement (Ajayi, 2005; Ugo, 2015; Onipede *et al*., 2020a).

Agricultural Science as a subject was enshrined in the national policy as a compulsory vocational subject in secondary schools (Federal Government of Nigeria, 2014) to stimulate and sustain students' interest, inculcate farming skills for professionalism, and ensure high progression among graduates. Recently, the government introduced 34 new trade subjects which included animal husbandry and fisheries, to further enhance the relevance of secondary school graduates in practical and entrepreneurial knowledge, job creation, and poverty alleviation (Ikeoje, 2018). To achieve these goals, the teacher's technical skills and experience remain imperative (Agwu and Dorgu, 2015). Otherwise, the present conditions of incompetent teachers, poor learning, slow understanding, and poor performance will jeopardize the desired goals of the subject (Aldridge *et al*., 2017).

Agriculture deals with the art or science of land cultivation, rearing of animals, management of forest resources, and entrepreneurship to meet the necessities of life (Iwena, 2017; Ndomi, 2018; Muhammad *et al*., 2022). On the other hand, agricultural education is any form of systematic instruction at the primary, junior and senior secondary, post-secondary and adult education that prepares individuals for entry or advancement in agricultural occupations and professions, job creation, and entrepreneurship (Philip *et al*., 2008; Ikeoji, 2018). Therefore, anyone capable of systematically organizing and presenting such facts, ideas, skills, information, and techniques to facilitate skills, knowledge, attitude, and achievement in secondary school is termed a reliable teacher (Obue, 2019; Ugo, 2019). Agricultural teacher(s) is/are persons trained in agricultural methodology, pedagogical and technical skills, and participate in transferring the knowledge to students (Ndem, 2016; Babayo & Kesiki, 2019; Okuku, 2019). Such person(s) may be efficient in preparing students for occupation in agriculture without wasting time and resources (Onipede *et al*., 2020b) or inefficient, resulting in poor students' interest, attitude, and performance (Kola and Sunday, 2015; Onwunali *et al*., 2022).

Reports on the meaning of technical skills are available (Olaitan, 2017; Onipede *et al*., 2020). However, technical skills are the stepwise and procedural approach to all aspects of agricultural production to facilitate learners' understanding and practice in training and field practice. Such abilities in crop and animal production, soil management, engineering and equipment, and extension services in post-primary schools are paramount for effective teaching and learning. Pedagogical skills on the other hand deal with teachers' acquisition of teaching skills such as effective guidance and counseling, good attitude, mastery of subject matter, and systematic transfer of such knowledge *inter alia* to facilitate learners' technical skills in agriculture (Hamilton-Ekeke, 2013; Olaitan, 2017; Amy *et al*., 2024). These skills are displayed in planning, organizing, implementing, and evaluating instructions in teaching students (Onipede *et al*., 2020a). In comparing early, mid, and career agricultural teachers, Richie *et al*. (2020) reported that early career teachers required training in the content of agriculture and pedagogical strategies to facilitate students' learning. The interpretation was based on presage, context, and

processing variables of Dunkin's and Biddle's (1974) model of teaching and learning.

The challenges of Agricultural Science teachers in Zaria, Nigeria, mirror those in other sub-Saharan African countries. The common issues of insufficient resources (Davis, *et al.*, 2007; Mashebe, 2018; Moore, *et al.*, 2014), outdated teaching methods (Abujaja *et al*., 2022*)*, inadequate professional development (Baasa and Tsotetsi, 2023), and curricula mismatch, which do not meet current agricultural or labor market needs (Moore *et al.*, 2014) are evident. Gender disparities in Nigeria were also noted in Namibia (Mashebe, 2018). These challenges require coordinated efforts in teacher training, curriculum reform, resource provision, ongoing professional development, and gender equality to build a robust, relevant, and engaging agricultural education system across the region.

Statement of problem

Agricultural Science as a compulsory subject was designed to cover soil tillage, crop and animal production, manufacturing, processing, and entrepreneurship in primary, secondary, and tertiary schools (Muhammad *et al*., 2022). Despite the sound self-reliance curriculum and policy, students' enrolment and academic achievement have been on the decline due to poor interest and attitude of students (Onwunali *et al*., 2022). Teachers' negligence and inability to adapt to the current and advanced technology in teaching may be associated with students' failure, particularly in the unified tertiary matriculation examination (UTME). Field observations revealed a relatively low number of trained agricultural science teachers. In most schools, the subject is taught by graduates from related subjects such as Integrated Science, Biology, and Geography, among others, in Zaria. Hence, poor performance may also be argued around poor application of teaching methodology (Onwunali *et al*., 2024a). Consequently, Agricultural Science remains second to least preferred and applied subject in post-secondary schools after Education. Therefore, there is a need to establish technical and pedagogical skills that teachers use in teaching the subject for sustainable, improved teaching and performance.

Objectives of the study

Following speculations and facts elsewhere on low numbers and incompetent teachers, poor interest and attitude, and the consequent poor performance of students, the study sought to establish secondary school teachers' areas of need in technical and pedagogical skills for effective teaching and academic achievement in Zaria.

Specifically, the study evaluated the following;

i. Areas of teachers' need in technical skills for effective teaching,

ii. Assess pedagogical skills needs in agricultural science for improved teaching, and

iii. Identify the dominant and least technical and Pedagogical skills in Zaria.

Research questions

The following research questions guided the investigation;

i. What are the limitations in teachers' technical skills that constitute massive failure of students?

ii. What are the areas of improvement needed' for teachers' pedagogical skills for effective teaching?

iii. Of the technical and pedagogical skills items, which is/are often applied by the teachers.

Hypotheses

The study tested the following null hypotheses at a $p \leq 0.05$ level of significance;

Ho$_1$: There is no significant difference in the teachers' application of technical skills in teaching.

Ho$_2$: There is no significant difference within teachers' application of pedagogical skills in teaching.

Ho$_3$: Teachers' application of technical and pedagogical skills does not significantly effect on the effective teaching of agricultural science in secondary schools.

MATERIALS AND METHOD

Description of the Study Area

The study was carried out in Zaria, a cosmopolitan city, hosting Federal, State, and Private tertiary institutions, one Unity School, and several Public and Private Secondary Schools. The area is located at a latitude of 11.07^0 and 12^0 North and a longitude of 07.44^0 and 8^0 East (Nwanosike, 2013). The educational zone comprised two Local Government Areas, namely, Soban Gari and Zaria. The

inhabitants are mostly Hausa and Fulani who speaks predominantly the Hausa language.

The gender imbalance associated with Zaria teachers is dominated by trained and qualified married male, between the ages of 35 and 40 years, with teaching experience of 6 to 10 years. However, they are discouraged by relatively low salaries (Onwunali *et al*., 2024b). Consequently, the contextual knowledge gap revealed the use of outdated pedagogical strategies, mostly lecture methods, and inadequate integration of ICT due to poor internet connectivity and unreliable electricity. The use of curricula that are mismatched with modern agricultural practices, and weak policy implementation, and discouraging students' perception that considers agriculture a dirty and low-status career have been reported (Onwunali *et al*., 2022).

Experimental Design

The survey research design adopted in the study was used to document, describe, and explain facts about Agricultural Science teachers in Zaria (Ali, 2006; Nworgu, 2015). The study utilized closed, structured questionnaire as an instrument for data collection. The instrument comprised eight sections and 91 items across Crop Production, Animal Production, Agricultural Engineering, Agricultural Economics, and Extension, Soil science (Technical Skills), Planning of Instruction, Implementing Instruction, and Evaluating Instruction (Pedagogical Skills). The items were drawn from the Agricultural Science curriculum for Junior and Senior Secondary Schools, with two columns of skill needs and performance of teachers for effective delivery of lessons. The instrument was validated by three experts, two from the Department of Agricultural Education, Federal University of Education, and one from the Department of Agricultural Education, Ahmadu Bello University, Zaria. The pilot study established a reliability coefficient value of 0.87, using the Cronbach's Alpha statistical tool.

Fifty Public and Private Secondary Schools were randomly selected, and the schools had one Agricultural Science teacher each, considering the limited number of teachers, sampling was not done; instead a population of 50 teachers was used for the study. A 4-point rating scale was used to evaluate the need and performance of teachers as highly needed (HN), averagely needed (AN), slightly needed (SN), and not needed (NN). In contrast, the performance of teachers was rated as high performance (HP), average performance (AP), slight performance (SP) and no performance (NP) adopted from Onipede, *et al*. (2020a). A corresponding value of 4, 3, 2, and 1 were assigned to the ratings, respectively, while a benchmark of ≥ 2.5 determined the significance of need and performance.

Data Analysis

Data were subjected to simple descriptive statistics of frequency and mean, while the need gap analysis was calculated using the mathematical technique (Onipede *et al*., 2020b) as below;

$NG = \bar{x}\,\mathbf{N} - \bar{x}\,\mathbf{P}$

Where:

NG = Need Gap Value

$\bar{x}\,\mathbf{N}$ = Mean of need category

$\bar{x}\,\mathbf{P}$ = Mean of performance category

$\bar{x}\,\mathbf{N}$-$\bar{x}\,\mathbf{P}$ = Difference between need and performance categories

The need gap decision was based on whether the mean value was positive, negative, or zero. Where the NG value is positive, improvement is needed, and implies that teachers' performance skills was lower than needed. Contrarily, negative NG implied that improvement is not needed as teachers' performance skill were greater than needed. But zero NG signified equal need and performance skills, and implied that improvement is not needed. Pearson Square correlation coefficient ($p \leq 0.05$) was used to test the hypothesis to determine the extent of the gap or significance of the teachers' competence in technical and pedagogical skills.

RESULTS AND DISCUSSION

The positive grand need gap of 0.9 (Table 1) indicated that teachers needed improvement in teaching animal production skills. Nevertheless, 11 items were critical of the 16 identified technical skills. Consequently, the need gaps varied from -0.10 to 0.22. The positive gaps in rearing non-ruminants, fish farming, animal vaccination, farm hygiene, and application of animal improvement implied incompetency among teachers, implying that teachers required improvement in such skills. Contrarily, the negative need gap in animal

Table 1: Animal Production Technical Skills for Effective Teaching of Agricultural Science in Secondary Schools.

S/No	Skills	$\bar{x}$ N	$\bar{x}$ P	$\bar{x}$ N - $\bar{x}$ P	Remark
1	Rear non-ruminant animals	3.66	3.44	0.22	IN
2	Establishment and maintenance of fish farm	3.50	3.28	0.22	IN
3	Vaccination of farm animals	3.16	2.96	0.20	IN
4	Maintain proper farm hygiene	3.38	3.20	0.18	IN
5	Apply animal improvement methods	3.10	2.94	0.16	IN
6	Incubation and insulation of farm animals	3.18	3.04	0.14	IN
7	Identification of farm animal disease	3.36	3.24	0.12	IN
8	Knowledge of artificial insemination	3.22	3.10	0.12	IN
9	Identification of endo and ecto pests of animals	3.10	3.00	0.10	IN
10	Operate simple animal management machines	3.04	3.00	0.04	IN
11	De-worm farm animals	3.22	3.20	0.02	IN
12	Rear ruminant animals	3.46	3.46	0.00	NIN
13	Formulate and compound of animal feed	2.86	2.96	-0.10	NIN
14	Knowledge of artificial intelligence	2.98	3.10	-0.12	NIN
15	Identification of different breeds of animals	3.16	3.34	-0.18	NIN
16	Castrate farm animals	2.76	2.98	-0.22	NIN
	GRAND MEAN	**3.20**	**3.14**	**0.9**	

Key: $\bar{x}$ ***N*** = Mean of need category, $\bar{x}$ ***P*** = Mean of performance category, $\bar{x}$ ***N*** - $\bar{x}$ ***P*** = Difference between need and performance categories, *IN* = needed, *NIN* = not needed

castration, identification of animal breeds, knowledge of artificial intelligence, and formulation and compounding animal feeds revealed teachers' competencies and as such do not need improvement while zero gap in rearing ruminant animals revealed an equal need and performance skills and implied that teachers were conversant with the skill, therefore, do not need improvement. Onipede *et al*. (2020c) earlier reported teachers' need for technical skills in cattle, pig, poultry, and rabbit production for effectively teaching of agricultural Science in Gombe State. Similarly, Ikeoji (2018) reported 47 training needs of teachers in livestock management, animal health, vaccination, and formulation of feeds in the Niger Delta Region. Asogwa (2016) also identified 15 areas of low teachers' technical information needs in fishery due to poor adoption to new technological tools in Enugu State.

Results (Table 2) revealed a positive grand mean of 1.7, which indicated low teachers' technical skills in Crop Production. However, the need gaps varied from -0.40 to 0.56. Of the 18 identified technical skills in crop production, 11 skills were critically needed for improvement based on the teachers' positive perceptions. The positive gaps in seed rate, pomology, site selection for crops, irrigation farming, and processing farm produce *inter alia* implied that teachers needed improvement in such skills. However the negative gaps in the establishment of floriculture and maintenance of ornamental, nursery preparation, prompt harvesting, application of fertilizers, and seed viability among others, indicated teachers' competency in teaching the skills. Similarly, Albritton and Robert (2020) reported high technical needs among Agricultural Science teachers in fertilizer application, transplanting, seedbed preparation, and irrigation. Aneke and Nwobi (2024) further supported the findings when they identified pre-planting, planting, post-planting, harvesting, and marketing skills as areas of teachers' need in Enugu State, due to the absence of significant difference between extension agents and farmers on the above skills. Teachers' improvement needs vary per location; hence, they should be addressed to facilitate effective teaching for sustainable agriculture.

Results of the nine technical skills in Agricultural Engineering yielded a zero (0.00) grand need gap, and indicated equal need and performance skill. By implication, it explains that teachers' skills in teaching the topics were generally good, hence requiring little or no improvement, particularly for items 6 to 9 (Table 3).

Table 2: Crop Production Technical Skills for Effective Teaching of Agricultural Science in Secondary Schools

S/No	Skills	$\bar{x}$ N	$\bar{x}$ P	$\bar{x}$ N - $\bar{x}$ P	Remark
1	To determine seed rate per hectare	3.30	2.74	0.56	IN
2	Establishment and maintenance of tree crops (pomology)	3.40	2.86	0.54	IN
3	Identification and site selection for a particular crop	3.74	3.40	0.34	IN
4	Farm irrigation during off-season	3.20	2.86	0.34	IN
5	Processing of farm produce	3.10	2.86	0.24	IN
6	Effective cultivation	3.38	3.20	0.18	IN
7	Effective weeding (manual and herbicides)	3.26	3.10	0.16	IN
8	Effective storage and use of facilities	3.28	3.12	0.16	IN
9	Formulation and application of organic fertilizers	3.12	3.06	0.06	IN
10	Application of crop improvement principles	3.14	3.08	0.06	IN
11	Seedling transfer to permanent site	3.22	3.18	0.04	IN
12	Establishment and maintenance of ornamental farm	2.86	2.92	-0.06	NIN
13	Nursery preparation based on recommendation	3.10	3.18	-0.08	NIN
14	Prompt harvesting of farm produce	3.06	3.14	-0.08	NIN
15	Application of inorganic fertilizers	3.10	3.20	-0.10	NIN
16	Determination of seed viability	3.18	3.32	-0.14	NIN
17	Establishment and maintenance of arable crops	2.78	2.92	-0.14	NIN
18	Establishment and maintenance of vegetables	2.78	3.16	-0.40	NIN
	GRAND MEAN	**3.17**	**3.07**	**1.7**	

Key: $\bar{x}$ ***N*** = Mean of need category, $\bar{x}$ ***P*** = Mean of performance category, $\bar{x}$ ***N*** - $\bar{x}$ ***P*** = Difference between need and performance categories, IN = needed, NIN = not needed

However, the need gap specifically varied from -0.26 to 0.84. The positive gaps in teachers' perception of driving and mounting of tractor implement (plough, harrow, and ridging), operation of machines for castration, trimming of cattle hoof, cassava pelleting and implementation, and maintenance of machines implied poor performance in such skills, hence, the teachers require improvement. The negative need gap in chemical sprays using a tractor or knapsack, use of seed planter, shelling and extraction of honey machines, identification of machine and farm tools, and use of debeaker and egg candler empirically disclosed teacher's conversant and competencies in teaching the skills. Earlier, Solomonson *et al.* (2022) reported the need for teachers to improve in operating power tools and equipment such as tractor and processing machines.

Table 3: Agricultural Engineering Technical Skills for Effective Teaching of Agricultural Science in Secondary Schools

S/No	Skills	$\bar{x}$ N	$\bar{x}$ P	$\bar{x}$ N-$\bar{x}$ P	Remark
1	Divine tractor effectively	3.78	2.94	0.84	IN
2	Mount and carry out activities with plough, harrow, rigger	3.32	3.02	0.30	IN
3	Use of surgical and post mortem kit, castrators, cattle hoof trimming	3.14	2.98	0.16	IN
4	Operate cassava pelleting machine	3.04	2.92	0.12	IN
5	Perform implementation and machine maintenance	3.12	3.02	0.10	IN
6	Use incubators, De-beakers, and Egg Candlers	2.94	2.98	-0.04	NIN
7	Identification of various farm tools and machines	2.58	3.64	-0.06	NIN
8	Operate manure sprayer, seed planters, sheller and oil, and honey extractor	2.96	3.12	-0.16	NIN
9	Apply chemicals with tractor mount or knapsack sprayer	2.96	3.22	-0.26	NIN
	GRAND MEAN	**3.09**	**3.09**	**0.00**	

Key: $\bar{x}$ ***N*** = Mean of need category, $\bar{x}$ ***P*** = Mean of performance category, $\bar{x}$ ***N***-$\bar{x}$ ***P*** = Difference between need and performance categories, IN = needed, NIN = not needed

Results (Table 4) showed a negative grand need gap of -0.2, indicating that teachers were well-skilled and familiar with the six identified concepts in Agricultural Economics and Extension skills, and thus do not need improvement. However, variation in needed gaps (-2.8 to 0.14), implied that, teachers needed improvement on the concept of income, wage, profit, rents and cost analysis, the principle of farm operations, and farm record keeping due to positive gaps, and do not in marketing of agricultural products, credit and finance of agricultural production and survey for the location of markets for farm produce with negative gaps. The World Economic Forum (2017) also reported a positive skill gap in secondary school. Consequently, it is associated with why entrepreneurs and industries do not have confidence in the students' ability to graduate with a job. Similarly, Omoleye *et al*. (2021) reported a positive need gap value of 0.5 to 2.0 in 22 Agricultural Economics and Extension items in Ekiti State. Reports have shown the need for teachers to improve on farm record keeping, accounting, and entrepreneurial skills for effective teaching of Agricultural Science in Secondary Schools (Sallau, 2018, Isiwu, 2019; Anjov *et al*., 2019).

Table 4: Agricultural Economics and Extension Technical Skills for Effective Teaching of Agricultural Science in Secondary Schools

S/N	Skills	$\bar{x}$ N	$\bar{x}$ P	$\bar{x}$ N-$\bar{x}$ P	Remark
1	Teach concepts like income, wages, profits, rents and interest, cost analysis and implication for agricultural. Product.	3.46	3.32	0.14	IN
2	Application of Concepts and Principle in Farm Operations	3.36	3.24	0.12	IN
3	Take and keep farm records	3.76	3.66	0.10	IN
4	Make surveys and locate markets for farm produce	3.26	3.30	-0.04	NIN
5	Handle topics like sources of credit, finance, capital for agricultural production	3.16	3.40	-0.24	NIN
6	Teach marketing of agricultural produce	3.12	3.40	-0.28	NIN
	GRAND MEAN	**3.35**	**3.39**	**-0.2**	

Key: $\bar{x}$ ***N*** = Mean of need category, $\bar{x}$ ***P*** = Mean of performance category, $\bar{x}$ ***N*** - $\bar{x}$ ***P*** = Difference between need and performance *categories*, *IN* = needed, *NIN* = not needed

Results in Table 5 revealed a very low but positive grand need gap of 0.16, which implied a close relationship between the teachers' skills performance and needs in Soil Science.

Table 5: Soil Science Technical Skills for Effective Teaching of Agricultural Science in Secondary Schools.

S/N	Technical Skills (Soil Science)	$\bar{x}$ N	$\bar{x}$ P	$\bar{x}$ N-$\bar{x}$ P	Remark
1	Identify soil samples	3.80	3.52	0.28	IN
2	Determine soil topography	3.26	3.0	0.26	IN
3	Carry out conservation Agriculture for soil maintenance	3.22	3.06	0.16	IN
4	Identify soil-living organisms	3.16	3.10	0.06	IN
5	Apply lime to control soil acidity	3.08	3.04	0.04	IN
6	Carry out PH test	3.26	3.24	0.02	IN
7	Experiments on soil fertility, aeration, water retention capacity	3.32	3.30	0.02	IN
8	Select appropriate soil type for specific crops	3.34	3.40	-0.06	NIN
9	Identify causes and types of soil erosion	3.18	3.24	-0.06	NIN
10	Determine soil texture and structure	3.24	3.32	-0.08	NIN
11	Identify soil nutrients	3.10	3.30	-0.20	NIN
12	Determine soil components	3.08	3.36	-0.28	NIN
	GRAND MEAN	**3.25**	**3.24**	**0.16**	

Key: $\bar{x}$ ***N*** = Mean of need category, $\bar{x}$ ***P*** = Mean of performance category, $\bar{x}$ ***N*** - $\bar{x}$ ***P*** = Difference between need and performance categories, *IN* = needed, *NIN* = not needed

The seven positive and five negative skills gave a gap need of -0.28 to 0.28, where the positive gaps implied improvement need skills, while the negative did not, because teachers' technical skills were better in such skills. Among others, soil identification and topography, conservation agriculture, and identification of soil micro-flora were major items that needed improvement. In contrast, soil components, nutrients, texture, and structure, as well as causes and types of erosion, were not needed, meaning that the teachers were conversant and performed well in the delivery of such concepts.

Reports have shown that holistic innovative pedagogical approaches that will combine classroom learning and complicated soil science courses using practical skills and field-based competencies are needed (Bouma, 2019; Barkley and Major, 2020; Brevik *et al*., 2022; Al-Ismaily *et al*., 2023). According to Al-Ismaily *et al*. (2023), this innovative approach will merge the "Soil skills" (SSK) pedagogy method with the "Soil Judging Contents" (SJC).

The results of the planning Instruction skills revealed a grand negative need gap of -0.2, as shown in Table 6. Such results implied that teachers were generally competent in planning instructions. However, the need gaps of the 10 identified items varied from -0.14 to 0.26, indicating variation in the items' analysis.

Table 6: Planning Instruction Pedagogical Skills for Effective Teaching of Agricultural Science in Secondary Schools

S/N	Skills	$\bar{x}$ N	$\bar{x}$ P	$\bar{x}$ N-$\bar{x}$ P	Remark
1	Identify instructional materials suitable for the topics	3.54	3.28	0.26	IN
2	Determine the objective of the lesson	3.54	3.46	0.08	IN
3	Identify topics in Agriculture to be taught to students	3.70	3.70	0.0	NIN
4	Improvise activities that encourage interest, attitude, and knowledge	3.26	3.26	0.0	NIN
5	Design basic requirements for teaching topics	3.44	3.46	-0.02	NIN
6	Identify appropriate instrumental techniques to apply in teaching the topics	3.38	3.40	-0.02	NIN
7	Design class activities to be performed	3.26	3.36	-0.10	NIN
8	Identify appropriate records to be kept on the instruction	3.32	3.44	-0.12	NIN
9	Develop appropriate lesson plans for the topics	3.36	3.50	-0.14	NIN
10	Determine adequate evaluation techniques for the achievement of objectives	3.44	3.58	-0.14	NIN
	GRAND MEAN	**3.42**	**3.44**	**-0.2**	

Key: $\bar{x}$ ***N*** = Mean of need category, $\bar{x}$ ***P*** = Mean of performance category, $\bar{x}$ ***N*** **-** $\bar{x}$ ***P*** = Difference between need and performance categories, *IN* = needed, *NIN* = not needed

The positive gaps observed on instructional materials suitable for different topics and the determination of lesson objectives implied that teachers, despite their experience, required knowledge improvement. The zero (0.00) need gap observed in the identification of topics and improvisation of activities to facilitate interest and attitudes implied equal need and performance skills of the teachers, hence confirming teachers' competence in the skills Results also showed negative gaps in the improvement of evaluation techniques, development of lesson plan, record keeping, designing of class activities and identification of instructional technique. The negative results implied that teachers were conversant and competent in delivering skills. The findings contradicted Isiwu (2019), who reported that secondary school teachers in Abia State needed improvement in planning instruction, keeping effective farm records and contents of farm records, and accounting practices. The conflicting reports may be due to the metropolitan nature and proximity of teacher training schools like the former Federal College of Education in Zaria, a difficult situation in Abia State. Furthermore, the competence may be influenced by the Kaduna State policy on teachers employment, which allows only university graduates to teach in secondary schools.

The majority of teachers used for the study were graduates of the Nigeria Certificate of Education (NCE) and a degree in Agricultural Education, and as such, superb in pedagogical skills, an uncommon condition in Abia State, where teachers are mostly university graduates with relatively low teacher training experience.

In Table 7, teachers showed a high level of skills, experience, and delivery in implementing instruction, with an average negative need gap of -0.74, from -0.26 to 0.2. However, there was need for improvement in assigning homework and arranging teaching material, which gave positive need gaps of 0.2 and 0.14, respectively. Of the 10 identified items, teachers' competency in implementing instruction of eight skills was superb, with negative gaps needed.

Table 7: Implementing Instruction Pedagogical Skills for Effective Teaching of Agricultural Science in Secondary Schools.

S/N	Skills	$\bar{x}$ N	$\bar{x}$ P	$\bar{x}$ N-$\bar{x}$ P	Remarks
1	Assign homework to the students based on the topics	3.62	3.42	0.2	IN
2	Arrange materials for teaching selected topics in agriculture	3.76	3.62	0.14	IN
3	Supervise students activities	3.32	3.34	-0.02	NIN
4	Carry out practical activities as demanded by the topics	3.42	3.46	-0.04	NIN
5	Determine students' residual knowledge	3.36	3.42	-0.06	NIN
6	Deliver the lesson content sequentially following the instructional materials	3.48	3.54	-0.06	NIN
7	Involve students in the lesson through activities like demonstration or motivation.	3.34	3.50	-0.16	NIN
8	Accomplishing the task within the required time	3.22	3.46	-0.24	NIN
9	Respond to students' questions honorably	3.40	3.64	-0.24	NIN
10	Introduce the lesson properly	3.26	3.52	-0.26	NIN
	GRAND MEAN	**3.42**	**3.49**	**-0.74**	

Key: $\bar{x}$ ***N*** = Mean of need category, $\bar{x}$ ***P*** = Mean of performance category, $\bar{x}$ ***N*** - $\bar{x}$ ***P*** = Difference between need and performance categories, *IN* = needed, *NIN* = not needed

Table 8 showed an average need gap of -0.74 and a range of -0.02 to -0.28 in the 10 identified evaluating instruction skills. The results implied that teachers' performance in evaluating instruction skills and delivery was far better than needed. It is therefore confirmed that, teachers' evaluation skills in the secondary school were good and do not need improvement. However, Weinberg *et al*. (2006) used students' grades to establish a positive relationship using current grades, which were uncorrelated with learning, once the current grades were controlled, giving a weak relationship between learning and student evaluation. Possibly because of the inability of students to determine what was learned in a course.

The significant ($p \leq 0.05$) correlation coefficient results presented in Table 9 rejected the hypotheses in animal production, agricultural engineering, soil science, and evaluating instructions, which stated that there were no significant differences. This is because there was a significant gap between the needs and performance skills. However, accepted hypotheses of crop production, agricultural economics and extension, planning and implementing instructions. Results empirically suggested a high need ofteachers' improvement in technical skills rather than pedagogical skills.

CONCLUSION

The study revealed teachers' areas of improvement need in both technical and pedagogical skills. Generally, teachers were better skilled in pedagogy, as teachers required relatively less improvement than in technical skills. However, among the technical skills, teachers were competent in skills of teaching Agricultural Engineering and Agricultural Economics and Extension, but needed improvement in Crop production, followed by Animal production and Soil Science. Hence, training and retraining of teachers through in-service programs, conferences, and workshops are imperative.

Table 8: Evaluating Instruction Pedagogical Skills for Effective Teaching of Agricultural Science in Secondary Schools

S/No	Skills	$\bar{x}$ N	$\bar{x}$ P	$\bar{x}$ N-$\bar{x}$ P	Remarks
1	Assign grades based on students' performance	3.26	3.28	-0.02	NIN
2	Assess students' mastery based on the instruction	3.20	3.24	-0.04	NIN
3	Determine the progressive growth of students'	3.16	3.22	-0.06	NIN
4	Determine the quality of the student's output instruction	3.10	3.18	-0.08	NIN
5	Construct assessment instruction to accommodate students with learning disability	3.42	3.52	-0.10	NIN
6	Disclose performance to individual students	3.00	3.12	-0.12	NIN
7	Determine the assessment procedure to be used to achieve an objective	3.60	3.62	-0.2	NIN
8	Design the assessment based on content that is important for the students	3.36	3.38	-0.2	NIN
9	Decide on the type of value judgment	3.10	3.30	-0.20	NIN
10	Keep appropriate student performance records for reference purposes	3.28	3.46	-0.28	NIN
	GRAND MEAN	**3.25**	**3.33**	**-0.74**	

Key: $\bar{x}$ **N** = Mean of need category, $\bar{x}$ **P** = Mean of performance category, $\bar{x}$ **N-**$\bar{x}$ **P** = Difference between need and performance categories, *IN* = needed, *NIN* = not needed

Table 9: Pearson Square correlation coefficients of technical and pedagogical skills used in teaching agricultural science in Zaria secondary schools.

Skills	R-value	Table value	Decision
Crop Production	0.282	0.456	NS
Animal Production	0.795	0.482	**
Agricultural Engineering	0.687	0.632	*
Agricultural Economics and Extension	0.608	0.754	NS
Soil Science	0.565	0.553	*
Planning Instruction	0.596	0.602	NS
Implementation Instruction	0.363	0.602	NS
Evaluating Instruction	0.929	0.602	**

** = Significant @ 0.05, ** = significant @ 0.001, NS = Not significant*

RECOMMENDATIONS

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

1. There is an urgent need to upgrade teachers' skills through in-service programs, conferences, and workshops in animal, crop, and soil science concepts by Governments (Local and State) and Non-Governmental Organizations.
2. Governments and other stakeholders need to close the wide gap between teachers' skills in Animal Production, Agricultural Engineering, Soil Science, and Evaluating instruction through retraining and employment of trained teachers and provision of modern facilities, materials, and equipment that align with modern agricultural teaching and practise.
3. Stakeholders also need to improve teachers' competencies in pedagogical skills through pre-service training and adequate monitoring of teachers, using well-paid experts and experienced teachers.

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Authors Contributions

Dr. Onwunali, M.R.O designed and printed the instrument, conducted analysis and wrote the

manuscript while Mohammed, H. B. collected the data from field, assisted in the pilot study and analysis.

Data Availability Statement

The data supporting the findings of this study could be provided by the corresponding author upon reasonable request.

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Ethical Statement

This study was conducted in accordance with the ethical standards of the Federal University of Education, Zaria, and there is no contrary consent to publish this article in Nature and Trend of Science and Technology.

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