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Research Article

Availability and Utilization of Mobile Technology Tools in Chemistry Education Instructional Delivery: A Survey Research

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Abstract
The study investigated the availability and utilization of mobile technology tools in chemistry education instructional delivery: A survey research. The population of the study was all the 400 level and 300 level students in chemistry education, Department of Science Education, Federal University Otuoke. A total population sampling technique was used to purposively select all the students in 400 level (53) and 300 level (38) in chemistry education as the sample (91) for the study. Three instruments, which included a checklist and two questionnaire were used for the collection of data for the study. These were 10 items check list on the availability of mobile technology tools in chemistry education instructional delivery, a 10 items questionnaire on the utilization of mobile technology tools in chemistry education instructional delivery, and a 10 items questionnaire on challenges militating against mobile technology tools in chemistry education instructional delivery. Three purposes and research questions guided the study. Cronbach's alpha was used to get a reliability index of 0.9 for each of the instruments for the study. Mean and standard deviation were used as statistical tools for data analysis. Findings revealed that students have technology tools for learning, but these tools are not maximally utilized. Also, prevailing issues abound, militating against the utilization of technology tools for teaching and learning. Significantly, the study has provided evidence on the availability of technology tools at students' disposal and challenges contributing to under-utilization of these tools in teaching and learning to improve the performance of chemistry students. Recommendations included that adequate support, training of lecturers and students would enhance integration of technology tools, which would further aid teaching and learning and improve academic achievement of students in Federal University Otuoke.

Keywords: Availability, Chemistry Education, Instructional Delivery, Mobile Technology Tools, Utilization

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1. INTRODUCTION

The use of mobile technologies has continued to rise steadily across all segments of society, including undergraduate students. In contemporary educational settings, soft copy learning materials on mobile devices have become more practical and convenient than traditional hardcopy learning materials. Their influence now extends beyond education, shaping accessibility to information, communication, security, safety, business coordination, and social interactions. As a result, mobile technology has gradually become embedded in global culture, particularly alongside the expansion of formal education systems. This transformation began several decades ago with the emergence of the internet, which introduced rapid technological advancement accompanied by both positive and negative consequences for an increasingly dynamic world. Consequently, there has been a growing demand for highly skilled individuals, as schools and higher education institutions now assume greater responsibility for socialization and workforce preparation.

The emergence of technologies such as mobile and tablet computing has brought about significant changes in teaching and learning practices worldwide. Education has increasingly shifted toward technology-driven approaches that support the integration of diverse digital tools into instructional processes. Although the presence of mobile phones in classrooms has long been debated and restricted in many countries, ongoing changes in educational philosophy have gradually created space for their classroom use. Over the past two decades, the link between education and technology has strengthened considerably, leading several countries, including Canada, Australia, and Denmark, to adopt the "Bring Your Own Device (BYOD)" approach. BYOD refers to a learning model in which students use their personal digital devices for academic activities (Alberta Education, 2012; Stavert, 2013). In some contexts, this model has been expanded to "Bring Your Own Technology (BYOT)," but the underlying objective remains the same: to promote creativity, communication, collaboration, critical thinking, and active student participation through the use of technology. Parental involvement has also influenced this trend, as reports indicate that about 78% of parents prefer their children to carry mobile phones to school for emergency purposes (National Parent Union, 2024).

Despite these benefits, debates surrounding the regulation and banning of mobile phones under BYOD policies have persisted, particularly due to concerns about ethical use and responsible digital behavior. In many cases, restrictions apply mainly to primary education, with limited exceptions for laptop use when required by teachers. However, the present focus is on higher education, where students are generally more mature and digitally literate. In 2024, several jurisdictions introduced policies limiting mobile phone use in K–12 schools because of concerns related to student distraction. Similarly, in 2025, Alberta implemented restrictions on mobile phone use for students in K–9, Grade 10, and Grade 12 classrooms. Empirical evidence also reflects shifting perceptions over time. Studies conducted in 2015, 2018, and 2022 on preservice teachers' views regarding mobile phone integration revealed an increase in acceptance from 45% in 2015 to 55% in 2018, followed by a decline to 40% in 2022 (Thomas et al., 2024). This decline was attributed to growing concerns such as student distraction (68%), teacher distraction (63%), academic dishonesty (76%), classroom disruption (70%), and cyberbullying (70%).

In recent years, mobile technologies have become deeply integrated into everyday life. For many individuals, being without a mobile device creates a sense of incompleteness. A study by Dhaka (2020) reported that 86.62% of students in higher education institutions in Bangladesh own smartphones. Similarly, Juskaite et al. (2019) found that students frequently use a range of technological tools, including smartphones (28%), sensors (32%), data collectors and loggers (30%), and other digital tools (10%). Further evidence suggests that nearly 80% of students use mobile phones during classroom sessions. Among these users, 24.54% reported using their phones for making or receiving calls, while 65.05% primarily engaged in social media browsing and text messaging (Hasan, Karimuzzaman et al., 2024).

Mobile devices have become practical tools that support students' everyday academic tasks, including note-taking, information searching, responding to academic questions, and communication (Tian & Zhou, 2023). Contemporary society has moved beyond the stage where mobile devices were used solely for calls and text messaging; they now provide constant access to the internet and a wide range of digital resources. This shift represents a transition from the traditional "information age" to what may be described as an influence-driven digital era. In the 21st century, mobile devices have increasingly been adopted as instructional tools, particularly in the teaching and learning of chemistry and other science subjects (Juskaite et al., 2019). For example, Oluwafemi et al. (2019) explored the design and usability of a chemistry learning application for Nigerian undergraduates within a blended learning framework, demonstrating the instructional potential of mobile-based platforms. Mobile technologies allow learners to access educational content at any time and from any location, encouraging continuous learning through digital materials and interactive tools. In addition, social media and communication applications enhance rapid information exchange, which supports collaboration and shared learning experiences (Amez & Baert, 2020). Research findings indicate that the integration of mobile technology positively influences learning outcomes, with no significant gender differences in its educational use. Similar conclusions were reported by Lok and Hamzah (2021) and Sobowale et al. (2024), who affirmed the effectiveness of mobile technology in improving physics education and other academic disciplines. Aliyu and Aliyu also emphasized that digital technologies support teaching and learning by enabling the development of instructional models and facilitating the visualization of abstract concepts in chemistry.

However, the impact of mobile phone use on university students' academic performance is not uniform, as it depends largely on the purpose and duration of usage (Qi, 2019; Amez & Baert, 2020). While evidence suggests that mobile device use in classrooms can significantly enhance students' literacy skills

(Dorris et al., 2024), it is equally important to acknowledge the associated challenges. Mobile technologies, though valuable instructional tools, may also serve as sources of distraction, time mismanagement, and reduced academic focus, which can negatively affect students' academic achievement (Amez & Baert, 2020). Several studies have shown that students often engage in non-academic activities during lessons, such as listening to music, watching videos, taking selfies, engaging in entertainment, or participating in cyberbullying, all of which divert attention from learning (Gath et al., 2024). Furthermore, excessive mobile phone use has been linked to adverse outcomes including poor sleep quality, sleep deprivation, anxiety, depression, social isolation, reduced life satisfaction, unstable interpersonal relationships, substance dependence, diminished attention span, and symptoms associated with hyperactivity disorders, all of which contribute to poor academic performance in science-related subjects (Amez & Baert, 2020; Qi, 2019).

Despite ongoing debates surrounding the appropriateness of mobile phone use in classrooms, it is widely acknowledged that the benefits and drawbacks of mobile technologies depend largely on ethical and responsible usage, given that digital technologies are now a permanent feature of modern education (Griffiths & Williams, 2018; Thomas, 2024). While ownership of mobile devices is important, their effective integration into teaching and learning processes is even more critical. Equally essential is the identification and mitigation of factors that hinder their optimal use in educational contexts. Prominent challenges affecting the effective utilization of mobile technology for instructional delivery include teachers' limited technical competence, inadequate professional development opportunities, and insufficient methodological support (Juskaite et al., 2019; Sobowale et al., 2024). Additionally, the absence of appropriate digital instructional resources in multiple languages poses a significant barrier, as teachers often struggle with lesson preparation due to the high level of technical expertise and time required. Collectively, these challenges reflect a broader lack of preparedness for the demands of future-oriented education and the learning needs of the next generation.

A considerable body of literature has documented both the beneficial and adverse effects of mobile phone use in educational settings. In Europe and several other regions of the world, extensive research has been conducted on the application of information and communication technologies in teaching and learning. However, empirical studies focusing specifically on mobile technologies in education remain limited within the Nigerian context. Most existing studies were carried out outside Nigeria and, more specifically, outside Bayelsa State, thereby underscoring the originality and relevance of the present study. There is therefore a need to determine whether mobile technology tools are readily available to 300- and 400-level Science Education students at the Federal University Otuoke, given the general assumption that a large proportion of undergraduates have access to mobile phones and related technologies. This situation highlights a clear content gap that the study seeks to address.

In addition, the study aims to examine the extent to which available mobile technology tools are actually utilized for teaching and learning in chemistry education. The integration of emerging technologies into instructional practices has become a defining feature of 21st-century education, yet evidence of its effective application in Nigerian universities remains sparse. This observation is supported by Sobowale et al. (2021), who noted the limited availability of literature on mobile technology integration in Nigerian educational contexts, thereby revealing a significant literature gap. Furthermore, persistent concerns regarding poor academic performance among undergraduate students, reflected in low cumulative grade point averages and the absence of clear class distinctions, further justify the need for this investigation. Against this backdrop, the study seeks to assess the availability and utilization of mobile technology tools for instructional delivery in chemistry education at the Federal University Otuoke.

1.1. Literature Review

Juskaite et al. (2019) explored the application of mobile technologies in physics education within Latvian secondary schools using a quantitative approach. The study adopted a descriptive survey design and involved a population of 3,764 students and 87 physics teachers. Data were gathered through surveys, classroom observations, and focus group discussions, with questionnaires serving as the primary data collection instrument. The development of instructional materials was informed by a systematic review of scientific and educational literature, while data analysis was conducted using SPSS Statistics version 19. Findings indicated that mobile technology–supported learning aligns with the Educational Technology

Competency Standards for Teachers. The authors emphasized the need to strengthen teachers' technological skills and attitudes through targeted knowledge enhancement and capacity-building initiatives.

Similarly, Oluwafemi et al. (2019) investigated the development and usability of a chemistry learning application designed for Nigerian undergraduates within a blended learning environment. The study employed a quasi-experimental research design and targeted undergraduate students across universities in Osun State. A purposive sample of 30 chemistry education undergraduates was selected for the study. Data were collected using a questionnaire and analyzed through descriptive and inferential statistics, including frequency counts, percentages, means, t-tests, and SPSS version 20.0. The findings revealed that the use of mobile learning applications significantly enhanced students' learning outcomes, with no observable gender differences in technology usage for educational purposes.

Rakhmatov (2021) examined the role of mobile technologies in higher education through a theoretical analysis. The paper discussed the advantages and limitations of mobile learning, identified emerging directions, and provided examples of how various mobile services and technologies are applied in educational contexts. The study revealed that the use of mobile technologies remains limited, as they are often employed primarily for information dissemination rather than as cognitive tools that actively support learning. Their application was largely restricted to content storage, information retrieval, access to teaching materials, and lesson scheduling. Nevertheless, the study highlighted the innovative potential of mobile technologies and their capacity to transform teaching and learning when effectively integrated.

In another related study, Lok and Hamzah (2021) examined students' experiences with mobile technology use in chemistry learning through a qualitative case study approach. The study involved 84 students who maintained online learning diaries, from which 17 participants were purposively selected for in-depth interviews. Data analysis followed systematic qualitative procedures, including transcription, data condensation, abstraction, categorization, member checking, triangulation, and inter-rater reliability assessment. These processes facilitated the identification of emerging themes related to students' learning experiences. The findings revealed mixed perceptions, with students reporting both positive and negative experiences. Positive outcomes included enhanced knowledge construction, improved visualization of abstract chemical concepts, greater self-regulation in learning, and increased intellectual engagement. However, challenges such as inadequate learning resources were identified as constraints. The study recommended careful planning and the adoption of appropriate instructional strategies tailored to students' learning needs to improve academic performance in chemistry.

Wohlfart et al. (2023) investigated the role of digital tools in secondary school chemistry education in Germany, questioning whether such tools add instructional value or merely represent modern trends. The study adopted a descriptive survey design and purposively selected 10 secondary school chemistry teachers as participants. Data were collected using semi-structured interviews and questionnaires, with the interviews focusing on teachers' perceptions of the value, acceptance, and use of digital tools in chemistry classrooms. Interviews were conducted via Microsoft Teams between June and July 2022. Qualitative data were transcribed and analyzed using MAXQDA Analytics Pro 2022, employing both deductive and inductive coding approaches. The analysis yielded 45 codes and 936 coded segments. Measures such as training, consensus meetings, and detailed documentation were employed to ensure reliability. Findings indicated that teachers generally valued digital tools and acknowledged their importance in teaching and learning. However, several barriers to effective use were identified, including time constraints, heavy workloads, inadequate infrastructure, limited technical support, and resistance to change. The study concluded that subject-specific digital tools have strong potential to enhance learning and recommended sustained teacher training and the development of institutional support systems.

Aliyu and Aliyu (2023) examined the effectiveness of web-based, computer-based, and mobile software applications in facilitating the teaching and learning of chemical concepts. The study involved a population of 700 chemistry teachers drawn from both public and private schools across all educational levels in Sokoto metropolis. Data were collected using a questionnaire and analyzed with SPSS version 25. The results demonstrated that web-based and mobile software applications significantly support instructional delivery and learning in chemistry.

Sobowale et al. (2024) focused on the development and evaluation of a mobile learning application for practical chemistry among pre-service teachers. The study adopted a repeated-measures research design involving 50 purposively selected pre-service teachers. A 40-item Practical Chemistry Achievement Test

(PCAT) served as the instrument for data collection. The ADDIE instructional design model guided the development and evaluation of the mobile learning intervention. Normality testing using the Kolmogorov–Smirnov test confirmed that the data were normally distributed ($p > 0.05$). Participants completed two pre-tests and post-tests over an eight-week intervention period. Data were analyzed using mixed-design repeated-measures ANOVA, which revealed significant improvement in students' performance across testing periods ($F(3,147) = 109.475$, $p = 0.000$, $\eta p^2 = 0.916$). The study also found no significant gender differences in performance ($F(3,144) = 2.051$, $p = 0.109$, $\eta p^2 = 0.21$). The authors recommended increased integration of mobile learning technologies by lecturers, researchers, and policymakers.

A review of the existing literature indicates that most empirical studies on mobile technologies in education have been conducted outside Africa, and particularly outside Nigeria, resulting in notable contextual and geographical gaps. Although some studies have expressed concerns about the implications of mobile technology use in classrooms, there is a lack of empirical evidence on the availability and utilization of such technologies at the Federal University Otuoke. This absence highlights a significant usability gap regarding mobile technology tools for educational purposes. It is against this backdrop that the present study seeks to investigate the availability and utilization of mobile technology tools in chemistry instructional delivery: a survey research.

1.2. Statement of the Problem

Despite the widespread availability of mobile technology tools, high levels of student access to digital devices, rapid technological advancement, and sustained efforts by educators and educational stakeholders, academic performance among undergraduate students in tertiary institutions remains a growing concern. In recent times, students enrolled in the Chemistry Education programme at the Federal University Otuoke have continued to record unsatisfactory academic outcomes, as reflected in low cumulative grade point averages and weak performance across faculty, departmental, and elective courses. Several scholars have linked poor academic achievement to inappropriate mobile technology usage, particularly when devices are used for non-academic purposes (Sobowale et al., 2024; Qi, 2019). While some studies advocate for the integration of mobile technology in teaching and learning due to its positive influence on academic achievement (Oluwafemi et al., 2019), the negative effects—especially distraction—have significantly reduced students' level of concentration during lectures.

Outside the classroom, students with internet-enabled mobile phones often spend excessive time engaging in social media platforms and messaging applications such as Twitter, TikTok, Facebook, Google services, Yahoo, and instant messaging platforms, thereby diverting time meant for academic activities (Oluwafemi et al., 2019). As a result, valuable study time is frequently wasted. Although mobile technology use is not the sole cause of poor academic performance, factors such as users' attitudes, patterns of usage, and purpose of engagement play a critical role, particularly in the 21st-century learning environment (Amez & Baert, 2020). Furthermore, challenges such as limited digital skills among teachers, inadequate professional development opportunities, and insufficient methodological support have contributed to the underutilization of mobile technology tools in higher education (Juskaite et al., 2019; Sobowale et al., 2024). Against this background, this study investigates the availability and utilization of mobile technology tools for chemistry instructional delivery at the Federal University Otuoke. Accordingly, the problem of the study is stated as: What is the availability and extent of utilization of mobile technology tools for chemistry instructional delivery at the Federal University Otuoke?

1.3. Purpose of the Study

The main purpose of the study was to ascertain the availability and utilization of mobile technology tools for chemistry instructional delivery in Federal University Otuoke.

1.4. Research Questions

1. What are the mobile technology tools available for chemistry instructional delivery in Federal University Otuoke?

2. What is the level of mobile technology tools utilized for chemistry instructional delivery in Federal University Otuoke?
3. What are the challenges militating against the availability and utilization of mobile technology tools for chemistry instructional delivery in Federal University Otuoke.

2. METHOD

2.1. Design

The study employed a descriptive survey research design to examine the existing conditions regarding the availability of mobile technology tools among students and their use for instructional delivery in chemistry education at the Federal University Otuoke. This design was considered appropriate because the study sought to describe the current situation as it exists, rather than to manipulate any variables or establish cause-and-effect relationships. The focus was on documenting the status quo concerning students' access to mobile technology tools and the extent to which these tools are utilized for teaching and learning purposes.

2.2. Respondents

The population of the study comprised all 300- and 400-level chemistry education students in the Department of Science Education, Federal University Otuoke. Specifically, the population included 53 students in the 400 level (21 males and 32 females) and 38 students in the 300 level (8 males and 30 females), giving a total population of 91 students. Given the manageable size of the population, a total population sampling approach was adopted. This approach, which is also a form of purposive sampling, involved the inclusion of every member of the target population in the study. The selection of these students was informed by their academic status, as they were either preparing for project work or final examinations and were therefore expected to possess adequate exposure to instructional technologies. Additionally, these students are close to graduation and are expected to demonstrate a reasonable level of technological competence. The use of the entire population eliminated sampling error and allowed for more detailed and in-depth analysis.

2.3. Instruments

Three researcher-developed instruments were used for data collection. These included a 10-item checklist designed to assess the availability of mobile technology tools for chemistry instructional delivery, a 10-item questionnaire to determine the extent to which these tools are utilized, and another 10-item questionnaire aimed at identifying challenges affecting the availability and effective use of mobile technology tools for chemistry instructional delivery. To establish the reliability of the instruments, 15 copies of the questionnaires were administered to students in the Mathematics and Physics Education departments of the Federal University Otuoke. The responses were subjected to reliability analysis using Cronbach's alpha, which yielded a coefficient of 0.90 for each instrument, indicating a high level of internal consistency and suitability for the study. The checklist enabled the researcher to determine the availability and functionality of mobile technology tools accessible to students, while the utilization questionnaire measured the extent to which these tools were used for instructional purposes. The challenges questionnaire identified factors hindering the effective availability and use of mobile technology tools in chemistry education. A four-point Likert scale was employed for all instruments. For the availability checklist, the response options included Available (AV), Not Available (NAV), Functional (FUNC), and Not Functional (NFUNC). For the utilization and challenges questionnaires, the response categories were Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). A criterion mean of 2.50 was adopted, with mean scores equal to or above this value considered acceptable, while those below were regarded as unacceptable.

2.4. Data Collection and Analysis

The researcher personally administered the checklist and questionnaires to the 91 students in the 300- and 400-level chemistry education programmes to ensure effective data collection. Completed instruments were retrieved immediately after completion to facilitate proper collation and analysis. Both primary and secondary sources of data were utilized in the study. Primary data were obtained directly from students through the administered instruments, while secondary data were sourced from relevant literature. Data were analyzed using mean and standard deviation to address the research questions. The mean was used to summarize responses across all items, while the standard deviation provided information on the degree of variability in participants' responses.

3. RESULTS

The mean scores of mobile technology tools available for chemistry instructional delivery in Federal University Otuoke are shown in Table1.

Table 1. Summary of Mobile Technology Tools Available for Chemistry Instructional Delivery in Federal University Otuoke

	Items	AV (4)	NAV (3)	FU (2)	NF (1)	Total	Mean	VAR	SD Dn
1	Smart Phone	58	12	18	3	91	3.37	2.51	1.58 A
		232	36	36	3	307			
2	IPad	18	64	4	5	91	3.04	2.05	1.43 A
		72	192	8	5	277			
3	Laptop	35	43	7	6	91	3.17	2.25	1.50 A
		140	129	14	6	289			
4	WI-FI	44	30	10	7	91	3.21	2.33	1.52 A
		176	90	20	7	293			
5	External Hard	22	53	5	11	91	2.94	1.92	1.38 A
	Drives	88	159	10	11	268			
6	Tablet	15	63	4	9	91	2.92	1.89	1.37 A
		60	189	8	9	266			
7	Flash Drives	37	45	5	4	91	3.26	2.42	1.55 A
		148	135	10	4	297			
8.	Learning	39	37	9	6	91	3.19	2.29	1.51 A
	Management System	156	111	18	6	291			
9	Google Classroom	15	57	6	13	91	2.81	1.78	1.33 A
		60	171	12	13	256			
10	Zoom facility	19	53	3	16	91	2.82	1.80	1.34 A
		76	159	6	16	257			

Note: Available (AV), Not Available (NAV), Functional (FU), Not Functional (NFU)

From Table 1, items 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 had mean scores of 3.37, 3.04, 3.17, 3.21, 2.94, 2.92, 3.26, 3.19, 2.81, and 2.82, respectively. All the items are accepted based on the criterion mean of equal to or above 2.5 for acceptance and equal to or less than 2.5 for rejection. This implies that all the technology tool items are available at students' disposal for instructional delivery of chemistry education. The standard deviation scores of items 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 are 1.58, 1.43, 1.50, 1.52, 1.38, 1. 37, 1.55, 1.51, 1.33, and 1.34. These scores show a movement toward the mean.

The mean scores of the level of mobile technology tools utilized for chemistry instruction in Federal University Otuoke are shown in Table 2. In Table 2, items 1 and 8 had mean scores of 3.14 and 2.63. These items are accepted based on the criterion mean equal to or above 2.50 for acceptance and equal to or below 2.50 for rejection. This implies that students have dependable and reliable smartphones that can be used for learning. Also learning management system is used for the exchange of ideas between lecturers and students. Items 2, 3, 4, 5, 6, 7, 9, and 10 had mean scores of 2.08, 2.04, 2.31, 2.07, 2.24, 2.25, 2.13, and 2.10, respectively. These items are rejected based on the criterion mean of equal to or above 2.50 for acceptance and equal to or below 2.50 for rejection.

Table 2. Summary of the Level of Mobile Technology Tools Utilized for Chemistry Instructional in Federal University Otuoke

	Items	SA (4)	A (3)	D (2)	SD (1)	TO	X	VAR	SD
1	I have a dependable and useful smartphone for chemistry class	39 156	32 96	14 28	6 6	91 286	3.14	2.20	1.38
2	I take notes in my classes using my iPad	8 32	17 51	41 82	25 25	91 190	2.08	1.89	1.37
3	Chemistry education students use their laptops during classes	8 32	20 60	31 62	32 32	91 186	2.04	1.94	1.39
4	Wi-Fi is available for use during chemistry lessons	24 96	9 27	30 60	28 28	91 211	2.31	1.70	1.30
5	External Hard Drives are at students' disposal during school hours	15 60	8 24	37 74	31 31	91 189	2.07	1.90	1.37
6	Students are allowed to use tablets to learn during chemistry classes	11 44	22 66	36 72	22 22	91 204	2.24	1.74	1.31
7	Flash drives are used for backup of information during chemistry classes	16 64	29 87	26 52	20 20	91 223	2.45	1.66	1.28
8.	Learning management system is used for interaction and the exchange of ideas between lecturers and students	19 76	38 11	16 32	18 18	19 240	2.63	1.63	1.24
9	Google Classroom is used regularly for chemistry lessons	13 52	14 42	36 72	28 28	91 194	2.13	1.84	1.35
10	Chemistry educators often organize classes through Zoom facilities	12 48	17 51	31 62	31 31	91 192	2.10	1.88	1.37

Note: Strongly Agreed (SA), Agreed (A), Disagree (D), Strongly Disagree (SD)

The mean scores of challenges militating against the availability and utilization of mobile technology tools for chemistry instructional delivery in Federal University Otuoke are shown in Table 3.

Table 3. Summary of Challenges Militating against the Availability and Utilization of Mobile Technology Tools for Chemistry Instructional Delivery at Federal University Otuoke

	Items	SA (4)	A (3)	D (2)	SD (1)	Total	Mean	VAR	SD
1	There is a regular power supply for the use of mobile technology tools during classes	24 96	25 75	31 62	11 11	91 244	2.68	1.70	1.30
2	The cost of data is a challenge to me	34 136	37 11	14 28	6 6	91 281	3.08	3.08	1.44
3	I cannot afford to buy a laptop for personal use in chemistry classes	27 108	24 72	28 56	12 12	91 248	2.72	1.71	1.30
4	I am skillful in the use of the Learning Management System and Google Classroom	16 64	31 93	29 58	15 15	91 230	2.52	1.45	1.20
5	The chemistry education students have external hard drives for use in the classroom	7 28	19 57	38 76	27 27	91 188	2.06	1.92	1.38
6.	Mobile technology tools are not allowed for use during chemistry education classes	21 84	27 81	25 50	18 18	91 233	2.56	1.66	1.28
7.	Chemistry education lecturers do not organize classes using Zoom	23 92	32 96	22 44	14 14	91 246	2.70	1.72	1.31
8.	The learning management system and Google Classroom are not working	20 80	32 96	26 52	13 13	91 241	2.64	1.68	1.29
9.	I do not use my smartphone for academic purposes	6 24	13 39	36 72	36 36	91 171	1.87	2.18	1.47
10.	I do not have a smartphone	8 32	10 30	38 76	35 35	91 173	1.90	2.14	1.46

Note: Strongly Agreed (SA), Agreed (A), Disagree (D), Strongly Disagree (SD)

From Table 3, items 1, 2, 3, 4, 6, 7, and 8 had mean scores of 2.68, 3.08, 2.72, 2.52, 2.56, 2.70, and 2.64, respectively. These items are accepted based on the criterion mean equal to or above 2.50 for acceptance and equal to or below 2.50 for rejection. Items 5, 9, and 10 had mean scores of 2.06, 1.87, and 1.90, respectively. These items are rejected based on the criterion mean of equal to or above 2.50 for acceptance and equal to or below 2.50 for rejection.

4. DISCUSSION

Findings presented in Table 1 indicate that a range of mobile and digital technologies—including smartphones, iPads, laptops, Wi-Fi devices, external hard drives, tablets, flash drives, learning management systems, Google Classroom, and Zoom facilities—are available to students for instructional purposes in chemistry education. This suggests that a substantial proportion of students possess the basic technological resources required to participate effectively in ICT-driven learning within the university environment. The results further reveal that students have access to reliable smartphones that can support chemistry learning and acknowledge that learning management systems can serve as useful platforms for collaboration and the exchange of academic ideas. These findings are consistent with those of Amez and Baert (2020) and align with Dhaka (2020), who reported that approximately 87% of students in higher education institutions own smartphones.

However, the results also show that despite the availability of these technologies, their use for instructional purposes remains limited. Chemistry education students reportedly do not make regular use of laptops or smartphones during classroom activities. In addition, Wi-Fi access is largely unavailable during school hours, tablets are scarcely used during lessons, Google Classroom is rarely utilized for learning, lecturers make limited use of Zoom for instructional delivery, and students do not commonly use iPads for note-taking. These findings indicate a clear underutilization of available technology tools for teaching and learning. This outcome supports the findings of Rakhmatov (2021), who observed that mobile technologies are still not optimally integrated into higher education teaching practices. Possible explanations for this situation include inadequate methodological support, poor infrastructure, limited digital competence among users, insufficient professional development opportunities, and concerns that technology use may increase classroom distractions (Juskaite et al., 2019; Amez & Baert, 2020; Sobowale et al., 2024). The results, therefore, underscore the need for comprehensive support systems for both lecturers and students to enhance the effective integration of mobile technologies in higher education institutions (Juskaite et al., 2019; Lok & Hamzah, 2021; Wohlfart et al., 2023).

5. CONCLUSION

Technological innovations such as mobile phones, tablets, and laptops have undoubtedly contributed significantly to social advancement and educational development. However, alongside these benefits, new challenges related to learning practices among university students have also emerged. Although concerns continue to grow regarding the limited instructional use of mobile devices within classroom settings, outright prohibition is unlikely to provide a lasting solution. Rather, greater emphasis should be placed on equipping students and lecturers with the knowledge and skills required for ethical, responsible, and purposeful use of mobile technology tools in educational environments.

This study examined the availability and utilization of mobile technology tools for chemistry instructional delivery at the Federal University Otuoke. The investigation focused specifically on 300- and 400-level chemistry education students and did not include students from mathematics or physics education programmes, nor those in other levels of chemistry education. The findings revealed that while mobile technology tools are readily available to students, their application for instructional purposes remains relatively low. This indicates a clear gap between access to technology and its effective use for teaching and learning within the institution. Consequently, there is a need to provide adequate training, institutional support, and structured guidance for both students and lecturers to ensure that available mobile technology tools are effectively integrated into instructional practices. Such efforts will promote more engaging, experiential, and meaningful teaching and learning experiences that align with the demands of 21st-century education.

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