

**FACTORS MILITATING AGAINST THE USE OF E-LEARNING AMONG  
CHEMISTRY EDUCATION STUDENTS IN UNIVERSITY OF BENIN**

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BENIN CITY.**

**DECEMBER, 2025**

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**BY**

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**BEING A PROJECT WORK SUBMITTED TO THE DEPARTMENT OF  
CURRICULUM AND INSTRUCTIONAL TECHNOLOGY, FACULTY OF  
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**DECEMBER, 2025.**

## CERTIFICATION

We the undersigned, Certify that this Research work was carried out and written by Oma ONAIWU of the Department of Curriculum and Instructional Technology, Faculty of Education, University of Benin, Benin City, Edo State.

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## **DEDICATION**

This project work is dedicated to God Almighty for His abundant grace in my life and for seeing me through my academic pursuit.

## **ACKNOWLEDGEMENTS**

The researcher wishes to express his profound gratitude to Almighty God for His divine guidance, protection, and strength throughout the course of this research work. Without His grace, wisdom, and sustenance, the successful completion of this study would not have been possible.

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## TABLE OF CONTENTS

	PAGE
<b>TITLE</b>	<b>i</b>
<b>CERTIFICATION</b>	<b>ii</b>
<b>DEDICATION</b>	<b>iii</b>
<b>ACKNOWLEDGEMENTS</b>	<b>iv</b>
<b>ABSTRACT</b>	<b>vii</b>
<b>CHAPTER ONE: INTRODUCTION</b>	
Statement of the Problem	1
Research Questions	3
Purpose of the Study	4
Significance of the Study	5
Scope and Delimitation of the Study	7
Operational Definition of Terms	8
<b>CHAPTER TWO: REVIEW OF RELATED LITERATURE</b>	
Theoretical framework	9
Concept of E-Learning in the Study of Chemistry	14
Digital Literacy Skills	16
Institutional Support	18
Perceived Usefulness of E-Learning	20
Economic/Financial Factors	22
Concept of Militating Against E-Learning Use	24
Frequency of E-Learning Use	27
Students' Engagement Level	28
Academic Performance/Outcome in Chemistry	30
Ease of Access and Interaction	31
Satisfaction with E-Learning Experience	33
Summary of reviewed related literature	35

	<b>PAGE</b>
<b>CHAPTER THREE: RESEARCH METHODOLOGY</b>	
Introduction	37
Research Design	37
Population of the Study	38
Sample and Sampling Technique	38
Research Instrument	39
Validity of the Instrument	40
Reliability of the Instrument	40
Method of Data Collection	40
Method of Data Analysis	41
<b>CHAPTER FOUR: DATA PRESENTATION, ANALYSIS AND INTERPRETATION</b>	
Introduction	42
Data Presentation and Analysis	44
Discussion of Findings	57
<b>CHAPTER FIVE: SUMMARY, CONCLUSION, AND RECOMMENDATIONS</b>	
Summary of the Study	60
Conclusion	61
Recommendations	62
REFERENCES	68
APPENDIX	71

## ABSTRACT

*The study examined the factors militating against the use of e-learning among chemistry education students in a tertiary institution in Benin City. Specifically, it investigated the influence of infrastructural challenges, students' digital literacy skills, institutional support, perceived usefulness of e-learning, and lecturers' attitudes and competencies on the adoption and utilization of e-learning in chemistry education. The study employed a descriptive survey research design, with a stratified random sample of 60 undergraduate students across all academic levels. Data were collected using a structured questionnaire and analyzed using descriptive statistics, including mean and standard deviation, and inferential statistics through multiple regression analysis. Findings revealed that poor internet connectivity, irregular power supply, limited access to ICT facilities, low digital literacy, inadequate institutional support, skepticism about the usefulness of e-learning, and lecturers' reluctance or lack of competence collectively hindered the effective use of e-learning. Regression analysis indicated that these factors jointly explained 76.8% of the variance in students' use of e-learning. Based on the findings, the study concluded that a combination of technological, institutional, and human factors significantly influences e-learning adoption in chemistry education. Recommendations include improving ICT infrastructure, enhancing digital literacy, providing institutional support, promoting the perceived usefulness of e-learning, and training lecturers to foster a positive attitude toward online teaching. The study contributes to a better understanding of discipline-specific barriers to e-learning adoption and provides a framework for interventions to enhance online learning in Nigerian tertiary institutions.*

**Keywords:** *E-learning, Chemistry Education, Digital Literacy, Institutional Support, Infrastructural Challenges, Lecturers' Competencies*

# CHAPTER ONE

## INTRODUCTION

### **Background to the Study**

The use of Information and Communication Technology (ICT) in schools has been a signature mark of learning and teaching in the 21st century. One of the most groundbreaking advancements in this regard is e-learning, which is the use of computer technology, electronic media, and web platforms to enhance and supplement teaching (Okebukola, 2020). In tertiary education, e-learning provides students with access to numerous digital resources, interactive websites, and virtual labs that facilitate flexible, self-paced, and distant learning (Adebayo & Jimoh, 2022).

As a foundation science subject, chemistry is usually believed to be abstract and conceptually inclined. The majority of the subjects such as atomic structure, chemical bonding, and reaction kinetics are difficult for students to comprehend in the absence of visualization and experimentation. Despite these identified benefits, the adoption and effective utilization of e-learning in Nigerian higher education institutions remain challenges. The National Bureau of Statistics reported internet penetration at approximately 44% in 2024, thus excluding more than half of the population from a continuous means of accessing the internet, which is paramount for effective e-learning (National Bureau of Statistics [NBS], 2024). Concurrently, the Nigerian Communications Commission has set a 70% broadband penetration objective of 2025, as a testament of recognition of infrastructural shortcomings in digital learning (NCC, 2023).

Digital literacy has also been a main contributor to e-learning adoption. Studies have indicated that students with advanced ICT skills are more likely to use e-learning platforms efficiently and achieve enhanced academic performance (Olaoye & Adebajo, 2022). Institutional support also determines the success of e-learning. While there are institutions that offer computer laboratories, subsidized internet, and training sessions, there are others that offer limited support, and students are left to rely on personal means (Eze et al., 2021). In the COVID-19 pandemic, private universities were also found with greater compliance rates for e-learning implementation compared to public universities with compliance rates of 67% and 52%, respectively, basing on institutional readiness differences (Okoye & Akpan, 2021).

Another key factor is the perceived utility of e-learning by students. It has been discovered in research that students who find e-learning a useful platform to improve their chemistry knowledge are likely to adopt it, while others who doubt its ability to compare with the performance of traditional laboratories are still skeptical (Lawal & Ibrahim, 2023). In disciplines such as chemistry, in which laboratory experiences are a central part, doubt over whether online platforms will suffice to teach laboratory practices still restricts them from going mainstream (Andersson & Holm, 2023).

Overall, the combination of infrastructural constraints, digital literacy skills of students, institutional support, and perceived usefulness of e-learning has a tendency to limit the fulfillment of its benefits in learning chemistry. For institutions of higher

learning in Benin City, these constraints are real and, if not addressed, will continue to impede students' learning outcomes and performance in chemistry.

### **Statement of the Problem**

In Nigeria, persistent poor chemistry performance has been linked in the long run with ineffective teaching methods, insufficiently suitable laboratory facilities, and poor instructional materials. E-learning came forward as the major solution to these challenges, where access to interactivity materials, web-based resources, and innovative learning methodologies could be made available. Its adoption and use in tertiary institutions are, however, still beset with challenges.

Infrastructural challenges such as erratic power supply, inferior internet connectivity, and ICT facilities inadequacies continue to be significant barriers to effective deployment of e-learning in Nigerian universities. Similarly, Olaoye and Adebajo (2022) noted that even though digital literacy is imperative towards effective use of online platforms, significant numbers of Nigerian undergraduate students are still deficient in skills to effectively utilize e-learning content. Similarly, Lawal and Ibrahim (2023) found that students' perceptions of the usefulness of e-learning significantly influence their adoption of e-learning for science courses, but questions have always existed regarding whether or not online resources would substitute laboratory experience in courses such as chemistry.

Despite such studies being helpful in enlightening us about the issues of e-learning in Nigeria, they do possess loopholes. To begin, the majority of existing research

has examined e-learning adoption in higher education as a whole with limited attention to chemistry education, an area with unique practical and conceptual demands. Second, infrastructural, digital literacy, and attitudinal concerns have been explored separately, but there is comparatively little research that combines these factors with institutional support, without which effective adoption is impossible. Thirdly, too little empirical evidence has been directed at the Benin City tertiary institutions with contextual factors such as urban infrastructure and institutional policy, which have the potential to influence the effectiveness of e-learning in a manner that is different from other areas.

This research thus attempts to bridge these gaps by examining in totality the factors hindering the adoption of e-learning to study chemistry among students of chemistry education in a Benin City tertiary institution. By examining infrastructural issues, students' digital skills, organizational support, and e-learning perceived utility, the research will yield a more context-dependent and discipline-specific insight into the obstacles to adopting e-learning in chemistry education.

### **Research Questions**

The following research questions will guide the study:

1. What infrastructural challenges hinder the use of e-learning in the study of chemistry?
2. How do students' digital literacy skills affect their utilization of e-learning platforms for chemistry?

3. To what extent does institutional support influence the use of e-learning in the study of chemistry?
4. How does students' perceived usefulness of e-learning affect their adoption of it in chemistry education?
5. In what ways do lecturers' attitudes and competencies toward e-learning influence its effective use in teaching chemistry?

### **Purpose of the Study**

The main purpose of this study is to examine the factors militating against the use of e-learning in the study of chemistry among chemistry education students in a tertiary institution in Benin City. The specific objectives are to:

1. Identify the infrastructural challenges hindering the use of e-learning in chemistry studies.
2. Assess the influence of students' digital literacy skills on their ability to use e-learning effectively.
3. Examine the role of institutional support in promoting or hindering e-learning in chemistry education.
4. Investigate the effect of students' perceived usefulness of e-learning on their willingness to adopt it for studying chemistry.
5. Determine how lecturers' attitudes and competencies toward e-learning affect its integration in the teaching and learning of chemistry.

## **Significance of the Study**

This study is highly significant as it provides pertinent information on the factors affecting the effective application of e-learning in the study of chemistry among chemistry education students in a tertiary institution in Benin City. The study will be beneficial to students, lecturers, university Management, policymakers, and future Researchers.

For students, this study will enlighten them about the key challenges that hinder their access to and utilization of e-learning platforms for academic purposes. This awareness will help them identify areas of improvement, particularly in acquiring enhanced digital literacy skills needed for navigating online learning resources effectively.

For lecturers, the study will provide valuable insights into how e-learning can be better integrated into the teaching of chemistry. Understanding the challenges faced by students will enable lecturers to adopt more inclusive and participatory pedagogical strategies that leverage e-learning tools to simplify abstract scientific concepts and encourage greater student engagement.

For university management, the findings will offer empirical evidence on the need to strengthen infrastructural support such as stable internet connectivity, constant electricity supply, and adequate ICT facilities. It will also highlight the importance of staff training programs and institutional policies that promote the broader implementation of e-learning across departments.

For policymakers, this research will serve as a guide in formulating and reforming educational policies aimed at integrating ICT effectively into Nigeria's tertiary education system. Addressing the barriers identified in the study will allow for targeted interventions that enhance both teaching and learning experiences through e-learning.

Finally, for future researchers, this study will serve as a useful reference point for subsequent investigations into e-learning challenges, particularly within science education. It will contribute to the growing body of literature on ICT integration in teaching and learning and provide a foundation for comparative studies across disciplines and institutional settings.

### **Scope and Delimitation of the Study**

This study is delimited to chemistry education students in a selected tertiary institution within Benin City, Edo State. The investigation focuses specifically on the factors that hinder the effective use of e-learning in the study of chemistry. These factors include infrastructural challenges, students' digital literacy skills, institutional support, and perceived usefulness of e-learning. The study aims to understand how these dimensions collectively influence students' ability to utilize e-learning platforms for learning chemistry effectively.

The scope of the study does not extend to students in other disciplines or departments outside chemistry education, nor does it cover tertiary institutions outside Benin City. Additionally, while lecturers' attitudes and competencies toward e-learning are considered as a supportive variable, the central emphasis remains on the experiences

and challenges of chemistry education students. Other possible determinants of e-learning adoption such as socioeconomic background, motivation, or personal learning preferences are beyond the scope of this study.

By limiting the research to chemistry education students in a single tertiary institution, the study ensures a focused and context-specific analysis, allowing for a deeper understanding of the peculiar barriers affecting e-learning within chemistry education in Benin City.

### **Operational Definition of Terms**

- **E-learning:** The use of digital and internet-based technologies to support teaching and learning.
- **Chemistry Education Students:** Undergraduate students studying chemistry education in a tertiary institution in Benin City.
- **Infrastructural Challenges:** Barriers such as poor internet connectivity, unstable power supply, and limited ICT resources.
- **Digital Literacy Skills:** The ability of students to effectively use digital tools, software, and e-learning platforms for academic purposes.
- **Institutional Support:** Efforts by the institution such as provision of ICT facilities, training programs, internet access, and supportive policies.
- **Perceived Usefulness of E-learning:** Students' belief that e-learning can improve their understanding and performance in chemistry.

## **CHAPTER TWO**

### **REVIEW OF RELATED LITERATURE**

The literature were reviewed under the following subheading;

- Theoretical framework
- Concept of E-Learning in the Study of Chemistry
- Digital Literacy Skills
- Institutional Support
- Perceived Usefulness of E-Learning
- Economic/Financial Factors
- Concept of Militating Against E-Learning Use
- Frequency of E-Learning Use
- Students' Engagement Level
- Academic Performance/Outcome in Chemistry
- Ease of Access and Interaction
- Satisfaction with E-Learning Experience
- Summary of reviewed related literature

#### **Theoretical Framework**

#### **Technology Acceptance Model (TAM)**

The Technology Acceptance Model (TAM) developed by Fred Davis in 1989 is one of the most commonly utilized models to explain how individuals adopt and accept

new technologies. It was an extension of the Theory of Reasoned Action (TRA) by Fishbein and Ajzen in 1975, which posits that human behavior is motivated by intentions, which in turn are influenced by attitudes and beliefs. Davis transferred this reasoning to the domain of information systems and technological innovation, arguing that users' acceptance of technology depends primarily on their perceptions of its usefulness and ease of use.

Two key factors are delineated by the model that influence users' decision to adopt and utilize a technology on a continuous basis. The first is Perceived Usefulness (PU), or the degree to which an individual believes that the utilization of a given system will enhance their job or academic performance. In the case of the academic environment, students will be more likely to accept e-learning systems when they believe that these technologies will allow them to better understand difficult concepts, complete assignments successfully, or improve their overall academic performance. The second is Perceived Ease of Use (PEOU), which defines the extent to which a person believes that using a system will be easy. When learners find an e-learning system easy to use, user-friendly, and convenient, they naturally develop a positive attitude towards using it regularly.

According to the model, both perceived usefulness and perceived ease of use affect one's attitude towards technology. A positive attitude consequently affects the intention to utilize the technology, and finally, actual usage. However, if the users find the technology complex, ineffective, or unreliable, they will be less prone to adopt or

continue using it. The TAM thus proposes that it is by enhancing the perceived usefulness and ease of use of a system that one can increase its rate of adoption by the users.

Applied to this study, the Technology Acceptance Model provides the theoretical explanation of how chemistry education students in a tertiary institution in Benin City perceive and use e-learning systems. If the students believe that e-learning systems can make their learning of chemistry more enjoyable, effective, and efficient, their perceived usefulness of the system is increased and, therefore, their intention to use it is increased. Similarly, when students find these platforms easy to use allowing them to utilize digital materials, virtual laboratories, and recorded lectures without any difficulty their perceived ease of use is boosted, and the likelihood of adoption is enhanced.

Several obstacles may, however, adversely affect these perceptions. Factors such as poor internet connection, unstable power supply, weak digital literacy, and the prohibitive expense of data may make e-learning cumbersome, time-consuming, or less beneficial. Such militating factors reduce perceived usefulness and perceived ease of use, hence hampering students' acceptance and utilization of e-learning systems. Hence, the TAM brings to light that for the successful adoption of e-learning in chemistry education, institutions must surmount infrastructural deficiencies, enhance computer literacy among students, and provide adequate institutional support. By strengthening these facilitating conditions, students' intentions and attitudes towards e-learning can be rendered more

positive, which will ultimately lead to greater acceptance and adoption of technology in chemistry learning.

### **Constructivist Learning Theory**

The Constructivist Theory of Learning, or Jean Piaget's (1972) and Lev Vygotsky's (1978) theory, deals with the concept that learning is a constructive process of active experience and not passive reception of information. In this theory, learners build their own meaning and knowledge regarding the world from experience, reflection, and interaction with the environment. That is, knowledge is not directly passed from student to teacher; instead, it is constructed by the student by discovery and interaction.

Piaget's constructivist theory focuses on the idea that students grow in stages of cognitive development, constructing new knowledge from prior knowledge. He believed that people learn best when they are directly involved in the learning process, manipulating objects on a table, trying things out, and discovering relationships for themselves. Vygotsky, on the other hand, was concerned with the social context of learning, proposing that building knowledge is achieved through communication with others—essentially through cooperation, dialogue, and guidance by more skilled peers or instructors. His Zone of Proximal Development (ZPD) framework specifies the function of support and scaffolding in facilitating learners in achieving tasks they cannot accomplish independently.

In the e-learning paradigm, Constructivist Learning Theory provides a sound pedagogical foundation. E-learning environments are designed to create student-centric

and interactive learning with the learners constructing their own knowledge actively rather than relying on direct guidance. Constructivism makes it easier to utilize tools such as interactive simulations, virtual labs, discussion forums, and multimedia presentations, which encourage inquiry, experimentation, and collaboration. With these internet tools, students can try out hypotheses, view chemical reactions, and perform problem-solving activities that reinforce conceptual knowledge.

Constructivism is particularly relevant in the context of learning chemistry because chemistry as a discipline involves abstract concepts as well as empirical experimentation. Traditional classroom instruction is not always able to provide the type of interactive engagement that creates meaningful learning, but e-learning software can fill in here by offering virtual experiments, 3D molecular visualization, and interactive online labs that mimic real laboratory settings. Using these tools, chemistry education students can positively build on their understanding of abstractions by exploring and finding out, which is best suited to the constructivist philosophy of learning. However, the whole potential of constructivist principle based e-learning can be fulfilled only if learners receive adequate access to virtual learning materials, stable internet connectivity, and adequate digital literacy competence. In situations where these enablers are absent—such as poor institutional capacity, weak infrastructures, or shortage of finances—students cannot actively participate in interactive learning processes. Consequently, the potential of constructivist learning through e-learning remains unrealized.

## **Concept of E-Learning in the Study of Chemistry**

E-learning in the study of chemistry is the level where chemistry education students utilize web-based learning platforms, digital content, and web-based tools to enhance learning, collaboration, and performance. It not only includes the availability of technology but also the capability of students to apply it to optimize understanding, engagement, and performance in the study of chemistry. E-learning can take the form of virtual lectures, online tutorials, video demonstrations of chemistry experiments, interactive simulations, and discussion forums that establish collaboration among students and instructors (Adeyemo & Oloyede, 2022).

In recent years, the application of e-learning has been an important component of higher learning around the globe. Studies have shown that the integration of e-learning tools in science-oriented subject matters like chemistry improves concept understanding and problem-solving abilities among students (Okafor & Onyekuru, 2021). Experiments can be conducted by students, viewed by them are molecular structures, and they engage in inquiry-based learning activities through the use of virtual laboratories to improve their chemical processes' understanding. However, the success of e-learning in education for chemistry relies on the frequency and manner in which students utilize such platforms to support classroom learning (Obielodan, 2020).

Quantification of implementation of e-learning for learning chemistry can be measured along several pertinent dimensions. To begin with, the frequency of use of e-learning accounts for how frequently the students take online classes, turn in assignments,

or utilize digital learning platforms like Google Classroom, Zoom, or Moodle. Second is student engagement, which is a measure of how intense the interaction with course material, online discussion boards, and virtual labs is. Highly engaged students tend to demonstrate higher improvement in academic performance. Third is academic outcome, which is the extent to which e-learning produces higher chemical concept understanding, better grades, and better laboratory skills (Adediran & Yusuf, 2023).

Ease of use and access is another major consideration, including how simple it is for students to access e-learning websites, access course content, communicate with instructors, and complete assigned work. Poor connectivity, non provision with devices, and sporadic sources of power can hinder ease of use and reduce engagement. Finally, satisfaction with the e-learning experience is a strong predictor of future use. Students who find the system to be interactive, flexible, and useful for learning are more likely to use it repeatedly (Eze, 2022).

Despite these benefits, the use of e-learning in teaching chemistry in Nigeria remains significantly low as opposed to developed countries. While there are majority of the tertiary institutions employing learning management systems, some challenges such as poor ICT infrastructure, low levels of digital literacy, and funding remain to affect normal usage (Okojie & Ehioghae, 2021). For instance, studies have shown that less than half of students in certain Nigerian universities experience normal internet connectivity or personal devices to access the internet for e-learning (Adebayo & Hassan, 2021). These limitations imply that e-learning in chemistry is not entirely dependent on

technology access but also depends on students' competency, institutional support, and perceived ease of computer-mediated learning environments.

### ***Digital Literacy Skills***

The level of digital literacy among learners defines the efficiency with which they can make use of e-learning sites for the purpose of studying. Digital literacy refers to the ability to use technology and digital tools efficiently and confidently to find, analyze, create, and communicate information. For e-learning, they cover skills such as the use of learning management systems, uploading and downloading instructional materials, participating in online forums, using video conferencing, and utilizing virtual labs and simulations. For chemistry students, they are particularly useful because they enable them to conduct online experiments, simulate chemical reactions, and interface with interactive resources that facilitate mastery of concepts.

But several Nigerian students of chemistry education still lag behind in the digital skills necessary for effective e-learning engagement. According to Adebayo and Jimoh (2022), low digital literacy among Nigerian undergraduates is one of the strongest barriers to e-learning adoption, as the students often lack adequate knowledge of digital resources, software packages, and online communication means. Similarly, Eze et al. (2021) pointed out that while most students own smartphones and laptops, their ability to make effective use of the learning tools is still hampered by the absence of ICT training and exposure. This inefficiency has a tendency to manifest in the fact that students find it difficult when they use multimedia chemistry materials, interact with simulation

packages, or upload assignments online through applications such as Moodle or Google Classroom.

At the national level, there remains a shortage of digital literacy. The National Bureau of Statistics (2024) reported that even though Nigeria had internet penetration around 44%, only an estimated 50% of Nigerians possessed basic digital literacy skills. This is very far from advanced nations, in which over 70% of tertiary students were proficient in using digital learning platforms (Andersson & Holm, 2023). These disparities underscore the need for Nigerian universities to expand ICT training programs that can increase students' readiness to effectively engage e-learning platforms.

In chemistry teaching, where laboratory work and experimentation are central aspects, digital literacy's importance is even more compelling. Such students can acquire online chemistry databases at will, carry out computer simulations of chemical reactions, and use computer lab sites such as PhET or ChemCollective to simulate experiments. However, students lacking such skills cannot gain full benefits from the interactive nature of e-learning. Digital literacy, offered by Lawal and Ibrahim (2023), enhances the motivation and confidence of learners to use e-learning technology, as it makes them more capable of carrying out learning activities themselves.

By contrast, Nigeria's private tertiary education institutions have registered higher student digital literacy compared to public tertiary institutions. This is largely due to enhanced institutional infrastructure, ICT infrastructures, and exposure to hybrid learning platforms (Okoye & Akpan, 2021). Such differences indicate that institutional investment

in digital education is vital to empowering students for effective participation in technology-based learning.

### **Institutional Support**

Institutional support is one of the most important factors influencing the proper utilization of e-learning by students, particularly in science subjects such as chemistry. Institutional support is the extent to which tertiary educational institutions provide the requisite infrastructure, facilities, technical assistance, and administrative assistance to promote online learning. When institutions establish proper support infrastructure such as ICT-lab facilities with the right equipment, an adequate internet connection, training workshops, and technical assistance students will likely embrace and sustain the use of e-learning platforms. Yet, where these supports do not exist, students' confidence and ability to meaningfully participate in online learning are typically undermined.

According to Owolabi and Adebayo (2022), institutional readiness and support facilities have a strong correlation with forecasting students' willingness to utilize e-learning platforms in Nigerian universities. They discovered that institutions with significant investments in digital material, training workshops, and student support centers had increased e-learning enrollment rates than institutions with limited digital facilities. Similarly, Nwankwo (2021) noted that where universities provide explicit technical guidance and e-learning induction to lecturers and students alike, it enhances the level of confidence in learning on online platforms.

In teaching chemistry, institutional support is even more essential due to the technical nature of the subject. Chemistry often requires access to laboratory simulations, visual experiments, and multimedia material that will only function optimally when supported by secure internet and harmonized digital infrastructure. Students who visited science oriented faculties and were exposed to institutional virtual laboratories and ICT hubs performed better in e-learning assessments compared to their peers without such facilities, Eze and Okonkwo (2023) assert. They drew their conclusion from the fact that institutional support has a direct impact on how accessible and effective e-learning experiences are within technical disciplines.

Furthermore, a comparison of public and private colleges and universities illustrates wide variances in the extent of institutional support provided for e-learning. Afolayan and Musa (2023) reported that private universities in Nigeria offer more consistent technical backup, subsidized data services, and workshops on e-learning than their public counterparts, who are often marred by infrastructural and financing difficulties. Based on their research, over 60% of students at private schools had consistent online tutorial and feedback systems, compared to fewer than 40% of their respective public university peers.

Therefore, the level of institutional commitment is a deciding criterion in the way students adopt and use e-learning technologies. Institutions that actively participate in digital inclusion, provide adequate technical assistance, and cultivate pedagogic innovation create a learning-friendly environment that enables e-learning to thrive.

Institutions, however, that fail to prioritize such mandates risk hampering the success of their online learning initiatives, particularly in high-interactivity and technology-integrative courses like chemistry.

### **Perceived Usefulness of E-Learning**

Perceived usefulness (PU) refers to the degree to which a student feels that the use of e-learning will enhance performance, generate understanding, or help achieve learning goals (Lee, 2010; Nuryakin, Rakotoarizaka & Musa, 2023). For chemistry education students, this perception is especially significant. When students perceive that online platforms, virtual simulations, and multimedia learning tools will allow them to learn more about challenging topics such as atomic structure, chemical bonding or reaction kinetics than traditional teaching, their interest and willingness to use e-learning increase. But when students doubt that e-learning can replicate laboratory experience or provide adequate interaction, their usage and frequency of use decline.

Empirical research confirms the precedence of perceived usefulness. For example, a large survey of university students found that around 72.6 % of participants agreed that e-learning during the pandemic was useful, despite only 63.7 % rating the ease of use positively, and the cost or access issues being still significant (Amin & Hussien, 2021). This indicates that even when usefulness is recognized, contextual barriers may still hinder adoption. The second study revealed that perceived usefulness accounted for as much as about 75 % of variance in students' continuance intention to utilize e-learning

systems, which shows that the stronger the conviction of value, the greater the intention to continue (Chen & Kuo, 2022).

In the context of chemistry learning, perceived usefulness could be tied to certain aspects: having virtual lab simulations when physical labs are not available, being able to rewind and replay videos on reaction mechanisms, and the ease of accessing materials 24/7. Research shows that when these kinds of features exist and are made known, students are more inclined to accept e-learning (Smith & Jones, 2023). And yet there is doubt: in a study of a chemistry cohort, while 68% of students perceived that virtual labs improved understanding, only 45% considered that they fully replaced actual laboratory sessions (Al-Dahhan, Zainulabdeen, Yousif, Al-Amiery & Bufaroosha, 2023). This gap identifies the nuance: usefulness is not enough; how it is useful and whether this aligns with student expectations matter.

Comparatively, students in developing countries will more likely have lower perceived usefulness scores than students in developed environments, a result that could be due to a lack of proper infrastructure or low interactivity levels. For instance, in a Middle Eastern study, only about 28% of students considered e-learning "enjoyable," and many preferred face-to-face learning despite the acceptance of e-learning flexibility (Eslamian, Khoshnoodifar & Malek, 2023). This suggests that usefulness belief may be moderated by contextual factors such as connectivity, device quality, or subject demands chemistry being a high-demand subject that requires visualization and experimentation.

For Benin City tertiary institutions, this suggests that it is worthwhile enhancing students' perception of usefulness. It involves developing e-learning initiatives that can empirically link to improved performance in chemistry, provide obvious benefits such as faster feedback or more engaging graphics, and answer questions about laboratory equivalence. Once the students understand that the web environment will enhance chemistry learning in a way that is optimal for them, their usage frequency, depth, and engagement is most likely to improve. On the other hand, if the platform is perceived as no more than an internet-based lecture, without interactive or practical value, then students can revert to minimal use or prefer traditional methods.

### ***Economic/Financial Factors***

Financial and economic situations largely decide the extent to which students engage with e-learning systems, especially in emerging nations like Nigeria. Technology devices' price, internet access, and the maintenance of needed digital tools all affect students' use of online learning directly. For the instance of chemistry learning, where students are to engage with multimedia content, virtual labs, and simulation classes, budget constraints can significantly hinder frequent use of e-learning (Adebayo & Oyeniran, 2023).

The very high cost of internet data is still one of the greatest budgetary impediments to implementing e-learning in Nigerian higher learning institutions. The majority of students use mobile data plans to download study materials, listen to online lectures, and participate in virtual group discussions. However, data plan prices in

Nigeria are quite high compared with the average level of students' monthly earnings. Based on Adamu and Olowu (2022), over 60% of Nigerian university students pay between ₦3,000 and ₦5,000 per month just for data, which is a significant portion of their living expenses. This financial load discourages regular participation in online learning, particularly by poor students.

Similarly, the price of technological tools such as laptops, tablets, and smart phones also dictates the level of participation in e-learning. The majority of chemistry education students utilize communal or outdated gadgets that are unlikely to accommodate sophisticated software applications or video conference software utilized during virtual lessons. Based on a study by Okoye and Jimoh (2023), almost 48% of the undergraduate Nigerian public university students reported that inadequate access to personal ICT devices hindered their participation in online learning. Moreover, an unstable power supply contributes to the cost factor as the students are likely to spend additional money on alternative sources of power such as generators or power banks in order to stay online during virtual classes (Ogunleye & Adebisi, 2021).

Economic inequality is also largely responsible for the digital divide that affects the enrollment of e-learning. While students in private institutions generally have better access to ICT facilities with the necessary equipment and subsidized internet, their public institution counterparts most of them are forced to rely on personal finances for their online learning needs. As Eze et al. (2022) emphasize, economic disparities between

students across different institutions are responsible for unequal access to e-learning platforms, thereby widening the disparity in education between social classes.

In the case of Benin City, where the economic status of most students in tertiary institutions is modest, affordability is a priority. The upkeep of internet-enabled devices and purchasing data normally coincides with the price of sustenance such as food, transport, and shelter. Consequently, students will opt for basic needs over frequent use of e-learning systems. For the learning of chemistry, it is a disturbing situation because the discipline relies heavily on interactive and experiential materials. If students are not able to afford frequent internet usage, their access to online laboratories, chemistry simulations, and web tutorials is significantly reduced, hindering their comprehension of basic scientific concepts (Lawal & Ibrahim, 2023). Therefore, budget constraints not only limit the incorporation of e-learning but also have an impact on the type of interaction. Highly funded students will be more likely to explore advanced e-learning tools, participate eagerly in web forums, and obtain higher marks. Others with less funding will irregularly or passively consume. This economic imbalance ultimately has an impact on the overall effectiveness of e-learning initiatives within institutions of higher learning (Olaoye & Adebajo, 2022).

### **Concept of Militating Against E-Learning Use**

These driving factors influence several elements of students' interaction with technology such as the extent of usage, degree of participation, academic performance, ease of use and interface interaction, and overall satisfaction with the learning experience.

The frequency of usage is one critical measure of utilization and adoption. Studies have shown that lack of adequate technological infrastructure and poor internet speeds often result in low utilization levels among students. To illustrate, Adeyare and Sulaiman (2023) found that less than half of Nigerian university students employed their school's e-learning portal regularly, whereas the majority used it rarely or never. This low usage percentage contrasts with findings in developed nations by Smith and Jones (2022), where over 70 percent of students use online learning platforms weekly. In chemistry learning, absence of regular utilization of e-learning platforms minimizes the number of virtual laboratory experiments and interactive modules that students engage with, which are vital in gaining insights into complex scientific concepts.

Extent of students' participation also has a significant role to play in e-learning success. Where militating conditions such as poor infrastructure, low digital literacy, or lack of motivation prevail, learners will not actively participate in online discussions, collaboration, or virtual experiments. Eze, Chinedu-Eze, and Bello (2020) reported that only 38 percent of Nigerian undergraduate students engaged actively on e-learning forums, whereas most used platforms for downloading. This passive use is of utmost disadvantage in the study of chemistry, where active engagement in problem exercises and simulation of labs enhances the concepts' understanding.

Besides, militating forces against e-learning are likely to lead to lower academic performance. According to Okaofor and Onyekuru (2021), students who visited e-learning platforms fewer than two times a week had 12 percent lower grades in chemistry

tests than students visiting such platforms more frequently. Virtual laboratory gaps and insufficient interaction with multimedia learning materials reduce opportunities for inquiry-based learning, which is essential to the attainment of higher academic performance in science courses.

Ease of use and access is another key indicator of whether or not e-learning will be successful. If there are issues with students being able to log into platforms, there is unstable power and unstable power supply, or issues with fluctuating internet services, then there is no chance students will continue to participate in online courses. Chinedu-Eze and Bello (2018) found that nearly 43 percent of students at a Nigerian private university reported unreliable access to e-learning platforms, with frequent technical interruptions affecting study. Conversely, institutions in technologically more advanced areas have more than 80 percent uptime on the platform and smoother virtual interactions, translating to a more fluid learning experience.

Satisfaction with e-learning is a more personal but significant indicator of how militating factors will shape adoption. Just 34 percent of Nigerian students, writes Adeyemi and Oyedokun (2022), reported being satisfied with their institution's e-learning systems, citing complaints of poor technical support, absence of interactivity, and insufficient feedback from lecturers. Conversely, as per research by Johnson, Smith, and Lee (2022) in the US, students in online science class reported over 65 percent satisfaction rates. Lower satisfaction in teaching chemistry typically results from the

inability of e-learning software to replicate hands-on laboratory experiences and facilitate proper engagement.

### ***Frequency of E-Learning Use***

The use intensity of e-learning refers to the frequency with which students use online platforms and computer applications to conduct their learning. In chemistry study, frequent visits to e-learning platforms such as Google Classroom, Zoom, or Moodle are critical because these platforms provide access to multimedia learning resources, online discussion boards, and virtual laboratories that allow comprehension of abstract concepts. The routine use facilitates students to study forever, re-study complex material, and participate in group sessions that improve better understanding.

However, in the majority of Nigerian institutions of higher learning, utilization of e-learning is minimal, primarily due to infrastructural and financial challenges. It has been established through research that most undergraduate students use e-learning sites intermittently due to poor internet connectivity, unreliable provision of electricity, or lack of requisite proper digital devices. According to Adebayo and Jimoh (2022), less than half of the southern Nigerian tertiary students reported using online learning platforms more than twice a week, while the rest used them sometimes or never. This limited use reduces the extent of active engagement and consistent academic progress.

In contrast, students in technologically advanced learning institutions make more use of e-learning platforms. Making a comparison between African and Asian universities, Oloyede (2021) found that over 70% of students in technologically advanced

universities visited online learning platforms no less than four times a week, whereas less than 40% of students in Nigerian public universities visited them. This variation recognizes the influence of infrastructural facilitation and institutional drive on e-learning patterns.

Further, the level of e-learning adoption has been linked to students' academic performance in science classes. Okonkwo and Nwosu (2023) reported that students learning chemistry who adopted e-learning resources at a greater extent scored higher conceptual knowledge and test scores compared to students who adopted them at a lesser extent. They attributed this achievement as being due to frequent exposure to computer laboratory simulations, animated lectures, and critical thinking-incentivizing exercises. On the other hand, students with inconsistent e-learning participation were likely to experience learning gaps in experimental or calculation-oriented courses. Student motivation and self-efficacy also decide the level of e-learning use. If the students see the online spaces as helpful and convenient, they will use them more. If the e-learning is deemed stressful or less interesting than classroom life, its usage goes down. Eze and Akpan (2021) emphasized that motivational drivers, as well as seamless institutional support, need to be in place for the long-term use of e-learning by science students.

### ***Students' Engagement Level***

Student engagement level refers to the extent of active participation, attention, and interaction that students have during online learning sessions. In learning chemistry, engagement includes students' involvement in virtual laboratory experiments,

participation in discussion forums, submission of group assignments, and reaction to feedback during e-learning sessions. Student engagement, Olanrewaju and Musa (2023) write, is a predictor of academic achievement in online learning settings because higher levels of participation are linked to improved comprehension and retention of scientific knowledge.

However, student engagement in e-learning varies significantly in relation to access to resources, quality of teaching, and the perceived relevance of learning material. Studies in Nigerian universities showed that only 45% of students take part in e-learning discussion and online activities compared to over 70% in industrialized countries where digital infrastructure and support mechanisms are stronger (Adebayo & Hassan, 2022). The difference highlights the persisting challenges undermining student uptake of online learning in resource-scarce settings.

Furthermore, poor internet connection, epileptic power, and lack of engaging multimedia content have been shown to undermine student motivation and engagement (Okon & Ibrahim, 2023). On the other hand, schools that use interactive elements such as online simulations, gamified quizzes, and immediate feedback record higher levels of student engagement in the learning of science (Nwachukwu, 2024). This would suggest that e-learning quality is a significant determining factor in ensuring active learning culture. Students' participation in e-learning for chemistry is not merely a matter of willingness but is subjected to institutional, technological, and instructional conditions. When such conditions are not ideal, participation diminishes, thus undermining the

overall effectiveness of online learning platforms in improving the performance of students in chemistry.

### ***Academic Performance/Outcome in Chemistry***

Chemical academic achievement is a crucial indicator of the extent to which students are capable of learning and utilizing chemical concepts using different approaches to teaching. The use of e-learning in learning chemistry has been reported to enhance students' mental competence and laboratory competence if well used. However, when there are barriers in the form of low digital literacy, insufficient learning technological equipment, and an unstable electricity supply, students' academic achievement is negatively impacted.

E-learning websites have the potential to improve student performance by offering dynamic learning environments where students can see multimedia lessons, conduct virtual labs, and engage in interactive simulations. Okafor and Adeyemi (2022) indicate that students who had constant access to online learning materials performed considerably better on chemical kinetics and stoichiometry compared to those whose learning was strictly based on face-to-face instruction. Similarly, Nwosu (2021) pointed out that the implementation of digital simulations and teaching videos in chemistry lectures increased students' scores on tests by over 20% relative to traditional lecturing methods.

Yet, the benefits of e-learning are most often undermined by situational failures. Where college students receive limited exposure to e-learning environments, inconsistent

internet connectivity, or inadequate counseling, the expected value increase is rarely realized. Ogunleye and Bello (2023) documented that inadequate e-learning infrastructure and poor student engagement directly contributed to poor performance in physical and organic chemistry courses. This finding corroborates that of Eze and Okoro (2020), who found that only 35% of southern Nigerian university chemistry students believed that e-learning had significantly improved their understanding of lab experiments due to irregular attendance and the unavailability of resources.

When students are not able to carry out virtual laboratory experiments or view teaching videos, their cognitive notion of chemistry is impacted. For instance, students who were not in a position to engage in online tutorials or virtual lab exercises scored lower grades in reaction rate topics compared to students who had access to such learning tools (Adebanjo, 2021). The use of e-learning portals such as Google Classroom, Zoom, and Moodle has also been linked with improved academic performance when used on a regular basis. Ibrahim and Yusuf (2022) argued that infrequent use of the same, often triggered by financial conditions or demotivation, results in poor academic performance and low understanding of abstract concepts.

### ***Ease of Access and Interaction***

Ease of interaction and ease of access are two fundamental aspects that determine the extent to which learners utilize e-learning interfaces efficiently in learning chemistry. With ease of interaction and access, learners can conveniently log into systems, browse online interfaces, download study materials, participate in live sessions, and engage with

lecturers or classmates without any technical issues, which improves their learning exponentially. However, when these processes are sabotaged by insecure internet connection, system crashes, or substandard digital infrastructure, students lose interest in using such platforms on a daily basis.

Limited access to quality internet services and frequent power outages have been identified as major setbacks that affect e-learning enrollment among Nigerian university students by Afolabi and Olayemi (2021). Fewer than half of the respondents in a survey that was conducted in some Nigerian universities in the south reported that they had accessed e-learning websites without problems, citing poor network services and incompatibility of devices as significant challenges. Similarly, Okoro and Eze (2022) found that students with stable connectivity in addition to support from their institutions were twice more likely to succeed with online homeworks in chemistry than learners with technical problems.

Ease of interaction is also an important consideration, particularly in subjects such as chemistry where comments, demonstrations, and discussions are central to comprehension. Students who are exposed to friendly online spaces in which they can engage in live chats, question-and-answer sessions, and feedback register higher levels of satisfaction and learning efficacy (Ogunleye & Adeyemi, 2023). Conversely, where there is a weak or tardy communication connection between lecturers and students, it results in decreased motivation and limited mastery of complex concepts of chemistry.

By contrast, studies in other developing countries such as Ghana and Kenya show marginally higher levels of access, with about 60% of tertiary students reporting they could freely engage with instructors on online platforms (Mensah, 2022). The disparity points to the necessity of investing in institutional digital support systems and infrastructure for enhanced access and interaction.

With virtual labs, chemical simulations, and multimedia descriptions being a key factor in the study of chemistry, ease of access and interaction become the benchmark of the quality of their interaction with abstract scientific information. With fewer barriers to access, learners are able to see better at the molecular level how reactions occur, perform simulated experiments, and interact comfortably with peers. Limited access and poor interaction, on the other hand, impede participation as well as learning achievement. In effect, ease of use and interaction yield the best measures of success in the adoption of e-learning. Reliable connectivity, improvement of digital infrastructure, and support for interactive communication channels between students and teachers will hence promote enhanced and greater use of e-learning in learning chemistry.

### ***Satisfaction with E-Learning Experience***

Student satisfaction with e-learning is a key driver of the success or failure of e-learning programs. When students feel that an online system delivers adequately to their learning requirements, they tend to remain on board and engage more deeply. Low levels of satisfaction typically signal underlying challenges such as technology problems, poor delivery of content, or lack of support from institutions. Satisfaction, in other words, is a

personal but important indicator of variables that can be adversely impacting the adoption of optimal e-learning.

Studies in the Nigerian environment reveal that the students' satisfaction level among university students pursuing e-learning is moderate to low, especially in science-related courses such as chemistry where interactive, experimental, and multimedia components are of paramount importance. For example, in a Nigerian distance education unit student survey, while most were generally satisfied, many more indicated that their dissatisfaction was a result of unpredictable power supply, poor telecommunication network, and prohibitively high costs of maintaining equipment for online learning engagement (Adekannbi, 2019). These infrastructural deficits translate to reduced satisfaction because students' expectations of seamless, enabling e-learning environments are thwarted.

Also, via another empirical study research on the teaching quality and influence of e-learning among Nigerian higher learning institutions, it was found that e-learning had a significant and positive influence on students' satisfaction, but this influence was moderated by students' access and exposure to e-learning technologies (Shuaib et al., 2023). That is, even when there was good teaching quality, those learners who lacked reliable access or exposed themselves scantily to web tools were less satisfied. This dynamic between institutional readiness and student satisfaction is thus highly significant.

Statistical contrasts underscore such problems even more. In one cross-country comparison of satisfaction with online learning in varied settings, roughly 30% of students

reported that they were "very satisfied" with their online learning, and roughly 10% reported that they were "dissatisfied" (Global Social Sciences Review, 2022). In Nigeria, though direct comparable data relating to students in chemistry education are not easily found, data from distance/open universities indicate that course-material and ICT infrastructure satisfaction levels often lag behind acceptable benchmarks (Oladipo et al., 2023). Reduced satisfaction levels are associated with descriptors like slow response, low interactivity, and poor device compatibility descriptors that work to diminish the effectiveness of e-learning in chemistry where laboratory work, simulation, and immediate interaction are relevant. Specifically for chemistry learning, if students do not find the e-learning system to be responsive, interactive or relevant to practical applications, their satisfaction decreases. For instance, if virtual lab simulations are delayed due to bandwidth issues or low-quality video demonstrations posted, students perceive the learning environment as less acceptable compared to face-to-face instruction and therefore feel less satisfied. When satisfaction goes down, students will have fewer opportunities to participate, avoid modules, or log off from virtual sessions hence decreasing the utilization of e-learning in the subject overall.

### **Summary of Reviewed Related Literature**

The review of literature has shown that e-learning plays a crucial role in enhancing the quality and flexibility of education, particularly in science based courses such as chemistry. However, several studies in Nigeria and other developing countries reveal persistent challenges that hinder effective implementation. Studies by Adebayo and Hassan (2021) and Adediran and Yusuf (2024) emphasize the importance of technological infrastructure, noting

that unreliable internet and power supply are key constraints to successful e-learning adoption. Similarly, Oluwatobi (2022) found that students' limited access to digital devices and inadequate ICT skills reduce the effectiveness of e-learning in higher institutions.

Institutional and economic challenges were highlighted by Eze et al. (2020), who noted that most tertiary institutions in Nigeria lack comprehensive e-learning policies and sufficient funding to maintain ICT facilities. Nwafor and Okeke (2023) also reported that the cost of data and devices remains a major impediment for students. Lecturer-related issues, such as poor ICT competence and negative attitudes towards technology, have also been identified as significant factors (Adedayo & Ibrahim, 2023). When lecturers do not receive proper training or motivation, e-learning becomes underutilized in science education. The review further shows that despite these challenges, e-learning offers immense opportunities for interactive, flexible, and learner centered education. When supported by strong institutional frameworks, technological infrastructure, and skilled facilitators, e-learning can enhance students' understanding of complex scientific concepts in chemistry. In summary, the reviewed literature establishes that while e-learning has the potential to revolutionize chemistry education, its success in Nigerian tertiary institutions particularly in Benin City is constrained by multiple interrelated factors such as poor infrastructure, inadequate funding, low ICT literacy, and insufficient institutional support.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

## **Introduction**

This chapter presents the methodology adopted for the study on Factors Militating Against the Use of E-learning in the Study of Chemistry among Chemistry Education Students in a Tertiary Institution in Benin City.

- Research Design
- Population of the Study
- Sample and Sampling Technique
- Research Instrument
- Validity of the Instrument
- Reliability of the Instrument
- Method of Data Collection
- Method of Data Analysis

## **Research Design**

The study employed a descriptive survey research design. This design was considered appropriate because it enables the researcher to collect data from a sample of respondents and examine the existing relationships among variables such as infrastructural challenges, digital literacy, institutional support, perceived usefulness of e-learning, and lecturers' attitudes and competencies. The descriptive survey design allows for a systematic description of the factors militating against the use of e-learning as they naturally occur among chemistry education students without manipulation of any

condition. It was also suitable because it provides an opportunity to gather opinions, attitudes, and experiences from respondents within a real academic environment.

### **Population of the Study**

The population of the study consisted of all undergraduate students enrolled in the Chemistry Education Programme in a selected tertiary institution in Benin City during the 2024/2025 academic session. These students were selected because they represent a group actively engaged in the study of chemistry and are directly affected by issues relating to e-learning adoption and utilization. The total number of students in the Chemistry Education Programme was estimated to be about one hundred (100), including students across all academic levels 100, 200, 300, and 400 levels. This population was deemed adequate to provide reliable information on the factors that hinder the effective use of e-learning in the study of chemistry.

### **Sample and Sampling Technique**

From the total population of one hundred (100) chemistry education students, a sample of sixty (60) respondents was selected to participate in the study. This sample size was considered sufficient to represent the population while maintaining manageability for data collection and analysis. The stratified random sampling technique was adopted to ensure equal representation of students across all academic levels. The population was stratified according to levels of study, and respondents were randomly selected from each stratum. This ensured that students from all levels ranging from first-year to final-year were adequately represented, providing a comprehensive understanding of how e-

learning challenges vary with academic exposure and experience. The random selection process minimized bias and enhanced the generalizability of the findings.

### **Research Instrument**

The main instrument used for data collection in this study was a structured questionnaire titled Factors Militating Against the Use of E-learning Questionnaire (FMAUEQ). The questionnaire was designed by the researcher to obtain information from chemistry education students on the various challenges affecting their use of e-learning in studying chemistry. It was divided into five sections, labeled A to E. Section A collected demographic information such as gender, age, and academic level. Section B focused on infrastructural challenges, assessing issues such as power supply, internet connectivity, and access to digital devices.

Section C addressed students' digital literacy skills, which measured their ability to navigate, interpret, and apply online learning tools effectively. Section D examined institutional support, including the availability of ICT facilities, training opportunities, and institutional encouragement toward e-learning use. Section E captured students' perceived usefulness of e-learning and lecturers' attitudes and competencies toward its integration into chemistry teaching. Each item was structured on a five-point Likert scale ranging from Strongly Agree to Strongly Disagree, allowing for quantifiable and comparable responses across all dimensions.

### **Validity of the Instrument**

To ensure that the instrument measured what it was intended to measure, both face and content validity were established. The draft questionnaire was presented to three experts in the Departments of Curriculum and Instructional Technology and Science Education at the University of Benin. The experts examined the clarity, wording, and relevance of the items in relation to the objectives of the study. Their constructive feedback led to the modification and improvement of several items to enhance precision and relevance. Ambiguous questions were rephrased for clarity, and redundant items were removed. This validation process ensured that the questionnaire was appropriate and comprehensive in addressing the key variables of the study.

### **Reliability of the Instrument**

The reliability of the questionnaire was determined through a pilot study involving fifteen (15) chemistry education students from another tertiary institution within Edo State who were not part of the main study. Their responses were analyzed using the Cronbach Alpha reliability test to determine internal consistency. The reliability coefficient obtained was 0.83, indicating a high level of consistency among the questionnaire items. This confirmed that the instrument was reliable and suitable for the main study.

### **Method of Data Collection**

Before data collection commenced, an introductory letter was obtained from the Department of Curriculum and Instructional Technology to present to the Head of the

Chemistry Education Department of the selected institution. Upon obtaining permission, the researcher, with the assistance of two trained research assistants, administered the questionnaires to the selected respondents. The purpose of the study was explained to the students, and they were assured that their responses would be treated with strict confidentiality. Participation was entirely voluntary, and respondents were free to withdraw at any point without penalty. The questionnaires were distributed during free periods to avoid interrupting lectures and were collected immediately after completion or at an agreed time to ensure a high retrieval rate. The data collection exercise lasted for approximately two weeks.

### **Method of Data Analysis**

After data collection, all responses were carefully coded and entered into the Statistical Package for the Social Sciences (SPSS) Version 27 for analysis. Descriptive statistics such as mean, frequency, and standard deviation were used to answer the research questions and describe the general trends in the data. Inferential statistics, specifically multiple regression analysis, were employed to determine the extent to which each independent variable infrastructural challenges, digital literacy, institutional support, perceived usefulness of e-learning, and lecturers' attitudes and competencies influenced the dependent variable, which is the use of e-learning in the study of chemistry.

## CHAPTER FOUR

### DATA PRESENTATION, ANALYSIS AND INTERPRETATION

#### Introduction

This chapter presents the analysis of data collected and the discussion of the findings

#### Socio-Demographic Characteristics of Respondents

<b>Gender</b>	<b>No of Respondents</b>	<b>Percent (%)</b>
Female	32	53.3
Male	28	46.7
<b>Total</b>	<b>60</b>	<b>100.0</b>
<b>Age</b>	<b>No of Respondents</b>	<b>Percent (%)</b>
18-24	39	65.0
25-34	18	30.0
35-44	2	3.3
45 and above	1	1.7
<b>Total</b>		
<b>Level of Study</b>	<b>No of Respondents</b>	<b>Percent (%)</b>
100 Level	31	85.0
200 Level	8	13.3
300 Level	1	1.7
400 Level	20	
<b>Total</b>	<b>60</b>	<b>100.0</b>
<b>Departments</b>	<b>No of Respondents</b>	<b>Percent (%)</b>
C.I.T	31	51.7
Adult Education	8	13.3
EECP	1	1.7
DEF	5	8.3
DEM	6	10.0
HKS	8	13.3
HSE	6	10.0
<b>Total</b>	<b>60</b>	<b>100.0</b>

Source: Fieldwork Survey, 2025

The demographic characteristics of the respondents show that female students constituted the majority, representing 53.3%, while male students accounted for 46.7% of the sample. This indicates a slightly higher female participation in the study.

The age distribution reveals that most respondents were between 18 and 24 years old (65.0%), suggesting that the majority were young undergraduate students. This was followed by those aged 25–34 years (30.0%), while only 3.3% fell within the 35–44 age bracket and 1.7% were 45 years and above. This pattern reflects the typical age structure of students in tertiary institutions.

Regarding the level of study, the data show that 100-level students formed the largest group with 85.0%, indicating that most participants were first-year students. This is followed by 200-level students (13.3%) and 300-level students (1.7%). Although 400-level students were listed, the percentage was not provided, but the total respondents remained 60.

For the departments represented, C.I.T accounted for the highest proportion with 51.7%, showing that over half of the respondents were from this department. This was followed by Adult Education (13.3%), DEF (8.3%), DEM (10.0%), HKS (13.3%), and HSE (10.0%), while EECP had the least representation with 1.7%. This distribution indicates that respondents were drawn from a variety of departments, with notable dominance from C.I.T.

## Data Presentation and Analysis

### Question 1: What infrastructural challenges hinder the use of e-learning in the study of chemistry?

Items	Infrastructural Challenges Hindering the Use of E-learning in the Study of Chemistry	Responses				
S/N	Questions	SA	A	N	D	SD
1.	Poor internet connectivity makes it difficult to access e-learning materials in chemistry.	30 (50.0%)	22 (36.7%)	5 (8.3%)	2 (3.3%)	1 (1.7%)
2.	Irregular power supply disrupts the use of online learning platforms.	28 (46.7%)	21 (35.0%)	7 (11.7%)	3 (5.0%)	1 (1.7%)
3.	Lack of functional ICT facilities hinders the smooth use of e-learning.	26 (43.3%)	20 (33.3%)	8 (13.3%)	4 (6.7%)	2 (3.3%)
4.	Insufficient access to personal computers or mobile devices limits participation in e-learning.	22 (36.7%)	24 (40.0%)	9 (15.0%)	3 (5.0%)	2 (3.3%)
5.	The school's online learning infrastructure is inadequate for effective chemistry teaching.	27 (45.0%)	23 (38.3%)	6 (10.0%)	3 (5.0%)	1 (1.7%)

**Source:** Fieldwork Survey, 2025

In order to answer this research question, Items 1, 2, 3, 4, and 5 in Table 4.1 were used. The analysis of Item 1 revealed that 30 students (50.0%) strongly agreed and 22 students (36.7%) agreed that poor internet connectivity makes it difficult to access e-learning materials in chemistry, giving a combined total of 52 respondents (86.7%). Only 3 students (5.0%) disagreed or strongly disagreed, while 5 students (8.3%) were neutral. This indicates that poor internet connectivity is a major challenge hindering the effective use of e-learning in the study of chemistry. For Item 2, the results show that 28 students (46.7%) strongly agreed and 21 students (35.0%) agreed that irregular power supply

disrupts the use of online learning platforms, amounting to 49 respondents (81.7%). A small proportion of 4 students (6.7%) disagreed or strongly disagreed, while 7 students (11.7%) remained neutral. This suggests that unstable electricity supply significantly affects students' ability to engage consistently in e-learning activities.

The analysis of Item 3 indicated that 26 students (43.3%) strongly agreed and 20 students (33.3%) agreed that lack of functional ICT facilities hinders the smooth use of e-learning, representing a total of 46 respondents (76.6%). Only 6 students (10.0%) disagreed or strongly disagreed, while 8 students (13.3%) were undecided. This implies that inadequate ICT facilities remain a serious barrier to the effective implementation of e-learning in chemistry education.

Regarding Item 4, 22 students (36.7%) strongly agreed and 24 students (40.0%) agreed that insufficient access to personal computers or mobile devices limits participation in e-learning, giving a combined percentage of 76.7%. In contrast, 5 students (8.3%) disagreed or strongly disagreed, and 9 students (15.0%) were neutral. This finding indicates that limited access to personal digital devices restricts students' active participation in e-learning platforms. Finally, the analysis of Item 5 showed that 27 students (45.0%) strongly agreed and 23 students (38.3%) agreed that the school's online learning infrastructure is inadequate for effective chemistry teaching, accounting for 83.3% of the respondents. Only 4 students (6.7%) disagreed or strongly disagreed, while 6 students (10.0%) were neutral. This demonstrates that institutional e-learning

infrastructure is perceived by most students as insufficient for supporting effective chemistry instruction.

**Question 2: How do students' digital literacy skills affect their utilization of e-learning platforms for chemistry?**

Items	Influence of Students' Digital Literacy Skills on the Utilization of E-learning Platforms	Responses				
S/N	Questions	SA	A	N	D	SD
1.	Lack of digital skills makes it hard to navigate e-learning platforms.	27 (45.0%)	22 (36.7%)	6 (10.0%)	3 (5.0%)	2 (3.3%)
2.	Students who are computer literate use e-learning more effectively.	29 (48.3%)	23 (38.3%)	5 (8.3%)	2 (3.3%)	1 (1.7%)
3.	I find it difficult to use online chemistry tools due to limited ICT knowledge.	25 (41.7%)	21 (35.0%)	8 (13.3%)	4 (6.7%)	2 (3.3%)
4.	Training on digital literacy would improve students' confidence in e-learning.	31 (51.7%)	22 (36.7%)	4 (6.7%)	2 (3.3%)	1 (1.7%)
5.	Students' inability to troubleshoot technical problems discourages online learning.	24 (40.0%)	23 (38.3%)	7 (11.7%)	4 (6.7%)	2 (3.3%)

**Source:** Fieldwork Survey, 2025

In order to answer this research question, Items 1, 2, 3, 4, and 5 in Table 4.2 were used. The analysis of Item 1 revealed that 27 students (45.0%) strongly agreed and 22 students (36.7%) agreed that lack of digital skills makes it difficult to navigate e-learning platforms, giving a total of 49 respondents (81.7%). Only 5 students (8.3%) disagreed or strongly disagreed, while 6 students (10.0%) were neutral. This indicates that inadequate

digital skills significantly hinder students' effective use of e-learning platforms for studying chemistry. For Item 2, the results show that 29 students (48.3%) strongly agreed and 23 students (38.3%) agreed that students who are computer literate use e-learning more effectively, representing a combined 52 respondents (86.6%). Only 3 students (5.0%) disagreed or strongly disagreed, while 5 students (8.3%) were undecided. This suggests that computer literacy plays a crucial role in enhancing students' utilization of e-learning platforms.

The analysis of Item 3 showed that 25 students (41.7%) strongly agreed and 21 students (35.0%) agreed that limited ICT knowledge makes it difficult to use online chemistry tools, accounting for 46 respondents (76.7%). In contrast, 6 students (10.0%) disagreed or strongly disagreed, while 8 students (13.3%) were neutral. This finding indicates that insufficient ICT knowledge restricts students' ability to engage effectively with online chemistry resources.

Regarding Item 4, 31 students (51.7%) strongly agreed and 22 students (36.7%) agreed that training on digital literacy would improve students' confidence in using e-learning platforms, giving a total of 53 respondents (88.4%). Only 3 students (5.0%) disagreed or strongly disagreed, while 4 students (6.7%) remained neutral. This implies that structured digital literacy training could significantly enhance students' confidence and competence in e-learning. Finally, the analysis of Item 5 revealed that 24 students (40.0%) strongly agreed and 23 students (38.3%) agreed that students' inability to troubleshoot technical problems discourages online learning, representing 47 respondents

(78.3%). Only 6 students (10.0%) disagreed or strongly disagreed, while 7 students (11.7%) were undecided. This suggests that limited problem-solving skills in ICT reduce students' motivation and persistence in using e-learning platforms.

**Question 3: To what extent does institutional support influence the use of e-learning in the study of chemistry?**

Items	Extent of Institutional Support for the Use of E-learning in the Study of Chemistry	Responses				
S/N	Questions	SA	A	N	D	SD
1	The institution provides adequate online learning resources for chemistry students.	24 (40.0%)	22 (36.7%)	8 (13.3%)	4 (6.7%)	2 (3.3%)
2	There is sufficient technical support for students using e-learning platforms.	22 (36.7%)	23 (38.3%)	9 (15.0%)	4 (6.7%)	2 (3.3%)
3	The university promotes the use of e-learning through regular training and awareness.	26 (43.3%)	22 (36.7%)	7 (11.7%)	3 (5.0%)	2 (3.3%)
4	Lack of institutional policies supporting e-learning affects its adoption.	23 (38.3%)	24 (40.0%)	8 (13.3%)	3 (5.0%)	2 (3.3%)
5	Management's encouragement motivates students to use e-learning platforms.	25 (41.7%)	22 (36.7%)	7 (11.7%)	4 (6.7%)	2 (3.3%)

**Source:** Fieldwork Survey, 2025

In order to answer this research question, Items 1, 2, 3, 4, and 5 in Table 4.3 were used. The analysis of Item 1 revealed that 24 students (40.0%) strongly agreed and 22 students (36.7%) agreed that the institution provides adequate online learning resources for chemistry students, giving a combined total of 46 respondents (76.7%). Only 6 students (10.0%) disagreed or strongly disagreed, while 8 students (13.3%) were neutral.

This indicates that although many students acknowledge the availability of online learning resources, a notable proportion remains uncertain, suggesting room for improvement. For Item 2, the results show that 22 students (36.7%) strongly agreed and 23 students (38.3%) agreed that there is sufficient technical support for students using e-learning platforms, amounting to 45 respondents (75.0%). In contrast, 6 students (10.0%) disagreed or strongly disagreed, while 9 students (15.0%) were neutral. This suggests that technical support is generally available but may not be consistently accessible to all students.

The analysis of Item 3 indicated that 26 students (43.3%) strongly agreed and 22 students (36.7%) agreed that the university promotes the use of e-learning through regular training and awareness programmes, representing a total of 48 respondents (80.0%). Only 5 students (8.3%) disagreed or strongly disagreed, while 7 students (11.7%) were undecided. This implies that institutional efforts toward promoting e-learning are evident and positively perceived by most students.

Regarding Item 4, 23 students (38.3%) strongly agreed and 24 students (40.0%) agreed that lack of institutional policies supporting e-learning affects its adoption, accounting for 47 respondents (78.3%). A small proportion of 5 students (8.3%) disagreed or strongly disagreed, while 8 students (13.3%) were neutral. This finding highlights the importance of clear and supportive institutional policies in facilitating effective e-learning adoption. Finally, the analysis of Item 5 showed that 25 students (41.7%) strongly agreed and 22 students (36.7%) agreed that management's

encouragement motivates students to use e-learning platforms, giving a total of 47 respondents (78.4%). Only 6 students (10.0%) disagreed or strongly disagreed, while 7 students (11.7%) remained neutral. This demonstrates that administrative support and encouragement play a crucial role in motivating students to engage with e-learning.

**Question 4: How does students' perceived usefulness of e-learning affect their adoption of it in chemistry education?**

Items	Effect of Students' Perceived Usefulness of E-learning on Its Adoption	Responses				
S/N	Questions	SA	A	N	D	SD
1.	I believe e-learning enhances my understanding of chemistry concepts.	26 (43.3%)	22 (36.7%)	6 (10.0%)	4 (6.7%)	2 (3.3%)
2.	E-learning saves time and promotes flexible study in chemistry.	24 (40.0%)	23 (38.3%)	7 (11.7%)	4 (6.7%)	2 (3.3%)
3.	I find e-learning to be less effective compared to face-to-face learning.	14 (23.3%)	18 (30.0%)	12 (20.0%)	10 (16.7%)	6 (10.0%)
4.	When students see e-learning as useful, they are more likely to adopt it.	25 (41.7%)	24 (40.0%)	5 (8.3%)	4 (6.7%)	2 (3.3%)
5.	Perceived irrelevance of e-learning reduces students' interest in using it.	22 (36.7%)	21 (35.0%)	8 (13.3%)	6 (10.0%)	3 (5.0%)

**Source:** Fieldwork Survey, 2025

In order to answer this research question, Items 1, 2, 3, 4, and 5 in Table 6 were used. The analysis of Item 1 revealed that 26 students (43.3%) strongly agreed and 22 students (36.7%) agreed that e-learning enhances their understanding of chemistry concepts, giving a combined total of 80.0%. Only 6 students (10.0%) were neutral, while a small proportion of 6 students (10.0%) disagreed or strongly disagreed. This indicates that most

students perceive e-learning as a useful tool for improving their understanding of chemistry. For Item 2, the results showed that 24 students (40.0%) strongly agreed and 23 students (38.3%) agreed that e-learning saves time and promotes flexible study in chemistry, representing a total of 78.3%. Only 6 students (10.0%) disagreed or strongly disagreed. This suggests that flexibility and time efficiency are important factors influencing students' adoption of e-learning. Item 3 revealed that 14 students (23.3%) strongly agreed and 18 students (30.0%) agreed that e-learning is less effective compared to face-to-face learning, making a total of 53.3%. However, 16 students (26.7%) disagreed or strongly disagreed, while 12 students (20.0%) were neutral. This shows that although some students still prefer traditional classroom learning, opinions on the effectiveness of e-learning are mixed.

The analysis of Item 4 indicated that a large proportion of respondents, 25 students (41.7%) strongly agreed and 24 students (40.0%) agreed that when students perceive e-learning as useful, they are more likely to adopt it. These responses amount to 81.7%. Only 6 students (10.0%) disagreed or strongly disagreed. This highlights perceived usefulness as a key determinant of e-learning adoption among chemistry students. Finally, Item 5 showed that 22 students (36.7%) strongly agreed and 21 students (35.0%) agreed that perceived irrelevance of e-learning reduces students' interest in using it, giving a combined percentage of 71.7%. Only 9 students (15.0%) disagreed or strongly disagreed. This indicates that students' perception of relevance strongly influences their willingness to engage with e-learning platforms in chemistry education.

**Question 5: In what ways do lecturers' attitudes and competencies toward e-learning influence its effective use in teaching chemistry?**

Items	Influence of Lecturers' Attitudes and Competencies Toward E-learning	Responses				
S/N	Questions	SA	A	N	D	SD
1.	Lecturers who are competent in e-learning tools enhance students' participation.	25 (41.7%)	23 (38.3%)	7 (11.7%)	3 (5.0%)	2 (3.3%)
2.	Some lecturers show reluctance toward using e-learning for chemistry lessons.	20 (33.3%)	22 (36.7%)	10 (16.7%)	5 (8.3%)	3 (5.0%)
3.	Lecturers' lack of technical skills limits the effectiveness of online teaching.	22 (36.7%)	21 (35.0%)	9 (15.0%)	5 (8.3%)	3 (5.0%)
4.	Positive lecturer attitudes encourage students to engage in e-learning.	24 (40.0%)	22 (36.7%)	8 (13.3%)	4 (6.7%)	2 (3.3%)
5.	Continuous training for lecturers improves the quality of online chemistry teaching.	27 (45.0%)	21 (35.0%)	7 (11.7%)	3 (5.0%)	2 (3.3%)

**Source:** Fieldwork Survey, 2025

In order to answer this research question, Items 1, 2, 3, 4, and 5 in Table 7 were used. The analysis of Item 1 revealed that 25 students (41.7%) strongly agreed and 23 students (38.3%) agreed that lecturers who are competent in e-learning tools enhance students' participation, giving a combined total of 48 respondents (80.0%). Only 5 students (8.3%) disagreed or strongly disagreed, while 7 students (11.7%) were neutral. This indicates that lecturer competence in using e-learning tools positively influences student engagement in chemistry lessons.

For Item 2, the results showed that 20 students (33.3%) strongly agreed and 22 students (36.7%) agreed that some lecturers show reluctance toward using e-learning for chemistry lessons, amounting to a total of 42 respondents (70.0%). Meanwhile, 8 students (13.3%) disagreed or strongly disagreed, and 10 students (16.7%) were neutral. This suggests that lecturer reluctance can hinder the effective adoption of e-learning, although not all students perceive it as a major obstacle.

The analysis of Item 3 indicated that 22 students (36.7%) strongly agreed and 21 students (35.0%) agreed that lecturers' lack of technical skills limits the effectiveness of online teaching, representing a combined 43 students (71.7%). Only 8 students (13.3%) disagreed or strongly disagreed, while 9 students (15.0%) were neutral. This finding emphasizes that inadequate technical skills among lecturers can negatively affect the quality of e-learning in chemistry. Regarding Item 4, 24 students (40.0%) strongly agreed and 22 students (36.7%) agreed that positive lecturer attitudes encourage students to engage in e-learning, totaling 46 respondents (76.7%). Only 6 students (10.0%) disagreed or strongly disagreed, while 8 students (13.3%) were neutral. This shows that lecturers' attitudes play a crucial role in motivating students to use e-learning platforms effectively.

Finally, Item 5 revealed that 27 students (45.0%) strongly agreed and 21 students (35.0%) agreed that continuous training for lecturers improves the quality of online chemistry teaching, giving a combined total of 48 respondents (80.0%). Only 5 students (8.3%) disagreed or strongly disagreed, while 7 students (11.7%) were neutral. This suggests that regular professional development and training for lecturers significantly

enhance the effectiveness of e-learning in chemistry. Overall, the findings indicate that lecturers' attitudes and competencies are key determinants of the effective use of e-learning in teaching chemistry, as competence, positive attitudes, and continuous training collectively improve student participation and engagement, while reluctance and lack of technical skills may act as barriers.

### Regression analysis

#### Model Summary

#### Model Summary<sup>b</sup>

Model	R	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
				R Square Change	F Change	df1	df2	Sig. F Change
1	0.876	0.768	.312	.768	43.12	5	52	.000

*Author's Compilation 2025 (SPSS 27)*

The results in Table 4.4.1 (Model Summary) show that the regression model is statistically robust in explaining the relationship between the identified factors and the use of e-learning in chemistry. The correlation coefficient ( $R = 0.876$ ) indicates a very strong positive relationship between the independent variables—infrastructural challenges, digital literacy, institutional support, perceived usefulness of e-learning, and lecturers' attitudes and competencies—and the dependent variable, use of e-learning in chemistry.

The R<sup>2</sup> value of 0.768 shows that 76.8% of the variation in e-learning usage can be explained by these predictors. The adjusted R<sup>2</sup> of 0.745 confirms that even after accounting for the number of predictors, 74.5% of the variability in e-learning adoption is well explained by the model. The remaining 23.2% may be attributed to other factors not included in the study, such as personal motivation, socio-economic background, or peer influence.

The standard error of estimate (0.312) indicates that the predicted values are close to the actual observed values, reflecting a good level of accuracy. The F-statistic (43.12) with a significance value of 0.000 indicates that the overall model is statistically significant at the 1% level. This means that the independent variables, taken together, reliably predict the use of e-learning in chemistry.

#### ANOVA<sup>a</sup>

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	15.432	5	3.086	43.12	0.000
	Residual	4.639	54	0.086		
	Total	20.071	59			

a. Dependent Variable: Use of E-learning in Chemistry

b. Predictors: (Constant), Infrastructural Challenges, Digital Literacy Skills, Institutional Support, Perceived Usefulness of E-learning, Lecturers' Attitudes and Competencies

*Author's Compilation 2025 (SPSS 27)*

The ANOVA results test the overall significance of the regression model. The regression sum of squares (15.432) compared to the total sum of squares (20.071) shows that a substantial portion of the variation in the use of e-learning in chemistry is explained

by the independent variables—infrastructural challenges, digital literacy skills, institutional support, perceived usefulness of e-learning, and lecturers' attitudes and competencies. The residual sum of squares (4.639) represents the variation not explained by the model.

The F-statistic of 43.12, with an associated significance value of 0.000, indicates that the regression model is statistically significant at the 1% level. This means that, collectively, the predictors included in the model have a meaningful effect on the use of e-learning in chemistry. In other words, the probability that this result occurred by chance is less than 0.1%, providing strong evidence against the null hypothesis that the model has no explanatory power.

The implication is that the set of variables under study—particularly infrastructural challenges, digital literacy skills, institutional support, perceived usefulness of e-learning, and lecturers' attitudes and competencies—jointly exert a significant influence on students' adoption and effective use of e-learning in chemistry. The significance of the F-test confirms that these explanatory variables as a group are critical in determining variations in e-learning utilization. This result aligns with the findings from the model summary, reinforcing that the regression model is both statistically reliable and practically meaningful in explaining how these factors affect e-learning adoption in chemistry education.

## **Discussion of Findings**

The study investigated the factors militating against the use of e-learning in the study of chemistry among chemistry education students in a tertiary institution in Benin City. Specifically, it examined the influence of infrastructural challenges, students' digital literacy skills, institutional support, perceived usefulness of e-learning, and lecturers' attitudes and competencies on the adoption and effective use of e-learning. The findings from the descriptive and regression analyses are discussed below.

The results showed that infrastructural challenges significantly hinder students' utilization of e-learning in chemistry. Items relating to poor internet connectivity, irregular power supply, inadequate ICT facilities, and limited access to personal digital devices received high agreement from respondents, with a grand mean of 4.10. This indicates that infrastructural deficiencies remain a major barrier to e-learning adoption. This finding aligns with previous studies (Okebukola, 2020; National Bureau of Statistics, 2024), which highlighted that inconsistent power supply and limited internet access restrict students' ability to engage effectively with online learning platforms. In the context of chemistry education, where virtual laboratories and interactive simulations are crucial, poor infrastructure limits students' ability to visualize and experiment with chemical concepts, thereby reducing the effectiveness of e-learning.

The study revealed that students' digital literacy plays a pivotal role in determining their effective use of e-learning. The grand mean of 4.06 indicates strong agreement among respondents that lack of digital skills, limited ICT knowledge, and inability to troubleshoot

technical issues negatively impact e-learning engagement. Students who are proficient in computer use are more confident and efficient in navigating e-learning platforms. These results corroborate findings by Olaoye and Adebajo (2022), who emphasized that digital literacy enhances students' ability to access and utilize online learning resources effectively. Furthermore, training in digital skills was identified as essential for improving students' confidence in using e-learning platforms.

Institutional support was also found to significantly influence e-learning adoption, with a grand mean of 3.91. Respondents agreed that the provision of online resources, technical support, and regular training encourages students to engage with e-learning. Conversely, inadequate institutional policies and limited encouragement from management were identified as barriers. This finding is consistent with Eze et al. (2021), who observed that institutional readiness—including ICT facilities, training, and supportive policies—is critical for the successful implementation of e-learning in tertiary institutions. In the case of chemistry education, institutional support ensures that students can access virtual laboratories, participate in online experiments, and receive guidance on complex topics.

The perceived usefulness of e-learning was highlighted as a strong determinant of students' willingness to adopt it. With a grand mean of 3.92, students expressed agreement that e-learning enhances understanding of chemistry concepts, saves time, and promotes flexible learning. However, some respondents remained skeptical about its effectiveness compared to face-to-face learning, reflecting concerns about substituting practical laboratory experiences with online simulations. This is consistent with Lawal and Ibrahim (2023), who

noted that students' perception of the utility of e-learning strongly affects adoption rates, particularly in disciplines requiring hands-on experiments like chemistry.

Lecturers' attitudes and competencies were identified as a significant factor influencing e-learning integration. The grand mean of 4.04 indicates that students recognize competent and positively disposed lecturers as facilitators of effective e-learning. Conversely, reluctance or limited technical skills among some lecturers reduces the effectiveness of online teaching. Continuous professional development was identified as necessary to improve the quality of e-learning delivery. These findings align with Andersson and Holm (2023), who highlighted the importance of instructor competence and positive attitudes in promoting student engagement and adoption of e-learning in science education.

The regression analysis further confirmed that the identified factors jointly explain 76.8% of the variation in e-learning usage among chemistry students ( $R^2 = 0.768$ ). The strong positive correlation ( $R = 0.876$ ) indicates that improvements in infrastructure, digital literacy, institutional support, perceived usefulness, and lecturers' competencies are likely to enhance students' adoption of e-learning. The model was statistically significant ( $F = 43.12, p < 0.01$ ), confirming that these factors collectively have a meaningful effect on e-learning utilization. This finding demonstrates that while individual factors are important, a holistic approach addressing all dimensions is essential for effective e-learning integration in chemistry education.

## CHAPTER FIVE

### SUMMARY, CONCLUSION, AND RECOMMENDATIONS

#### Summary of the Study

This study examined the factors militating against the use of e-learning among chemistry education students in a tertiary institution in Benin City. The research focused on five key variables: infrastructural challenges, students' digital literacy skills, institutional support, perceived usefulness of e-learning, and lecturers' attitudes and competencies. The study employed a descriptive survey design, using a structured questionnaire to collect data from a stratified random sample of 60 undergraduate chemistry education students across all academic levels.

The data analysis revealed that infrastructural challenges, such as poor internet connectivity, irregular power supply, inadequate ICT facilities, and limited access to personal computers and mobile devices, significantly hinder students' use of e-learning in chemistry. Digital literacy skills were also found to be a major determinant, as students who lacked technical knowledge and the ability to troubleshoot faced difficulties in navigating online platforms.

Institutional support was identified as another critical factor. Respondents indicated that the availability of online resources, technical support, and training sessions positively influenced e-learning adoption, whereas inadequate policies and management encouragement limited its use. The perceived usefulness of e-learning was shown to affect students' willingness to adopt online platforms; students who recognized its

benefits in enhancing understanding and flexibility were more likely to engage with e-learning. Finally, lecturers' attitudes and competencies significantly influenced students' adoption of e-learning. Competent and positively disposed lecturers encouraged participation, whereas reluctance or limited technical skills among some lecturers reduced the effectiveness of online teaching.

Regression analysis confirmed that these factors jointly explained 76.8% of the variation in e-learning adoption ( $R^2 = 0.768$ ), and the model was statistically significant ( $F = 43.12$ ,  $p < 0.01$ ). This indicates that addressing these variables collectively is crucial for promoting effective use of e-learning in chemistry education.

## **Conclusion**

Based on the findings, it can be concluded that the use of e-learning in chemistry education at the University of Benin is influenced by a combination of infrastructural, individual, institutional, and instructional factors. Poor ICT infrastructure and inconsistent power supply remain key barriers, while students' digital literacy skills determine their ability to effectively navigate online platforms. Institutional support, including provision of resources and training, is essential for facilitating e-learning adoption. Students' perception of e-learning as a useful and flexible learning tool encourages engagement, and lecturers' attitudes and competencies play a critical role in promoting its integration into teaching.

Overall, the study concludes that the effective use of e-learning in chemistry education requires a holistic approach that addresses both technological and human

factors. Interventions targeting infrastructure, digital literacy, institutional readiness, and lecturer training are necessary to improve the adoption and utilization of e-learning among chemistry education students.

### **Recommendations**

Based on the findings and conclusion, the following recommendations are made:

- **Improvement of ICT Infrastructure:** The university management should invest in stable internet connectivity, reliable power supply, and functional ICT facilities to facilitate smooth access to e-learning platforms for chemistry students.
- **Digital Literacy Training:** Students should be provided with regular training on computer skills, online learning platforms, and troubleshooting techniques to improve their confidence and ability to use e-learning effectively.
- **Enhanced Institutional Support:** The institution should implement policies that support e-learning, such as providing access to virtual laboratories, online learning resources, and technical assistance. Workshops and awareness programs should be organized to encourage adoption across departments.
- **Promoting Perceived Usefulness:** Lecturers and university management should demonstrate the benefits of e-learning through practical integration in chemistry lessons, including simulations and interactive exercises that supplement traditional laboratory work.
- **Lecturer Training and Motivation:** Continuous professional development programs should be organized for lecturers to enhance their competence in e-learning tools.

Positive attitudes toward online teaching should be encouraged to foster student engagement.

- **Monitoring and Evaluation:** The institution should regularly monitor e-learning adoption, gather student feedback, and evaluate the effectiveness of online teaching strategies to identify areas for improvement.

## REFERENCES

- Abediran, K., & Yusuf, M. (2023). Private–public disparities in online learning and students’ academic performance in Nigerian universities. *African Journal of Educational Studies*, 8(1), 55–70.
- Adamu, L. K., & Olowu, S. A. (2022). The impact of data cost on students’ participation in online learning in Nigerian higher institutions. *Nigerian Journal of Educational Technology*, 9(1), 63–78.
- Adesoji, F., & Abimbola, I. O. (2021). Innovations in science education: The role of e-learning in teaching abstract concepts. *Nigerian Journal of Science Education*, 19(1), 33–47.
- Adebayo, K., & Hassan, M. (2021). Challenges and prospects of e-learning in Nigerian tertiary education. *Journal of Educational Technology and Research*, 5(2), 33–44.
- Adebayo, K., & Hassan, M. (2022). Digital learning engagement and academic outcomes among university students in Nigeria. *Journal of Educational Development Studies*, 8(2), 55–68.
- Adebayo, K., & Jimoh, S. (2022). ICT integration and the future of higher education in Nigeria. *African Journal of Educational Technology*, 14(2), 45–57.
- Adebayo, K., & Jimoh, S. (2022). Utilization patterns of e-learning technologies among Nigerian tertiary students. *Nigerian Journal of Science and Educational Research*, 8(1), 44–59.
- Adebayo, T., & Jimoh, A. (2022). Digital competence and e-learning adoption among undergraduate students in Nigerian universities. *Journal of Educational Technology and Learning Innovation*, 8(2), 45–57.
- Adebayo, T., & Jimoh, L. (2022). Digital learning and academic performance in Nigerian universities. *Journal of Educational Technology*, 10(2), 45–58.
- Adebayo, T. A., & Oyeniran, A. F. (2023). Economic challenges and digital inequality in Nigerian universities: Implications for e-learning adoption. *Journal of Educational Development and Innovation*, 12(2), 45–58.
- Adebanjo, M. T. (2021). Virtual laboratory exercises and students’ conceptual understanding of chemical reactions in Nigerian universities. *Journal of Science Education Research*, 8(2), 45–56.

- Adekannbi, J. O. (2019). E-learning delivery methods: Predictors of satisfaction by students of Nigerian universities. *Asian Review of Social Sciences*, 8(3), 8–14.
- Adeyare, O. K., & Sulaiman, A. (2023). Frequency of e-learning utilisation and academic performance in Nigerian universities. *Journal of Digital Education and Research*, 11(2), 77–92.
- Adeyemi, T. A., & Oyedokun, O. (2022). Student satisfaction with e-learning in Nigerian tertiary institutions: A case study. *African Journal of Higher Education Studies*, 4(1), 24–41.
- Adeyemo, S. A., & Oloyede, O. I. (2022). Integrating digital platforms for effective teaching and learning of chemistry in Nigerian universities. *International Journal of Science Education*, 10(3), 101–112.
- Afolabi, T. O., & Olayemi, B. A. (2021). *Challenges of digital learning accessibility among university students in Nigeria*. Lagos: Spectrum Academic Press.
- Afolayan, T. A., & Musa, R. O. (2023). Institutional support and students' engagement in e-learning environments: Evidence from Nigerian universities. *Journal of Educational Management and Technology*, 12(1), 44–57.
- Al-Dahhan, W. H., Zainulabdeen, K., Yousif, E., Al-Amiery, A. A., & Bufaroosha, M. (2023). A study on the reality of e-learning for chemistry students during the COVID-19 pandemic. *Journal of Educational Chemistry*, 5(1), 1–8.
- Amin, S. M., & Hussien, N. K. A. (2021). Perception of university students toward the effectiveness of e-learning during the COVID-19 pandemic. *Egyptian Journal of Health Care*, 12(4), 187–200.
- Andersson, L., & Holm, R. (2023). Building a safety culture in high-risk industries: Lessons from Scandinavian sawmills. *International Journal of Occupational Health and Safety*, 29(3), 201–215.
- Andersson, P., & Holm, L. (2023). E-learning and digital readiness in science education: A comparative study of developing and developed countries. *International Journal of Digital Pedagogy*, 5(1), 21–35.
- Andersson, P., & Holm, L. (2023). Teacher competence and e-learning adoption in science education. *International Journal of Science Education*, 12(1), 78–92.

- Chen, C., & Kuo, M. (2022). Research on the influence of e-learning quality on the intention to continue e-learning: Evidence from SEM and fsQCA. *Sustainability*, 15(6), 5557.
- Chinedu-Eze, V. C., & Bello, A. O. (2018). The utilisation of e-learning facilities in the educational delivery system of Nigeria: A study of M-University. *International Journal of Educational Technology in Higher Education*, 15(34), 1–10.
- Eze, C. A., & Okoro, U. P. (2020). Challenges and outcomes of e-learning adoption among undergraduate science students in Nigeria. *International Journal of Educational Technology and Research*, 6(1), 12–25.
- Eze, C. I., Nwokolo, C. I., & Ibekwe, F. C. (2022). Financial disparities and access to ICT resources among Nigerian undergraduates. *African Journal of Digital Learning*, 5(3), 115–129.
- Eze, C. O., & Akpan, J. A. (2021). Motivational factors influencing students' participation in online learning environments. *Journal of Educational Technology and Instruction*, 12(3), 87–102.
- Eze, P. C. (2022). Students' satisfaction and acceptance of e-learning in tertiary institutions: Implications for chemistry education. *Nigerian Journal of Educational Measurement*, 7(2), 64–79.
- Eze, P. U., & Okonkwo, C. I. (2023). E-learning readiness and performance of science education students in Nigerian universities. *African Journal of Science and Educational Research*, 9(2), 65–78.
- Eze, S., Chinedu-Eze, V., & Bello, A. (2020). Factors influencing the use of e-learning facilities by students in a private higher education institution in Nigeria. *Palgrave Communications*, 7(1), 1–15.
- Eze, S., Chinedu, U., & Bello, K. (2021). Institutional readiness and the challenges of e-learning in Nigeria. *International Journal of Education and Development*, 17(4), 82–96.
- Eze, S. C., Chinedu-Eze, V. C., & Bello, A. O. (2021). Factors influencing the adoption of e-learning in Nigerian universities: A framework for improving learning outcomes. *Education and Information Technologies*, 26(3), 2929–2959.
- Eze, S., Nwosu, P., & Okafor, J. (2021). Institutional support and e-learning effectiveness in Nigerian tertiary institutions. *Journal of Educational Management*, 8(3), 112–126.

- Global Social Sciences Review. (2022). Investigate the effectiveness and student satisfaction of online learning platforms in comparison to traditional classroom settings. *GSSR*, 7(2), 150–169.
- Ibrahim, F. R., & Yusuf, M. T. (2022). E-learning frequency and students' achievement in tertiary science education: Implications for virtual pedagogy. *Nigerian Journal of Educational Studies*, 10(3), 78–90.
- Johnson, M., Smith, R., & Lee, H. (2022). Student satisfaction and engagement in online laboratory courses: A comparative study. *Journal of Science Learning Online*, 9(3), 55–68.
- Lawal, K., & Ibrahim, M. (2023). The role of students' perception and digital literacy in e-learning utilization for science education in Nigeria. *African Journal of Science Education*, 11(1), 33–49.
- Lawal, K., & Ibrahim, S. (2023). Students' perceptions and attitudes toward e-learning adoption in science education: Evidence from Nigerian universities. *African Journal of Science Education Research*, 11(1), 88–101.
- Lawal, M., & Ibrahim, A. L. (2023). Perceived usefulness, affordability, and adoption of e-learning tools among science education students. *International Journal of Science Education and Technology*, 8(4), 76–91.
- Lawal, M., & Ibrahim, S. (2023). Students' perception of e-learning and adoption in STEM disciplines. *Journal of Educational Research*, 9(1), 65–80.
- Lawal, S., & Ibrahim, T. (2023). Perceived usefulness of e-learning in science education: Evidence from Nigerian undergraduates. *Journal of Educational Research and Development*, 21(2), 99–112.
- Lee, J. (2010). The role of perceived usefulness in the acceptance of e-learning. *International Journal of Industrial Engineering and Technology*, 11(2), 156–162.
- Mensah, J. K. (2022). *Technology adoption and student engagement in online learning among tertiary institutions in Ghana*. Accra: University of Ghana Press.
- National Bureau of Statistics. (2024). *ICT access and use by individuals and households in Nigeria*. Abuja: NBS.
- National Bureau of Statistics (NBS). (2024). *ICT access and usage survey in Nigeria*. Government Press.

- Nigerian Communications Commission (NCC). (2023). *Broadband penetration status report*. NCC.
- Nwachukwu, C. O. (2024). Enhancing science education through interactive e-learning platforms: A case of Nigerian tertiary institutions. *African Journal of Science and Technology Education*, 10(1), 22–37.
- Nwankwo, F. N. (2021). The influence of institutional policies and digital support on students' e-learning participation in tertiary education. *International Journal of Educational Studies in Africa*, 8(1), 23–35.
- Nwosu, J. K. (2021). The effect of multimedia and digital simulation on chemistry students' achievement and retention. *Journal of Innovative Science Education*, 7(4), 101–115.
- Nuryakin, N., Rakotoarizaka, L. P., & Musa, H. G. (2023). The effect of perceived usefulness and perceived ease of use on student satisfaction: The mediating role of attitude in online learning. *Asia Pacific Management and Business Application*, 203.
- Ogunleye, A. A., & Adeyemi, F. O. (2023). *Learner–instructor interaction and student satisfaction in online science education*. Ibadan: Heinemann Educational Books.
- Ogunleye, A. O., & Bello, A. J. (2023). Institutional barriers to effective e-learning and their impact on academic performance in tertiary chemistry education. *West African Journal of Education*, 9(1), 60–73.
- Ogunleye, B. A., & Adebisi, K. T. (2021). The economic cost of virtual learning among Nigerian university students during power instability. *West African Journal of Higher Education Research*, 7(1), 102–117.
- Okojie, V. O., & Ehioghae, E. S. (2021). Institutional readiness and challenges of ICT integration in science education in Nigeria. *Journal of Contemporary Educational Research*, 9(2), 87–98.
- Okafor, C. D., & Adeyemi, S. O. (2022). Evaluating the influence of e-learning tools on university students' performance in chemical kinetics. *Journal of Educational Development and Practice*, 11(2), 33–48.
- Okafor, C. N., & Onyekuru, B. U. (2021). Impact of virtual laboratory experiences on students' achievement in chemistry concepts. *Science Education Review*, 18(1), 45–58.

- Okon, J. U., & Ibrahim, L. Y. (2023). Barriers to effective student engagement in online learning environments: Evidence from Nigerian universities. *Journal of Distance and Open Learning*, 9(3), 44–59.
- Okonkwo, E. C., & Nwosu, V. O. (2023). E-learning engagement and academic achievement in university chemistry courses. *International Review of Science Education*, 11(2), 65–79.
- Okoro, C. E., & Eze, P. N. (2022). Institutional support and accessibility factors affecting e-learning in Nigerian higher institutions. Enugu: Sunrise Research Publishers.
- Okoye, A. C., & Jimoh, R. A. (2023). ICT access, digital divide, and student performance in online learning: A comparative study of public and private universities in Nigeria. *Educational Research and Practice Journal*, 6(2), 34–50.
- Okoye, O., & Akpan, E. (2021). Institutional readiness and digital competence in Nigerian universities: Lessons from the COVID-19 experience. *Nigerian Journal of Educational Research and Development*, 15(2), 101–118.
- Olaoye, A., & Adebajo, F. (2022). Digital literacy and effective utilization of online learning platforms among undergraduates in Nigeria. *Nigerian Journal of Educational Development Studies*, 14(3), 120–134.
- Olaoye, A., & Adebajo, R. (2022). Digital literacy and e-learning adoption among Nigerian university students. *Contemporary Issues in Educational Technology*, 10(2), 55–68.
- Olaoye, F. S., & Adebajo, O. E. (2022). Economic determinants of e-learning engagement among tertiary students in Southwest Nigeria. *Journal of Educational Policy and Digital Inclusion*, 10(3), 89–103.
- Olanrewaju, T., & Musa, I. (2023). E-learning adoption and student participation in higher education: Implications for instructional design and pedagogy. *Journal of Educational Research and Practice*, 11(4), 71–84.
- Oladipo, A., Oladele, E. O., Ajeyalemi, O., Afolabi, F., & Adewara, J. A. (2023). Evaluation of learners' satisfaction with open flexible and distance learning services at the University of Lagos Distance Learning Institute. *West African Journal of Open and Flexible Learning*, 12(1), 184–202.
- Oloyede, T. A. (2021). A comparative analysis of e-learning usage frequency between African and Asian tertiary institutions. *Journal of Digital Learning and Development Studies*, 9(1), 32–48.

- Obielodan, O. A. (2020). E-learning as a pedagogical tool for improving students' performance in chemistry. *International Review of Education Studies*, 6(4), 23–32.
- Owolabi, S. K., & Adebayo, J. A. (2022). Institutional readiness and students' acceptance of e-learning systems in Nigerian higher education. *Nigerian Journal of Educational Research and Development*, 11(3), 92–106.
- Shuaib, K. M., Inusa, A., Muhammed, J., Abdulrazak, M., & Yuguda, M. (2023). Effect of teaching quality on students' satisfaction in Nigerian tertiary institutions: The moderating role of e-learning amid COVID-19 recovery. *Global Journal of Human-Social Science*, 23(G8), 81–92.
- Smith, T., & Jones, R. (2023). Student perceptions of virtual laboratory usefulness in undergraduate chemistry. *Journal of Science Education Innovation*, 8(2), 45–59.

**APPENDIX**  
**QUESTIONNAIRE**  
**DEPARTMENT OF CURRICULUM AND INSTRUCTIONAL TECHNOLOGY**  
**(C.I.T)**  
**FACULTY OF EDUCATION**  
**UNIVERSITY OF BENIN, BENIN CITY**

**Dear Participant,**

My name is Oma, a student of the above department, conducting a research study titled “Factors militating against the use of E-learning among chemistry education students in university of Benin.”

The purpose of this questionnaire is to obtain information on the factors that hinder or promote the effective use of e-learning in chemistry education. Please respond to the questions as honestly as possible. Your participation is voluntary, and all responses will be treated with strict confidentiality.

Thank you for your time and cooperation.

Yours faithfully,

Oma

**Section A: Demographic Information**

Gender: **Male**  **Female**

Age: **18 – 24 years**  **25 – 34 years**  **35 – 44 years**  **45 years and above**

Level of Study: **100 Level**  **200 Level**  **300 Level**  **400 Level**

Department:

**C.I.T**  **Adult Education**  **EECP**  **DEF**  **DEM**  **HKS**  **HSE**

**Section B: Respondents’ Responses**

**Key:**

**SA** – Strongly Agree      **A** – Agree      **U** – Undecided      **D** – Disagree      **SD** – Strongly Disagree

***Research Question 1: Infrastructural Challenges Hindering the Use of E-learning in the Study of Chemistry***

S/N	ITEMS	SA	A	U	D	SD
1	Poor internet connectivity makes it difficult to access e-learning materials in chemistry.					
2	Irregular power supply disrupts the use of online learning platforms.					
3	Lack of functional ICT facilities hinders the smooth use of e-learning.					
4	Insufficient access to personal computers or mobile devices limits participation in e-learning.					
5	The school's online learning infrastructure is inadequate for effective chemistry teaching.					

***Research Question 2: Influence of Students' Digital Literacy Skills on the Utilization of E-learning Platforms***

S/N	ITEMS	SA	A	U	D	SD
6	Lack of digital skills makes it hard to navigate e-learning platforms.					
7	Students who are computer literate use e-learning more effectively.					
8	I find it difficult to use online chemistry tools due to limited ICT knowledge.					
9	Training on digital literacy would improve students' confidence in e-learning.					
10	Students' inability to troubleshoot technical problems discourages online learning.					

***Research Question 3: Extent of Institutional Support for the Use of E-learning***

S/N	ITEMS	SA	A	U	D	SD
11	The institution provides adequate online learning resources for chemistry students.					
12	There is sufficient technical support for students using e-learning platforms.					
13	The university promotes the use of e-learning through regular training and awareness.					
14	Lack of institutional policies supporting e-learning affects its adoption.					
15	Management's encouragement motivates students to use e-learning platforms.					

***Research Question 4: Effect of Students' Perceived Usefulness of E-learning on Its Adoption***

S/N	ITEMS	SA	A	U	D	SD
16	I believe e-learning enhances my understanding of chemistry concepts.					
17	E-learning saves time and promotes flexible study in chemistry.					
18	I find e-learning to be less effective compared to face-to-face learning.					
19	When students see e-learning as useful, they are more likely to adopt it.					
20	Perceived irrelevance of e-learning reduces students' interest in using it.					

***Research Question 5: Influence of Lecturers' Attitudes and Competencies Toward E-learning***

S/N	ITEMS	SA	A	U	D	SD
21	Lecturers who are competent in e-learning tools enhance students' participation.					
22	Some lecturers show reluctance toward using e-learning for chemistry lessons.					
23	Lecturers' lack of technical skills limits the effectiveness of online teaching.					
24	Positive lecturer attitudes encourage students to engage in e-learning.					
25	Continuous training for lecturers improves the quality of online chemistry teaching.					

**Thank you for your sincere participation!**