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ZARIA JOURNAL OF EMPIRICAL STUDIES IN EDUCATION EVALUATING THE IMPLEMENTATION OF THE CHEMISTRY CURRICULUM IN COLLEGES OF EDUCATION: A CASE STUDY OF NORTH-CENTRAL NIGERIA

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ABSTRACT

Effective implementation is crucial for a well-planned curriculum. The poor performance of National Certificate in Education (NCE) graduates in science subjects, particularly Chemistry, raises concerns. Research by science educators and stakeholders highlights inadequacies in the current Chemistry curriculum in Nigeria's Colleges of Education, warranting a thorough investigation. This study evaluated the implementation of the Chemistry curriculum in Colleges of Education in North-central Nigeria. Adopting a descriptive survey design, the study involved 42 Chemistry lecturers and 538 Chemistry students from seven Colleges of Education, selected using purposive and census sampling techniques. Instruments included two questionnaires, an observation schedule, and a checklist, with reliability coefficients of 0.81, 0.72, and 0.78, respectively. Data were analysed using percentages, means, and standard deviations. Findings revealed that while facilities and resources were available, they were inadequate and underutilised. The study recommended increased provision of resources by state and federal governments, alongside improved monitoring and supervision of Chemistry lecturers, to enhance teaching and learning.

Keywords: Curriculum, Implementation, Chemistry, Education, College.

INTRODUCTION

The production of effective teachers is fundamentally influenced by the quality and design of the curriculum, particularly in science education. Recent empirical studies reveal persistent challenges in the performance of National Certificate in Education (NCE) graduates in Chemistry and other science subjects, highlighting systemic issues within Pre-Service Teacher Education (PSTE) programs (Olawale, 2024). The Federal Republic of Nigeria (FRN, 2016) identified critical shortcomings in PSTE, noting an overemphasis on rote memorization rather than fostering deep conceptual understanding and innovative pedagogical skills necessary for science teaching. Chemistry education within Nigerian Colleges of Education adheres to a structured curriculum that delineates its philosophy, objectives, admission criteria, required facilities, personnel qualifications, and instructional methodologies. The curriculum is designed to develop competent middle-level manpower capable of effectively teaching Chemistry at primary and secondary

school levels and preparing graduates for advanced studies in the discipline (NCCE, 2020).

Curriculum evaluation remains a vital empirical process that measures the extent to which curricular content aligns with and achieves educational goals (Yang, 2023). Effective curriculum implementation depends largely on teachers as key agents who translate curriculum frameworks into actionable syllabi, schemes of work, and lesson plans. The quality of implementation is influenced by teachers' knowledge, training, competence, motivation, and initiative, alongside contextual factors such as student preparedness and adequacy of learning environments (Stumbrienė et al, 2024). This study specifically examines the availability and adequacy of facilities and equipment, as well as the qualifications and competencies of personnel involved in curriculum implementation. To guide this evaluation, the Context, Input, Process, and Product (CIPP) model developed by Stufflebeam (2003), cited in (Rejina & Baral,

2023) was employed. The CIPP model provides a comprehensive framework for assessing curriculum effectiveness by examining the relevance of objectives to societal needs, the adequacy of resources and personnel, the implementation process, and the outcomes achieved (Widodo et al, 2024). Previous research underscores that quality implementation, as assessed through models like CIPP, is crucial for ensuring curriculum relevance and the attainment of educational objectives (Mazidah, & Masruroh, 2024).

Curriculum implementation refers to the process of translating officially prescribed courses of study, syllabuses, and subjects into actionable teaching and learning experiences. It is widely acknowledged by scholars that curriculum implementation is a critical challenge to educational advancement in Africa, often cited as a major impediment to achieving the continent's educational goals (Shittu & Olorundare, 2025). Implementation is said to take place when learners engage with the teacher-developed syllabus, the teacher's personality, instructional materials, and the broader teaching environment. It continues as learners acquire the intended knowledge, skills, concepts, attitudes, and experiences designed to prepare them for effective societal participation. In this regard, the learner occupies a central role in the curriculum implementation process. Osuji and Koko (2018) defined curriculum implementation as the day-to-day activities undertaken by school administrators and classroom teachers to achieve the objectives of a given curriculum. Despite thorough planning, most curricula encounter significant challenges at the implementation stage. Akanbi and Omosewo (2014) estimate that approximately 75% of educational innovations fail during implementation, underscoring its complexity and importance. The relevance of any curriculum is determined by how effectively it is put into practice and the extent to which educational goals are achieved depends primarily on the curriculum that is implemented. As noted by Wibowo et al (2025), the success of curriculum innovation is inseparable from the quality of its execution,

reaffirming that implementation remains the most decisive phase in the educational process.

Several studies have documented the persistent challenges confronting Chemistry curriculum implementation. Amadu et al. (2023) assessed the B.Ed. Chemistry curriculum in Ghana and found deviations in classroom strategies from prescribed methods, underscoring the need for robust professional development. In Nigeria, Olubunmi and Aarinola (2022) reported that over 30% of secondary school Chemistry teachers encountered difficulties with curriculum implementation due to limited content mastery and inadequate resources. Achimugu (2016) identified poor funding and low teacher motivation as primary constraints in Kogi State. Batool et al. (2018) advocated for updated teaching techniques and frequent curriculum revisions to reflect international best practices. Widhiyanti et al (2017) also looked at how chemistry teachers develop their content knowledge during their training, specifically focusing on the particulate nature of matter. It checks how the curriculum is designed, understood by teachers, put into practice, and the results it achieves. The study points out that even if the curriculum intends to build strong content knowledge, how it's taught and perceived by lecturers plays a big role in the outcomes. Collectively, these studies emphasize the pressing need to enhance teacher preparation and provide adequate resources to improve outcomes in Chemistry education.

To further enrich the evaluation framework, this study integrates Complexity Theory. Emerging in the mid-20th century with contributions from Lorenz, Prigogine, Schneider, and Somers, the theory posits that complex systems consist of multiple interconnected but autonomous components that adapt and evolve over time (Ahmad et al., 2024). Educational programs are inherently dynamic and cannot be adequately explained using linear, reductionist models. Instead, Complexity Theory emphasizes a relational, systems-based perspective that views educational elements as interdependent Karga, & Ceyhan, (2024) This theoretical lens complements the CIPP model, allowing for a more nuanced analysis of the interplay among

curriculum context, input, process, and outcomes.

Statement of the Problem

There is a growing concern about the poor performance of N.C.E. graduates in classrooms in chemistry and sciences generally (Aina, 2014 & Oluwadurotimi 2018). This is evident in the research reports from different education stakeholders showing inadequacies in the curriculum contents of Colleges of Education and University undergraduates (FRN 2012; Oluwadurotimi, 2018; Asiyai 2020). This situation points to the facts that the current curriculum contents of these institutions require total overhauling. Although several researchers have carried out evaluation studies in different subject areas, very few of them worked on chemistry. The fundamental gap in the previous studies and the present study are that this study examined the content of chemistry curriculum and equally considered the facilities and equipment available for its implementation which were rarely found in the previous studies.

Objectives of the Study

The objective of this study was to:

1. ascertain the facilities and equipment that are available for the implementation of chemistry curriculum in Colleges of Education
2. determine the adequacy of facilities and equipment available for the implementation of chemistry curriculum in Colleges of Education
3. determine the level of utilization of the available facilities and equipment for the implementation of chemistry curriculum in Colleges of Education.

Research Questions

1. What facilities and equipment are available for the implementation of chemistry curriculum in Colleges of Education in Nigeria?
2. How adequate are the facilities and equipment available for the implementation of chemistry curriculum in Colleges of Education in Nigeria?
3. What is the level of utilization of the available facilities and equipment for the

implementation of chemistry curriculum in Colleges of Education in Nigeria?

METHODOLOGY

This study adopted descriptive research of the survey type. This design was considered appropriate because the opinion of the students and their lecturers are gathered to show the level of provision, adequacy and utilization of the equipment and resources which are already in operation and the writer had no control over the independent variables. The population comprised 58 lecturers and 643 students. Purposive and census sampling techniques were adopted to select 42 Chemistry lecturers and 538 Chemistry students from seven Colleges of Education in North-central, Nigeria. Two research assistants helped with data collection.

Three instruments were used to collect data for this study, researcher-designed Lecturers' Questionnaire on Evaluation of Chemistry Curriculum (LQECC); Students' Questionnaire on the Evaluation of Chemistry Curriculum (SQECC); an Observation Schedule and Observational Checklist (OSOC). LQECC and SQECC consist 60 items respectively structured questionnaire of "Taught and Not Taught" that examined content covered by the lecturers; 10 items assessed the methods of teaching employed by the lecturers, while OSOC consists of two parts with 17 items on 5-points rating scale designed to observe lecturers during classroom teaching and 46 items which was adapted from the NCCE Minimum Standards' list of recommended laboratory apparatus, and facilities that ought to be provided for teaching chemistry used to examine the availability, adequacy and utilization of the equipment and resources. The two questionnaires; an observation schedule and checklist were subjected to face and content validity by a lecturer in science education, an expert in educational measurement and evaluation and an English language lecturer, as well as two chemistry lecturers from College of Education. The experts were requested to scrutinize the items on the questionnaire In order to ensure the reliability of the instruments, 8 copies were administered to lecturers and 20 copies to

students from College of Education outside the coverage of the study. The Cronbach alpha method was used to ascertain the internal consistency of the instrument. With Cronbach Alpha Reliability Coefficients 0.81, 0.72 and 0.78 respectively.

The instruments were administered to the respondents by the researcher and two trained assistants who were adequately briefed on the administration of the instruments. Their involvement helped to ensure a high percentage rate of return. The data collected were analysed using percentage, mean (\bar{x}); standard deviation (SD); and independent sample *t-test* at 0.05 level of significance. The availability of facilities, equipment and resources were rated as < 50% -low; 50-69% -average; and 70-100% - high.

RESULTS

The results of the data analysis are presented below according to the research questions posed and hypothesis tested and presented in Tables 1-4.

Table 1: Availability of Facilities, Equipment and Resources for the Implementation of Chemistry Curriculum According to the Students

S/N	Facilities/ Equipment	Available (%)	Not Available (%)	Mean	SD	Decision
1.	Classrooms	87.10	12.90	2.84	1.4	Accepted
2.	Lecture Theatres	60.46	39.54	2.70	1.9	Accepted
3.	Lecture halls	95.56	4.44	2.74	1.1	Accepted
4.	Office furniture	65.43	34.57	2.64	1.8	Accepted
5.	Computers	76.21	23.79	2.24	1.3	Accepted
6.	Chemistry laboratory	95.36	4.64	2.04	1.1	Accepted
7.	Departmental library	82.11	17.89	2.18	1.8	Accepted
8.	Staff offices	86.69	13.31	2.13	1.4	Accepted
9.	Typewriters	23.84	76.16	1.66	1.3	Accepted
10.	Meter balance	40.42	59.58	1.59	1.9	Accepted
11.	Toploading balance	44.54	55.46	2.05	1.0	Accepted
12.	Thermostat	58.40	41.60	2.11	1.9	Accepted
13.	water bath,	28.85	71.15	1.91	1.5	Accepted
14.	Centrifuge. (Hand and Electric)	49.37	50.63	1.41	1.0	Rejected

S/N	Facilities/ Equipment	Available (%)	Not Available (%)	Mean	SD	Decision
15.	oven, (hot plate/heating mantle),	49.79	50.21	1.50	1.0	Accepted
16.	steam bath	39.72	60.28	1.60	1.9	Accepted
17.	magnetic stirrer,	46.26	53.74	1.44	1.0	Rejected
18.	suction pump	38.91	61.09	1.41	1.9	Rejected
19.	circulating water pump	57.26	42.74	2.43	1.0	Accepted
20.	soxlet extractor,	14.57	85.43	1.25	1.5	Rejected
21.	rotator evaporator	45.71	54.29	1.54	1.0	Accepted
22.	Calorimeter	75.50	24.50	2.24	1.3	Accepted
23.	pH meter,	85.65	14.35	2.14	1.5	Accepted
24.	overhead water tank	73.19	26.81	2.26	1.4	Accepted
25.	first aid box,	73.19	26.81	2.26	1.4	Accepted
26.	Victor Meyer's apparatus for measuring vapour density	41.14	58.86	1.39	1.9	Rejected
27.	conductivity meter	66.37	33.63	2.33	1.7	Accepted
28.	water distiller	64.92	35.08	2.35	1.8	Accepted
29.	Spectrophotometer	32.67	67.33	1.27	1.7	Rejected
30.	Kjedahl Digestion flask	24.06	75.94	1.16	1.3	Rejected
31.	Supply of chemicals	86.29	13.71	2.43	1.4	Accepted
32.	water supply	91.33	8.67	2.68	1.8	Accepted
33.	Electricity	99.60	0.40	2.90	1.0	Accepted
34.	Gas	61.89	38.11	2.18	1.9	Accepted
35.	Overhead projectors with accessories	59.88	40.12	2.40	1.9	Accepted
36.	White board	72.98	27.02	2.47	1.4	Accepted
37.	Magnetic chalkboards	26.79	73.21	1.83	1.4	Accepted
38.	Air-conditioners	53.38	46.62	1.96	1.0	Accepted
39.	White board marker	90.93	9.07	2.39	1.8	Accepted
40.	Fire extinguisher	76.37	23.63	1.73	1.2	Accepted
41.	Magnetic white board duster	41.68	58.32	1.58	1.9	Accepted
42.	Laboratory technologist	74.85	25.15	2.25	1.3	Accepted
43.	Laboratory attendants	78.90	21.10	2.29	1.1	Accepted
44.	clerical officer	45.78	54.22	1.54	1.0	Accepted
45.	Messenger	73.19	26.81	2.66	1.4	Accepted
46.	Cleaner	91.33	8.67	2.68	1.8	Accepted

Benchmark mean is 1.5 (The availability of facilities, equipment and resources were rated as < 50% -low; 50-69% -average; and 70-100% - high.)

Table 1 shows that 29 out of 46 equipment and facilities (63.0%) for the implementation of chemistry curriculum were available with percentages above 50% as indicated by the students. In addition, 39 out of 46 equipment and facilities (84.8%) had mean scores above 1.5 benchmark mean. 7 items which include: Centrifuge (hand and electric), magnetic stirrer, soxlet extractor, Victor Meyer's apparatus for measuring vapour, Suction Pump, Kjedadhl Digestion flask, and Spectrophotometer had mean scores below 1.5 benchmark. Hence, facilities and equipment for implementation of chemistry curriculum in Colleges of Education were said to be available.

Table 2: Availability of Facilities, Equipment and Resources for Teaching Chemistry as perceived by Lecturers

S/N	Facilities/ Equipment	Available (%)	Not Available (%)	Mean	SD	Decision
1.	Classrooms	87.27	12.73	2.33	0.33	Accepted
2.	Lecture Theatres	61.52	38.48	2.38	0.49	Accepted
3.	Lecture halls	95.76	4.24	2.04	0.20	Accepted
4.	Office furniture	65.23	34.77	2.35	0.48	Accepted
5.	Computers	77.10	22.90	2.03	0.42	Accepted
6.	Chemistry laboratory	95.76	4.24	2.44	0.20	Accepted
7.	Departmental Library	81.44	18.56	2.39	0.39	Accepted
8.	Staff Offices	86.74	13.26	2.13	0.34	Accepted
9.	Typewriters	24.20	75.80	1.76	0.43	Accepted
10.	Meter Balance	40.44	59.56	1.60	0.49	Accepted
11.	Toploading Balance	43.92	56.08	1.56	0.50	Accepted
12.	Thermostat	58.29	41.71	2.02	0.49	Accepted
13.	Water Bath,	29.48	70.52	1.71	0.46	Accepted
14.	Centrifuge (Hand And Electric)	50.55	49.45	1.49	0.50	Rejected
15.	Oven (Ho Plate/Heating Mantle)	50.55	49.45	1.69	0.50	Accepted
16.	Steam Bath	41.09	58.91	1.59	0.49	Accepted
17.	Magnetic Stirrer,	46.51	53.49	1.53	0.50	Accepted

S/N	Facilities/ Equipment	Available (%)	Not Available (%)	Mean	SD	Decision
18.	Suction Pump	39.52	60.48	1.60	0.49	Accepted
19.	Circulating Water Pump	58.36	41.64	1.72	0.49	Accepted
20.	Soxlet Extractor,	15.36	84.64	1.85	0.36	Accepted
21.	Rotator Evaporator	46.50	53.50	2.13	0.50	Accepted
22.	Calorimeter	75.65	24.35	2.14	0.43	Accepted
23.	PH Meter	85.32	14.68	2.45	0.35	Accepted
24.	Overhead Water Tank	74.01	25.99	2.26	0.44	Accepted
25.	First Aid Box,	73.74	26.26	2.01	0.44	Accepted
26.	Victor Meyer's Apparatus Fo Measuring Vapour Density	42.11	57.89	1.58	0.49	Accepted
27.	Conductivity Meter	67.25	32.75	1.63	0.47	Accepted
28.	Water Distille	66.05	33.95	2.09	0.47	Accepted
29.	Spectrophoto meter	32.75	67.25	1.67	0.47	Accepted
30.	Kjedahl Digestion Flask	24.06	75.94	1.76	0.43	Accepted
31.	Supply O Chemicals	86.74	13.26	2.13	0.34	Accepted
32.	Water Supply	91.51	8.49	2.18	0.28	Accepted
33.	Electricity	100.00	0.00	2.38	0.00	Accepted
34.	Gas	62.32	37.68	1.78	0.49	Accepted
35.	Overhead Projectors With Accessories	59.42	40.58	1.61	0.49	Accepted
36.	White Board	73.21	26.79	1.87	0.44	Accepted
37.	Magnetic Chalkboards	27.15	72.85	1.73	0.45	Accepted
38.	Air- Conditioners	53.61	46.39	1.86	0.50	Accepted
39.	White Boar Marker	91.39	8.61	2.09	0.28	Accepted
40.	Fire Extinguisher	77.22	22.78	1.93	0.42	Accepted
41.	Magnetic White Boar Duster	42.17	57.83	1.58	0.49	Accepted
42.	Laboratory Technologist	74.73	25.27	2.12	0.44	Accepted
43.	Laboratory Attendants	78.89	21.11	2.01	0.41	Accepted

S/N	Facilities/ Equipment	Available (%)	Not Available (%)	Mean	SD	Decision	S/N	Facilities /Equipment	Adequate (%)	Not Adequate (%)	Mean	SD	Decision
44.	Clerical Officer	46.26	53.74	1.54	0.50	Accepted	13.	water bath,	47.18	52.82	1.47	0.50	Rejected
45.	Messenger	73.47	26.53	1.97	0.44	Accepted	14.	Centrifuge. (Hand and Electric)	64.72	32.26	1.67	0.47	Accepted
46.	Cleaner	91.78	8.22	2.05	0.28	Accepted	15.						

Benchmark mean is 1.5

Table 2 shows that 31 out of 46 (67.4%) equipment and facilities for the implementation of chemistry curriculum in Colleges of Education in Nigeria were available, with percentages above 50% as indicated by the lecturers. In addition, 45 out of 46 equipment and facilities (97.8%) had mean scores above the 1.5 benchmark. Hence, facilities and equipment for the implementation of the chemistry curriculum in Colleges of Education are claimed to be available. By comparing lecturers' responses with those obtained from students, the apparatuses that were reported not to be available (Centrifuge (hand and electric), magnetic stirrer, Soxhlet extractor, Victor Meyer's apparatus for measuring vapour, Suction Pump, Kjedadhl Digestion flask, and Spectrophotometer) are too important to be ignored.

Table 3: Adequacy of Facilities, Equipment and Resources for Teaching Chemistry According to the Students

S/N	Facilities /Equipment	Adequate (%)	Not Adequate (%)	Mean	SD	Decision	S/N	Facilities /Equipment	Adequate (%)	Not Adequate (%)	Mean	SD	Decision
1.	Classrooms	70.56	29.44	1.75	0.54	Accepted	16.	oven, (heating plate/heating mantle),	26.01	73.99	1.46	0.44	Rejected
2.	Lecture Theatres	49.40	50.60	1.41	0.50	Rejected	17.	steam bath	58.87	41.13	1.59	0.49	Accepted
3.	Lecture halls	58.47	41.53	1.58	0.49	Accepted	18.	magnetic stirrer	38.31	61.69	1.48	0.49	Rejected
4.	Office furniture	51.41	48.59	1.51	0.50	Accepted	19.	suction pump	31.85	68.15	1.32	0.47	Rejected
5.	Computers	39.72	60.28	1.30	0.49	Rejected	20.	circulating water pump	38.10	61.90	1.38	0.49	Rejected
6.	Chemistry laboratory	38.91	61.09	1.49	0.49	Rejected	21.	soxhlet extractor	35.89	64.11	1.36	0.48	Rejected
7.	departmental library	45.97	54.03	1.42	0.50	Rejected	22.	rotator evaporator	45.97	54.03	1.46	0.50	Rejected
8.	Staff offices	46.57	53.43	1.45	0.50	Rejected	23.	Calorimeter	58.87	38.31	1.61	0.49	Accepted
9.	Typewriters	48.99	51.01	1.42	0.50	Rejected	24.	pH meter,	52.62	47.38	1.53	0.50	Accepted
10.	Meter balance	40.52	59.48	1.48	0.49	Rejected	25.	overhead water tank	49.40	50.60	1.49	0.50	Rejected
11.	Toploading balance	55.44	44.56	1.55	0.50	Accepted	26.	first aid box,	37.70	62.30	1.38	0.49	Rejected
12.	Thermostat	53.23	46.57	1.53	0.50	Accepted	27.	Victor Meyer's apparatus for measuring vapour density	41.94	58.06	1.22	0.49	Rejected
							28.	conductivity meter	52.82	47.18	2.03	0.50	Accepted
							29.	water distiller	32.06	67.94	1.32	0.47	Rejected
							30.	Spectrophotometer	46.98	53.02	1.47	0.50	Rejected
							31.	Kjedahl Digestion flask	53.63	46.37	1.54	0.50	Accepted
							32.	Supply chemicals	46.57	53.43	1.47	0.50	Rejected
							33.	water supply	41.33	58.67	1.41	0.49	Rejected
							34.	Electricity	54.84	45.16	2.15	0.50	Accepted
							35.	Gas	32.46	67.54	1.32	0.47	Rejected
							36.	Overhead projectors with accessories	47.78	52.22	1.48	0.50	Rejected
							37.	White board	49.80	50.20	1.40	0.50	Rejected
							38.	Magnetic chalkboards	49.40	50.60	1.41	0.50	Rejected
							39.	Air- conditioners	37.90	62.10	1.38	0.49	Rejected
							40.	White board marker	52.82	47.18	1.53	0.50	Accepted

S/N	Facilities/ Equipment	Adequate (%)	Not Adequate (%)	Mean	SD	Decision	S/N	Facilities/ Equipment	Adequate (%)	Not Adequate (%)	Mean	SD	Decision
41.	Fire extinguisher	46.57	53.43	1.47	0.50	Rejected	14.	Centrifuge. (Hand and Electric)	32.60	67.40	1.67	0.47	Accepted
42.	Magnetic whit board duster	44.15	55.85	1.44	0.50	Rejected	15.	oven, (hot plate/heating mantle),	75.07	24.93	1.25	0.43	Rejected
43.	Laboratory technologist	50.81	49.19	1.51	0.50	Accepted	16.	steam bath	40.32	59.68	1.60	0.49	Accepted
44.	Laboratory attendants	37.90	62.10	1.38	0.49	Rejected	17.	magnetic stirrer,	62.86	37.14	2.37	0.48	Accepted
45.	clerical officer	28.02	71.98	1.28	0.45	Rejected	18.	suction pump	68.44	31.56	2.32	0.47	Accepted
46.	Messenger	24.80	75.20	1.31	0.52	Rejected	19.	circulating water pump	62.33	37.67	2.38	0.49	Accepted
47.	Cleaner	70.56	29.44	2.38	0.49	Accepted	20.	soxlet extractor,	65.52	34.48	2.34	0.48	Accepted

Benchmark mean is 1.5

Table 3 shows that 31 out of 46 equipment and facilities (67.4%) for the implementation of chemistry curriculum in Colleges of Education in Nigeria were not adequate with percentages above 50% as indicated by the students. In addition, 38 out of 46 (82.6%) equipment and facilities had mean scores below 1.5 benchmark mean. Hence, facilities and equipment for implementation of chemistry curriculum in Colleges of Education were available but not adequate.

Table 4: Adequacy of Facilities, Equipment and Resources for Teaching Chemistry as Perceived by Lecturers

S/N	Facilities/ Equipment	Adequate (%)	Not Adequate (%)	Mean	SD	Decision	S/N	Facilities/ Equipment	Adequate (%)	Not Adequate (%)	Mean	SD	Decision
1.	Classrooms	71.23	28.77	1.84	0.54	Accepted	31.	Supply of chemicals	53.05	46.95	1.97	0.50	Accepted
2.	Lecture Theatres	49.60	50.40	1.80	0.50	Accepted	32.	water supply	59.15	40.85	1.81	0.49	Accepted
3.	Lecture halls	41.11	58.89	1.59	0.49	Accepted	33.	Electricity	44.30	55.70	1.56	0.50	Accepted
4.	Office furniture	49.87	50.13	1.80	0.50	Accepted	34.	Gas	68.44	31.56	2.32	0.47	Accepted
5.	Computers	59.42	40.58	1.61	0.49	Accepted	35.	Overhead projectors with accessories	53.32	46.68	2.04	0.50	Accepted
6.	Chemistry laboratory	62.60	37.40	1.37	0.48	Rejected	36.	White board	49.60	50.40	1.50	0.50	Accepted
7.	departmental library	53.32	46.68	1.47	0.50	Rejected	37.	Magnetic chalkboards	50.13	49.87	1.50	0.50	Accepted
8.	Staff offices	52.52	47.48	1.47	0.50	Rejected	38.	Air-conditioners	62.33	37.67	1.38	0.49	Rejected
9.	Typewriters	50.66	49.34	1.49	0.50	Accepted	39.	White board marker	46.95	53.05	2.53	0.50	Accepted
10.	Meter balance	58.89	41.11	1.41	0.49	Rejected	40.	Fire extinguisher	53.05	46.95	1.47	0.50	Rejected
11.	Toploading balance	43.50	56.50	1.56	0.50	Accepted	41.	Magnetic white board duster	56.76	43.24	1.43	0.50	Rejected
12.	Thermostat	46.68	53.32	1.53	0.50	Accepted							
13.	water bath,	53.58	46.42	2.46	0.50	Accepted							

S/N	Facilities/ Equipment	Adequate (%)	Not Adequate (%)	Mean	SD	Decision
42.	Laboratory technologist	49.60	50.40	1.50	0.50	Accepted
43.	Laboratory attendants	62.60	37.40	2.37	0.48	Accepted
44.	clerical officer	75.60	24.40	2.59	0.43	Accepted
45.	Messenger	74.52	25.48	1.31	0.53	Rejected
46.	Cleaner	71.23	28.77	2.32	0.47	Accepted

Benchmark mean is 1.5

Table 4 shows that 30 out of 46 equipment and facilities (65.2%) for the implementation of chemistry curriculum in Colleges of Education in Nigeria were adequate with percentages above 50% as indicated by the lecturers. In addition, 36 out of 46 equipment and facilities (78.3%) had mean scores above the 1.5 benchmark mean. Hence, facilities and equipment for the implementation of the chemistry curriculum in Colleges of Education were adequate according to the lecturers.

DISCUSSION

This study reveals a significant gap between the availability and effective utilization of chemistry teaching resources in Nigerian Colleges of Education. Though 65.21% of essential facilities and equipment were reportedly available, their use in instructional practice was limited. This supports findings by Asiyai (2020) and Okeke (2025), who emphasized that inadequate access to and training in laboratory equipment during pre-service education hinders effective science teaching. Despite lecturers claiming frequent use of available resources, student reports and observational evidence contradicted these assertions. Many students noted they rarely interacted with teaching aids or laboratory equipment during practical sessions. Observations of overcrowded classrooms and overstretched facilities confirmed systemic challenges in curriculum implementation. Similar findings by Olubunmi and Aarinola (2022) reported that over 30% of secondary school chemistry teachers in Nigeria experienced difficulties in implementing the curriculum due to limited mastery and resource constraints. These limitations hinder the development of hands-on competencies

essential for inquiry-based teaching. As emphasized by Rieckmann and Muñoz (2024), sustainable teacher education must combine theoretical grounding with practical application, supported by functioning infrastructure. However, this study found that the lack of hands-on engagement during training perpetuates teacher-centered approaches, undermining the learner-centered ideals embedded in the curriculum. The systemic nature of these challenges is well documented. Akanbi and Omosewo (2014) estimated that about 75% of educational innovations fail during implementation due to underfunding, low motivation, and poor professional support. Wibowo et al. (2025) also emphasized that successful curriculum reform depends on quality execution. Without active efforts to address real-world implementation barriers, even well-designed curricula may fall short of intended outcomes.

The findings of this study resonate with international experiences. Amadu et al. (2023) noted that chemistry tutors in Ghana deviated from learner-centered strategies due to inadequate training. In Kogi State, Nigeria, Achimugu (2016) identified underfunding and low teacher motivation as major impediments. Batool et al. (2018) stressed the importance of curriculum updates and modern teaching techniques, while Widhiyanti et al. (2017) highlighted that curriculum effectiveness depends largely on how it is interpreted and practiced by educators. Together, these findings underscore the need for comprehensive reform in chemistry teacher education. It is not enough to ensure resource availability; institutions must also foster strategic utilization, reflective practice, and professional development. Bridging the gap between curriculum design and classroom reality demands a coordinated approach involving policy intervention, infrastructure investment, and continuous assessment.

CONCLUSION

The study highlights a critical disconnect between the availability of teaching and learning resources for chemistry and their effective utilization in pre-service teacher education. While resources may exist in

considerable measure, their inadequacy, poor maintenance, and underuse coupled with overcrowded classrooms undermine the development of competent and confident future chemistry teachers. Effective teacher preparation goes beyond infrastructure; it requires intentional training, access to practical experiences, and a supportive learning environment. Addressing these gaps is essential if teacher education programmes are to fulfill their mandate of producing skilled educators capable of transforming science learning in schools.

RECOMMENDATIONS

The following recommendations are considered appropriate:

1. Government at all levels should not relent efforts in funding education, most importantly; the Colleges of Education that is saddled with the responsibility of training students to teach in the foundation stages (primary and junior secondary schools).
2. The National Commission for Colleges of Education (NCCE) and college management should carry out regular supervision to ensure that available facilities and equipment are properly and effectively utilized by lecturers.
3. The NCCE, in collaboration with the state and Federal Ministries of education, should organize periodic on-the-job training for lecturers to enhance their understanding and implementation of the NCE curriculum objectives.
4. The Federal and state governments, through the Ministries of Education and TETFund, should ensure the provision of adequate facilities and recruit more academic staff in Colleges of Education to reduce lecturer-student ratios and enhance instructional effectiveness.

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