

**Technology Enhanced Learning: A Case Study of the  
Potentials of Mobile Technologies in Nigerian College of  
Education**

Arit Etim Tabowei

A thesis submitted in partial fulfilment of the requirement of the University of the  
West of England for the degree of

DOCTOR OF PHILOSOPHY

Faculty of Environment and Technology, University of the West of England  
Bristol

June 2021

## **Abstract**

Technology has proven to be an effective tool and a driving force for developments in the education sector, hence the term “technology enhanced learning” (TEL). Despite the continuous impact of technology in education, the lack of TEL in teacher education institutions in Nigeria has created a technological gap between learners in the teacher training institution (College of Education), and their contemporaries in other higher institutions. The primary goal of College of Education is to train students in various fields of expertise to become teachers. However, if they must function in the imminent digital era as educators, they need to learn with, and learn how to teach with technology. Using the cultural historical activity theory (CHAT), this qualitative study adopted a phenomenological case study methodology, to understand the factors affecting technology integration in Federal College of Education (Technical) Asaba, and to reveal the potentials of mobile technologies to enhance learning. The findings revealed the need to re-evaluate the structure of teacher education as poor infrastructure, unproductive professional development training on ICT integration in the classroom, lack of emphasis on teaching with technology in the curriculum, and the perception of stakeholders towards technology, has trampled its integration. Although some educators and students have adopted mobile technology and digital platforms to enhance communication, and collaboration within and outside the classroom, the consolidation of such practices within the college to meet their demands, is dependent on the perception and attitude of management towards technology. This is due to lack of knowledge of the possibilities of mobile technology in enhancing learning, and the funding to support its implementation in this institution. Therefore, this calls for a review of the curriculum and the development of new ICT policies in education to incorporate teaching and learning with mobile technology. Measures and actions to foster teacher development and training, as well as the resources to promote the digitalization of teacher education institutions in Nigeria must be ensured.

## **Acknowledgement**

Firstly, I would like to express my sincere gratitude to my Director of studies Dr Mari Carmen Gill Ortega for her continuous support throughout my Ph.D. studies, and for her patience, encouragements, motivation and advise. Her guidance helped me throughout the major stages of my studies, despite the restructuring of our research centre, which greatly affected us both. Besides her, I would also like to thank my first supervisor Prof. Liz Falconer, whose insightful comments and guidance from our first meeting, aided the organisation and structuring of my thesis. Likewise, to my managing director of studies Dr Alistair Clark, for his patience, and mentoring, and to the graduate school for all their support.

My appreciation also goes to the management, staff members, students, and former colleagues of the Federal College of Education (Technical) Asaba, Delta State Nigeria, for all the support and access to resources and data used in this study.

To my family, my parents who have been so supportive of my studies, and has made efforts and sacrifices, providing emotional and moral support, for me to complete this journey; my siblings for their encouragements; and my parent in-laws, who have been so wonderful and supportive throughout my studies I thank you all. To my dearest husband who has been my rock, encouraging and understanding me throughout these years, and to my 3 wonderful children (2 of which I had during this study), thank you. Sincerest thanks to my church community also, who prayed and encouraged me throughout these years, I truly appreciate you all.

Most importantly, I want to appreciate Almighty God for the gift of life and for the grace he has given me through these years. Also, for the gift of having all these wonderful people in my life and my academic journey, thank you.

## Table of Contents

Abstract.....	i
Acknowledgement.....	ii
List of Figures .....	xi
List of Tables .....	xii
<b>CHAPTER 1: TECHNOLOGY IN EDUCATION.....</b>	<b>1</b>
1.1 Introduction .....	1
1.2 Mobile Technology in Education .....	2
1.3 Challenges of Mobile Technology in Education .....	3
1.4 Problem Statement.....	4
1.5 Purpose Statement .....	7
1.6 Research Aim and Objectives .....	8
1.7 Research Questions.....	9
1.8 Research Location .....	9
1.9 Research Contribution .....	10
1.10 Definition of Terms and Terminologies .....	10
1.10.1 Digital identity.....	11
1.10.2 E-Learning.....	11
1.10.3 ICT .....	12
1.10.4 iPad Generation .....	12
1.10.5 M-Learning.....	12
1.10.6 Mobile Technologies.....	13
1.10.7 Pedagogy .....	13

1.10.8	Student-teacher .....	13
1.10.9	Technology Enhanced Learning (TEL) .....	13
1.10.10	Users.....	14
1.10.11	Users' Environment .....	14
1.11	Thesis Structure .....	14
<b>CHAPTER 2: GLOBAL IMPACT OF MOBILE TECHNOLOGIES IN TEACHING AND LEARNING .....</b>		<b>16</b>
2.1	Introduction .....	16
2.2	Technology Enhanced Learning in Higher Education.....	16
2.3	The Impact of TEL .....	17
2.3.1	Student Learning Experience .....	18
2.3.2	Learning Environment .....	18
2.3.3	Pedagogical Practices.....	19
2.4	Foundation of Mobile Learning.....	20
2.4.1	Mobile learning definitions .....	21
2.5	Potentials of Mobile Learning in Educational Institutions .....	24
2.5.1	The Device/Technology .....	26
2.5.1.1	Usability/ Portability .....	26
2.5.1.2	Social Interactivity .....	26
2.5.1.3	Context Sensitivity.....	27
2.5.1.4	Connectivity .....	27
2.5.1.5	Individuality .....	28
2.5.2	The Users .....	29
2.5.2.1	Digital Literacy and Competency .....	29
2.5.2.2	Digital Natives and Immigrants.....	36

2.5.2.3	Technical Capital .....	37
2.5.3	The User Environment.....	39
2.5.3.1	Facilitating Conditions .....	40
2.5.3.2	Pedagogical Approach .....	41
2.5.3.3	Technology Integration Level .....	41
2.5.3.4	Social Factors .....	42
2.5.3.5	Government Support.....	43
2.6	Challenges with Mobile Technology in Education .....	45
2.6.1	Management and Institutional Challenges .....	46
2.6.2	Design Challenges .....	46
2.6.3	Technical Challenges .....	47
2.6.4	Cultural and Social Challenges .....	47
2.6.5	Digital Divide .....	47
2.7	Mobile Learning in Teacher Education .....	48
2.7.1	Motivators and Method.....	49
2.7.2	Internal Institutional Characteristics .....	50
2.7.3	Implementation Challenges and Advice .....	51
2.8	Summary .....	51

**CHAPTER 3: TECHNOLOGY ENHANCED LEARNING IN NIGERIAN COLLEGES OF EDUCATION .....54**

3.1	Introduction .....	54
3.2	Overview of Education Policy on Implementing ICT in Nigeria’s Tertiary Education. ....	54
3.2.1	National Policy on Education.....	55
3.2.2	ICT Policy in Education.....	56

3.3	Evaluation of ICT implementation in Nigeria’s Colleges of Education.....	57
3.3.1	Current state of ICT Integration .....	58
3.3.2	Factors affecting the integration of ICT in Teaching and Learning .....	58
3.4	Integration of Mobile Technology in Teaching and Learning in Nigerian Colleges of Education.....	60
3.5	Perception of Stakeholders on Integrating Mobile Learning in Nigerian.....	62
3.6	Summary .....	64
<b>CHAPTER 4: RESEARCH THEORY AND PARADIGM.....</b>		<b>66</b>
4.1	Introduction .....	66
4.2	Knowledge Acquisition.....	66
4.3	Philosophical Perspective.....	67
4.3.1	Pragmatism.....	68
4.4	Theoretical Framework: Cultural-Historical Activity Theory .....	71
4.4.1	CHAT Elements .....	71
4.4.2	Contradictions in CHAT .....	73
4.4.3	CHAT in Context.....	76
4.4.4	Expansive Learning Cycle .....	83
4.5	Summary .....	86
<b>CHAPTER 5: METHODOLOGY.....</b>		<b>88</b>
5.1	Introduction .....	88
5.2	Research Design .....	89
5.2.1	Research Methodology- Phenomenological Case Study .....	90
5.2.2	Research’s Role .....	92
5.2.3	Setting and Participants.....	93
5.3	Data Collection Procedure .....	94

5.3.1	Participant Observation.....	95
5.3.2	Educators Interview .....	96
5.3.3	Document Analysis.....	97
5.4	Data Analysis Procedure.....	105
5.4.1	Organising Data.....	106
5.4.2	Coding.....	107
5.5	Research Integrity.....	110
5.5.1	Trustworthiness .....	110
5.5.2	Triangulation .....	110
5.5.3	Members Check.....	111
5.5.4	Audit Trail.....	111
5.5.5	Reflexivity.....	111
5.6	Ethical Considerations .....	112
5.6.1	Informed Consent .....	112
5.6.2	Confidentiality, Anonymity and Privacy .....	114
5.7	Summary .....	116
<b>CHAPTER 6: FINDINGS.....</b>		<b>117</b>
6.1	Introduction .....	117
6.2	Data Generation.....	118
6.2.1	Data Labels.....	119
6.3	Technology Enhanced Teaching and Learning - Documents .....	120
6.3.1	Roles and Responsibilities of Educators.....	126
6.3.2	Roles and Responsibilities of the Institutions .....	127
6.4	Technology Enhanced Teaching and Learning – Educators.....	129
6.5	Potentials of Mobile Technology .....	138



6.6	Summary .....	142
<b>CHAPTER 7: CHAT ANALYSIS .....</b>		<b>145</b>
7.1	Introduction .....	145
7.2	Data Generation and Analysis .....	146
7.3	Defining the Activity System .....	150
7.3.1	Subject .....	152
7.3.2	Object .....	155
7.3.3	Tools .....	157
7.3.4	Rules .....	161
7.3.5	Community .....	166
7.3.6	Division-of-labour .....	166
7.4	Summary .....	168
<b>CHAPTER 8: DISCUSSION OF CONTRADICTIONS .....</b>		<b>169</b>
8.1	Introduction .....	169
8.2	Primary Contradictions .....	173
8.2.1	Subject .....	173
8.2.2	Tools .....	174
8.2.3	Rules .....	174
8.3	Secondary Contradictions .....	175
8.3.1	Subject-Tools-Object .....	175
8.3.2	Subject-Rule-Object .....	175
8.3.3	Subject-Division of labour-Object .....	176
8.3.4	Community-Tool-Object .....	177
8.3.5	Community-Rule-Object .....	177
8.3.6	Community-Division of labour-Object .....	178

8.4	Tertiary Contradictions .....	179
8.5	Quaternary Contradictions .....	179
8.6	Matrix of Analysis for Expansive Learning.....	181
8.7	Summary .....	185
<b>CHAPTER 9: DISCUSSION, CONCLUSION AND RECOMMENDATIONS .....</b>		<b>186</b>
9.1	Introduction .....	186
9.2	Discussion .....	187
9.2.1	The current pedagogic approach .....	187
9.2.2	Identification of ICT to support teaching and learning.....	189
9.2.3	The application of ICT in teaching practices .....	190
9.2.4	Challenges of ICT Implementation .....	191
9.2.5	The potentials of mobile technology to enhance teaching and learning.....	192
9.2.5.1	Mobile technology as motivator to improve digital literacy and competence 192	
9.2.5.2	Mobile technology to improve access to resources and pedagogic practices	193
9.2.6	Challenges of mobile technologies in enhancing learning.....	195
9.3	Implication of Findings.....	196
9.4	Conclusion and Recommendation .....	198
9.5	Reflection on Research Process.....	200
9.6	Limitations .....	201
9.7	Contribution to Knowledge.....	201
9.8	Recommendations for Further Research.....	202
<b>REFERENCES.....</b>		<b>203</b>
<b>APPENDICES.....</b>		<b>227</b>
	Appendix A: Sample Information Sheet .....	227

Appendix B: Sample Consent Form.....	231
Appendix C Sample Observation Notecard.....	232
Appendix D: Sample Interview Questions .....	234
Appendix E: Themes, and Sub-themes Flow Diagram .....	236
Appendix F: Topics and Description of Contradictions Identified.....	241
Appendix G: Documents Reviewed.....	252

## List of Figures

Figure 2-1: The Frame Model .....	25
Figure 2-2: Model of Student Digital Literacies.....	30
Figure 2-3: DigCompEdu Competence and their Connections .....	33
Figure 2-4: DigCompEdu Proficiency progression .....	35
Figure 4-1: Research Paradigm and Design .....	68
Figure 4-2: The Structure of the Human Activity System .....	73
Figure 4-3: Joint Activity System.....	81
Figure 4-4: Expansive Learning Cycle. (Engeström, 2001, p.152). .....	84
Figure 7-1: Teaching Activity System within the College Activity System.....	150
Figure 7-2: Learning Activity System within College Activity System.....	151
Figure 7-3: Tool Activity System within College Activity System.....	151
Figure 7-4: College Activity System. ....	152
Figure 8-1: Interactions of surrounding activities and potential contradictions within and between them.....	181

## List of Tables

Table 2-1:Difference between e-learning and m-learning .....	22
Table 4-3: Activity Structures for College environment, The classroom and FME.....	77
Table 4-6: Matrix of analysis of Expansive Learning (Engestrom, 2001).....	85
Table 5-1:Research questions and expected outcome.....	99
Table 6-1: Data generation phases.....	118
Table 6-2: Qualitative Study Participants .....	119
Table 7-1: Topics identified and data source .....	146
Table 7-2: Data ID Generation .....	147
Table 7-3: Examples of CHAT constructs identified from data excerpts based on topic.....	149
Table 8-1 - Contradictions.....	169
Table 8-2:Examples of Contradictions.....	171
Table 8-4: Presentation of Study of Expansive Learning .....	182

# CHAPTER 1: TECHNOLOGY IN EDUCATION

## 1.1 Introduction

There has been a remarkable evolution in digital technologies over the past few decades, from more advanced portable computers and mobile devices to more efficient storage spaces and applications; not to mention the social networking platforms and many more (Geidd, 2012).

The use of digital technology has affected every aspect of our lives and society (Acilar, 2011)

One part of our society that seems to benefit from this evolution is the education sector. Its use in the education systems has become a global phenomenon across different countries as it has increased access to education (Higgins et al., 2012). One important question that researchers have been seeking to answer since the potential of computer technology to transform was recognized in the 1960s, is the role of technology in education. So far, the research evidence over the last four decades about its impact on learning, consistently identifies positive benefits (Higgins, et al., 2012).

Higher education institutions are often faced with the challenge of providing quality education and adequate support for learners across various disciplines. This has caught the attention of international bodies. According to UNESCO (2017), the United Nations set out 17 sustainable development goals to ‘promote peace and prosperity’ for the people living on the planet. One of the goals is to provide quality education by ensuring inclusive and equitable quality education as well as promoting lifelong learning opportunities for all (UNESCO, 2017). This has called for several research in the education sectors to achieve this goal. Grobler (2013) mentioned that millions of students qualified to study at a university are unable to do so, as existing universities do not have the capacity to accommodate them. Through innovation in technology and extensive research, learning is becoming increasingly flexible and accessible to all. The traditional classroom is evolving to accommodate learning technologies that promotes an integrated learning in the classroom.

Today, technologies such as electronic learning (e-learning) and virtual learning environment (VLE) are considered pedagogical enhancement (Higgins, et al., 2012). These technologies are implemented in institutions and schools to ultimately transform the way educators teach as well as how students learn, engage with one another, and experience the world at large (Gunhouse and Sinclair, 2016). Although these types of learning technologies push beyond traditional classroom boundaries, they tend to limit learners to a setting and a particular technology and offers no flexibility in learning and communication. As a result of these limitations in the technology, researchers continue to explore more flexible approaches institutions can adopt to enhance learning with technology.

## **1.2 Mobile Technology in Education**

Many researchers in the past few decades, have studied the role of mobile technologies in education (Rafidah, et al., 2018), and these studies have shown that universities and colleges are exploring the use of mobile technologies to make learning more flexible for both learners and educators. Although mobile technologies do not replace the existing technologies in the institution, it does rather enhance access to learning resources and fosters the adoption of diverse pedagogical methods to support teaching and learning. Mobile technologies such as smartphones, PDA's, tablets etc. has been considered suitable tools for improving education in developing countries because of its portability and mobility, ability to transfer information without physical infrastructure and its widespread use around the globe (Valk, et al., 2010). Thus, as the years go by, its capabilities in changing the mode of learning increases, as research into the advancements of learning technologies has stimulated the development of mobile-learning applications (apps) to enhance teaching and learning. With the ubiquity of these devices, many higher institutions are implementing mobile learning (m-learning) to provide a more flexible learning approach (Krull and Duart, 2017).

Research into the use of emerging technologies in education is pertinent, especially with the imminent digital era of the fourth industrial revolution which has seen the emergence of integrated digital technologies to promote efficiency. These advancements have birthed more robust and sophisticated educational technologies, and more advanced digital learning environments, and higher education institutions around the world have, and are preparing to take advantage of its potential (Feldman, 2018). According to Rogers (2019), The Open University has identified innovations that could influence education worldwide, and some of these technologies includes learning with robots, drone-based learning etc., (Rogers, 2019). Despite these advancements, Salmon (2019), whose study focused on the evolution of technology in education, emphasized that the value of previous technologies cannot be denied but must be embraced and built into opportunities for education in the digital era. Therefore, despite the technological advancements mobile technologies will continue to play a major role in the human and technology interaction.

### **1.3 Challenges of Mobile Technology in Education**

Several studies have been conducted in recent years to investigate the use of mobile technology in teaching and learning, and findings have shown its potentials as a learning tool which can impact both classrooms and outdoor learning, facilitate access to learning as well as student motivation and involvement in the learning process (Montrieux et al., 2015; Valk et al., 2010; Sung et al., 2015; Ferriera, 2015). The ubiquity and flexibility of mobile technologies are some of the distinct characteristics highly emphasized by researchers, nevertheless, like every other technology, they are limitations to its use in learning. Mehdipour and Zerehkafi, (2013) considered the risk of distraction, the screen, and key size of mobile devices, as some of the challenges of mobile technology in learning, which is a limitation to its functionality. In addition, Farley, et al., (2015) in a study conducted in an Australian university, also found the use of mobile technologies to facilitate learning challenging, as course materials are rarely



optimized for use on smartphones, making it difficult to navigate through websites and learning management systems. Although this is indisputable, size is not a disadvantage, but an advantage due to its portability and mobility. Nevertheless, it can only be considered as a challenge if one incorrectly plans learning content for mobile technologies.

Another major challenge of using mobile technology for learning particularly in developing countries, is the public perception of mobile devices. The society quite often perceive mobile devices as disruptive devices that are used predominantly by students for social interactions, to play games and potentially engage in inappropriate behaviours (Mehdipour and Zerehkafi, 2013). Despite its limitations, it can be argued that its potential exceeds its challenges in a learning environment with little or no information and communication technology (ICT) infrastructure to support interactive learning. Overall, mobile devices offer a platform that enables students learn anything, anywhere, at any time. Thus, students and educators in challenging learning environments can benefit from using this technology.

#### **1.4 Problem Statement**

Studies have shown that while ICT has certainly influenced the Nigerian higher education system, the sector is still struggling to fully implement technology in teaching and learning due to challenges which poses as obstacles on the adoption of ICT in teaching and learning (Musa, et al., 2018). According to Okonji (2015), Nigeria Computer Society (NCS) raised concerns about the technology gap that exists within the country's educational system which they blamed on the outdated school's curriculum. The pedagogical approach in the country's education system especially in higher education, has shown that not much has improved when compared to the pre-technology era where chalk boards and physical libraries still dominated schools (Adomi and Kpangban, 2010). The method of teaching and delivery of knowledge and the curriculum are not yet ICT enhanced (Agbetuyi and Oluwatayo, 2012). This means that

there is still a high level of dependency on traditional teaching methods that do not require technology.

Oni, (2012) observed that the use of digital technology in the classroom is still in its infancy as the education sector is yet to fully harness the potentials of digital technology in the teaching and learning. According to Dike (2015) Nigeria has been dealing with unresolved educational challenges for decades. He further iterated that the lack of learning technologies affects schools, colleges, and universities. He went further to suggest that for the country to thrive in the highly competitive global economy, the education sectors must invest in educational technologies.

It is evident that the Nigerian education sector recognises the potentials of digital technologies through the educational reform policies aimed at integrating the use of ICT, particularly computers, in Nigerian schools and higher education institutions, however, the challenge is implementing it (Yusuf and Yusuf, 2009). Anene, et al., (2014) mentioned that electronic learning (e-learning) was introduced in Nigerian higher institution as an alternative to regular university schooling, which suggests that there are developments in the sector with regards to the application of ICT in schools, however, the challenges still exist (Anene, et al., 2014). According to the Baller, et al., (2016), based on the networked readiness index (NRI), the overall conditions for ICTs' impacts in Nigeria seem to have deteriorated: both economic and social impacts record a decline as Nigeria ranked 119 on the table. The low ranking is an indication that Nigeria has not been able the leveraged ICT for increased competitiveness and wellbeing as well as driving innovations in the country, let alone in the education sector.

This can be attributed to the lack of adequate infrastructure, as universities in Nigeria are still confronted with the problem of inadequate ICT infrastructure (Egoeze, et al., 2014). In addition, most universities where computers are made available to students, are usually not enough. Network access is also a challenge and in most cases internet facilities are non-existent

and where they are available, they are plagued by various technical issues such as low access speed, poor power supply (Egoeze, et al., 2014).

Another challenge that affects the adoption of digital technologies, according to Eze, et al., (2018), is the lack of digital knowledge and attitudes of educators. This indicates that if educators are properly trained to use these technologies, it will impact their attitude towards its adoption in the classroom. Hence, to close the technological gap in the country's education sector, it is imperative that students training to become educators must be trained with technology, and on how to use technology to support learning to properly utilize it in their own teaching practices. Hence the importance of technology integration into Nigerian teacher-training colleges, such as Colleges of Education.

Despite these technological challenges that plagues the use of digital technologies in Nigerian institutions, Okonji (2015) disclosed that steps are being taken address the technology gap through the adoption and use of modern technology tools for teaching and learning, to make Nigerian tertiary institutions future ready in the digitized world. This is where the potential of mobile technology, can be harnessed to transform the education sector.

According to Adegboye (2016), statistics has shown that Nigeria has a very strong mobile presence in the country with an estimated 15-20 million smartphones registered to various mobile network operators as of 2014. An analysis of the mobile network operators showed that the total active mobile lines in 2016 was 152,614,413, while the total active mobile internet connections were 93,524,398 (Adegboye, 2016). Also, according to the Nigerian Communications Commission, a report of monthly subscription of technology data showed that between April 2017 – December 2019, the total mobile active lines was 184,426,187 while total mobile connected lines was 268,549,433 at the end of 2019. This remarkable difference indicates that mobile device usage and internet data use is constantly rising, which presents an opportunity for the education sector. Furthermore, Okafor (2016), also observed that social networking and instant messaging are the most frequently used applications by mobile

subscribers. This is because its potential in learning has not been fully harnessed by education providers and mobile app developers in Nigeria.

This research seeks to build on the works of the likes of Eze et al., (2018) and Egoeze, et al., (2014) to propose the adoption of mobile technologies to address the technological challenges in teaching and learning in Nigerian teacher-training institutions, by training current (in-service) and future (pre-service) educators in Nigerian Colleges of Education on how to integrate technology into their teaching practices using mobile technologies. It is worth noting that while mobile technology may not completely eradicate the educational challenges in the country, it will be a step towards preparing students and equipping the future generation of educators for the potentials that the technologically transformed era in education has to offer. Additionally, it will also close the literature gaps in this research area, as they are very limited research exploring the potentials of mobile technologies in teacher-education colleges in Nigeria.

## **1.5 Purpose Statement**

Research has shown that the Nigerian education system is constantly undergoing changes, and the government is relentless in implementing policies to integrate ICT in the education sector to meet the educational needs of students and educators (Yusuf and Yusuf, 2009). However, the adoption of technology in education has been challenging, especially for teacher-education colleges, which calls for an intervention and change to address the current challenges.

Therefore, the purpose of this phenomenological case study research is to investigate the technological challenges in the teaching and learning methods and explore how mobile technology can be used to support the pedagogical practices of educators and learners in Nigerian Colleges of Education. It explores the perception of 8 educators about the current teaching and learning methods, the current challenges with ICT in their teaching and learning practice, and their views on the adoption of mobile technology as a learning tool, as well as

their expectations from the system to provide the resources required to deliver quality education. Through this, an insight is gained to form the basis for intervention.

To contribute to policy reforms that can reshape teacher education particularly in the area of technology enhanced learning (TEL), it is important for the government and education providers to begin to look at some of the benefits of digitizing our education sector for a more accessible and collaborative learning experience. Therefore, reviewing some of the potentials of introducing mobile technologies as a teaching and learning tool in teacher education, can influence its adoption in primary and secondary schools, and higher education institutions, which may be a catalyst to boosting the country's economy and improving the country's education sector, whilst preparing students for the growing digital labour market.

Finally, to further contribute to Adeyemo and Babatunde (2018) study, this research seeks to bridge the immense literature gap that exist in learning technology research in teacher education institutions in Nigeria.

## **1.6 Research Aim and Objectives**

The aim of this research is two-fold. Drawing on the cultural historical activity theory framework, the first aim of this research is to understand the cultural, historical, and human challenges that affects the implementation of technology in teaching and learning in the Nigerian teacher education colleges (Colleges of Education) and secondly, explore the potentials of mobile technologies in addressing those challenges in the sector.

To address this aim, the following four objectives have been identified:

1. Identify some of the teaching and learning approaches in Nigerian college of education.
2. Analyse to what extent ICT has been used to support these approaches.
3. Investigate the social, cultural, or environmental issues affecting the effective implementation of ICT in teaching and learning in these colleges.

4. Assess how mobile technologies can be used to improve the quality of teacher education in Nigeria.

The aims and related objectives of this study was established to produce significant contribution to existing knowledge on ways to bridge the technological gap in Nigeria's teacher education institutions through the adoption of mobile technologies.

## **1.7 Research Questions**

Based on the research objectives outlined above, the following research questions have been formulated to guide the identification and development of a methodological approach to ensure the objectives of this research are met.

- 1) What are the current pedagogic approaches used in Nigerian college of education?
- 2) Are ICT currently being used to support these pedagogic approaches?
- 3) How has/can ICT support the current pedagogic approach used in the college?
- 4) What are the factors affecting the effective integration of ICT in pedagogy in the college, and how has it been addressed??
- 5) In what ways can mobile technology enhance teaching and learning in colleges of education in Nigeria?

## **1.8 Research Location**

This study was conducted in Federal College of Education (Technical) Asaba, Delta State Nigeria, which is 1 of the 22 Federal colleges in the country (National Commission for Colleges of Education NCCE, 2012). It was established by the Nigerian government in 1986 but commenced operation in September 1987. The college has two sites, the temporary site and the new permanent site and this study was conducted in the permanent sites. The college has 7 major schools' faculties and 24 Departments split between these two sites. They offer National Certificate in Education (NCE) qualifications to students training to become teachers

in Pre-primary Education or Early Childhood Care and Education (ECCE), Primary Education, Junior Secondary Education, Adult and Non-Formal Education, Special Needs Education, vocational training centres, secondary schools, and technical colleges, which is the minimum qualification for teachers in Nigeria (National Teachers Institute, 2017). They also offer Professional Diploma in Education (PDE) qualifications for in-service teachers as well as bachelor's degree in Education.

## **1.9 Research Contribution**

The anticipated outcome of this study is to create technology enhanced pedagogic intervention in teacher education in Nigeria. This study combines existing knowledge of findings that highlights the impact of mobile technologies in higher education and teacher education in developed countries, with the perception of educators in Nigerian colleges of education. This is to create new knowledge that can give technology experts, policy makers, the Federal Ministry of Education, as well as private institutions and organizations, an understanding of educators' experience and expectations, in order to provide appropriate intervention and develop policies and standards that accommodates the adoption of mobile technologies as pedagogic tools to support learning.

Technology enhanced learning (TEL) research, explores, creates, and identifies emerging technologies and the ways they can improve teaching and learning. Thus, the inter-disciplinary nature of the research allows integration of knowledge from Computing and Information Technology and Education, to create new knowledge that can be used to develop mobile learning applications to facilitate learning for learners in environments with little or no ICT infrastructure.

## **1.10 Definition of Terms and Terminologies**

Several terms, phrases and concepts used to define contextual information in this study, were adopted from literatures of similar studies. However, due to the distinct definitions of these

terms within their various contexts, some definitions did not adequately portray it's meaning within the context of this study. Therefore, this section provides definitions based on the meaning derived from these terms and its applicability as they are used throughout the research.

### **1.10.1 Digital identity**

Our Identity is who we say we are, and identification is a means of authenticating that identity (White et al., 2019). Thus, digital identity can be understood as a form of identity within the digital space such as internet browser, mobile interfaces etc. According to White et al., (2019) A digital ID can authenticate an individual's identity through a variety of factors such as who a person is (for example, a fingerprint); what they know (e.g., a PIN); and what they have (for instance, a smart card or mobile phone). However, in this study, the term *digital identity* is used to refer to an individual's digital knowledge and skills based on their identity as either a digital native or a digital immigrant (Prensky, 2001). (see chapter 2).

### **1.10.2 E-Learning**

There are various definition of e-learning depending on the study and the context of its use. Sangra, et al., (2012) provided for categories of e-learning definitions as (1) Technology-driven definition emphasise the technological aspects of e-learning, while presenting the rest of its characteristics as secondary; (2) Delivery-system-oriented definition presents e-learning as a means of accessing knowledge through an electronic means with emphasis on accessibility of learning; (3) Communication-oriented definitions considers e-learning to be a communication, interaction, and collaboration tool and assigns secondary roles to its other aspects and characteristics; and (4) Educational-paradigm- oriented definitions defines e-learning as a new way of learning or as an improvement on an existing educational paradigm. The e-learning definition in this study is based on the Technology-driven definition which defines e-learning as the use of technology for learning.



### **1.10.3 ICT**

The acronym stands for Information and Communication Technologies. Ratheeswari (2018) defines ICT as technologies that provide access to information through telecommunication. It is similar to Information Technology (IT) but focuses primarily on communication technologies such as the internet, wireless networks, and other communication mediums (Ratheeswari, 2018). ICT in this study refers to the use of computers, laptops, Wi-Fi, projectors, software, projector monitors and local area network (LAN) to communicate information and resources for learning purposes.

### **1.10.4 iPad Generation**

iPad generation in this study, this term is used to refer to the digital identity of digital natives who are well abreast with the use of tablets and iPads, particularly, children in pre-school to secondary school.

### **1.10.5 M-Learning**

Traxler (2009) expressed that some definitions of m-learning are technocentric as they define it purely in terms of its technologies and its hardware as learning delivered or supported solely or mainly by handheld and mobile technologies, excluding the learning experience m-learning may offer. Although I agree with Traxler (2009) that there are many facets of m-learning, and as such, should be defined to encompass these facets. Thüs, et al., (2012) definition of m-learning captured some important aspects of mobile learning relevant in this study. Therefore, m-learning in this study is defined as the use of mobile devices operating on 3G, 4G, 5G, and/or wireless networks to enhance existing learning methods, by utilizing online platforms as well as mobile applications to promote interactive learning and collaboration, resource access and sharing, and real-time communication within the learning environment.

### **1.10.6 Mobile Technologies**

Mobile technologies are portable two-way communications devices, computing devices and the networking technology that connects them. Mobile technologies are classified as internet-enabled devices like smartphones, tablets and watches etc. Thus, the term mobile technologies are used interchangeably with “mobile devices” and “mobile gadgets” to refer to smartphones, tablets, and iPads with the wireless technologies such as cellular networks, 4G networking, Wi-Fi, Bluetooth, to enable the mobile devices to share voice, data, mobile application (apps).

### **1.10.7 Pedagogy**

Pedagogy is a term widely used in education and teacher education research. According to Cuenca (2010), the term pedagogy has been appropriated in education discourse as simply strategies of instruction as opposed to an inter-individual relationship that places a teacher in a position to lead students toward academic and personal growth. This implies that teachers’ actions during interactions with students are significant, given that students of teaching often learn as much from the experience of being taught as from the instructional strategies and theories they are prepared with (Cuenca, 2010). Thus, Pedagogy is used interchangeably with “teaching methods” and “learning methods” in this study to reflect this meaning.

### **1.10.8 Student-teacher**

Ryan et al., (2017) defined student teacher or pre-service teacher as the student enrolled in a teacher preparation program who must successfully complete degree requirements including course work and field experience before being awarded a teaching license. Based on this definition, this term is used interchangeably with “learners” in this study to refer to students training to become qualified teachers in the Nigerian college of education.

### **1.10.9 Technology Enhanced Learning (TEL)**

The term Technology Enhanced Learning (TEL) often indicates the use of technology such as ICTs to improve or facilitate learning. However, in this study, the definition of TEL is based

on Wang and Kinuthia's (2004) definition. Wang and Kinuthia (2004) gave an interesting definition of TEL to include four core components of the learning environment: (1) learning goals; (2) People; (3) resources; (4) strategy. They define TEL as the use of technology to motivate people, to enrich learning resources, to implement learning and instructional strategies, to assess and evaluate learning goals. These four uses of technology make a learning environment technology enhanced (Wang and Kinuthia, 2004).

#### **1.10.10 Users**

The Cambridge online dictionary (2021) defines a user as *a person who uses a machine, a service or a product*, in this context a technology user. Users are used in this study to refer to the educators and learners within a learning environment who use technology to facilitate or enhance all aspects of learning.

#### **1.10.11 Users' Environment**

The user's environment in this study refers to their immediate surrounding. Environment can mean the air, plants water, etc., however, another definition of environment according to the Cambridge online dictionary (2021) *is the conditions that you live or work in, and the way that they influence how you feel or how effectively you can work*. Therefore, User's environment, used interchangeably with "learning environment" refers to the location and the society including rules, social norms, and the leadership of the college where the users are observed, as well as the immediate social space of the learners or educator and the way that these conditions influence their use of technology to teach and learn.

### **1.11 Thesis Structure**

This thesis consists of 9 chapters. **Chapter One** discusses the background of the study, introduces the research problem, and identifies the rationale behind the study. In addition, the research aims, and objectives are disclosed in this chapter and the associated research questions are presented. The contribution to existing knowledge is also explained in this chapter. The

next chapter, **Chapter Two** provides an extensive literature review on the concept of technology enhanced learning (TEL) and the foundation of mobile learning and learning technologies in the higher education sector. It also examines some of the characteristics and challenges with mobile learning. **Chapter Three** provides an in-depth analysis of relevant literature exploring the TEL concept in Nigerian higher education sector with emphasis on colleges of education. It also examines Nigeria's education policy on implementing ICT in higher institutions. In addition, this chapter explores the potential of using mobile technologies as a learning tool. **Chapter Four** provides a detailed overview of research philosophies and the theoretical framework that guides the research design, the data collection and analysis. **Chapter Five** discusses the methodology of the research, the data collection procedures and the method of analysis. Additionally, ethical considerations of the research are discussed in detail. **Chapter Six** presents then phenomenological finding based on the observation and interviews of educators. Additionally, findings from the document analysis such as ICT policy document, curriculum and standards are also presented. **Chapter Seven** presents a detailed description of CHAT construct within the study. **Chapter Eight** presents a discussion of the contradictions identified in the study as well as the matrix of analysis. Finally, **Chapter Nine** draw conclusions, outlining the limitations of the study, as well as presenting a reflection of the research process and suggestions are made for further study in the research area.

# **CHAPTER 2: GLOBAL IMPACT OF MOBILE TECHNOLOGIES IN TEACHING AND LEARNING**

## **2.1 Introduction**

The use of technology in education is often aimed at enhancing current educational practice such as teaching and learning, which has been conceptualised as technology enhanced learning (TEL). One cannot discuss the global impact of mobile technologies in teaching and learning without outlining its foundation in TEL. Thus, this chapter provides a conceptual framework of technology enhanced learning (TEL) by critically reviewing various literatures with emphasis on the impact, and the challenging implementation of TEL, and the role of mobile technology in pedagogy and learning in developed country. It introduces the foundation of mobile learning alongside its definitions, and its evolution in higher education, its characteristics, as well as its challenges. The resources used for this study includes academic journals available on UWE online library, as well as open access databases. Resources also included Nigerian online newspapers and academic blogs with up-to-date information on mobile technology in the education sector in Nigeria. All articles used in this study were published within the last fifteen years.

## **2.2 Technology Enhanced Learning in Higher Education**

Technology Enhanced Learning (TEL) is used to describe the application of ICT to facilitate teaching and learning (Kirkwood and Price, 2014). Since the early 1980's, the adoption of technology in higher education continues to rise. The evolution from traditional classroom to a digital classroom suggest that technology has had major impact in the education sector. Various articles have heralded the prospects of technology in higher education as a tool that can create a more flexible approach to teaching and learning (Price and Oliver, 2007), in other words, enhancing teaching and learning. Despite these findings, Kirkwood and Price (2014)

expressed concerns on how technology enhances learning and its value on learner's experience. Though this study will not focus on the value of technology on learners' experience, it does lay emphasis on how it enhances learning. Particularly, in a learning environment with little or no technology, it is important to really assess the extent to which technology can 'enhance' teaching and learning. Enhancement as the Cambridge online dictionary (2019) describes, is "to improve the quality, amount or strength of something", in this context, TEL is aimed at improving the quality of teacher education.

The promise of technology in enhancing teaching and learning, comes with possibilities of forming policies on the adoption of technology (Price and Oliver, 2007). However, considering the high cost of implementing technology, which includes infrastructure, equipment, training, technical support etc., it is imperative to understand the educators and the learners' perspectives of TEL for informed decisions about the type of technology that should be used for teaching and learning and (Price and Oliver, 2007).

### **2.3 The Impact of TEL**

From the works of Price and Oliver (2007); Kirkwood and Price (2014); Casanova et al., (2011); it is evident that technology undoubtedly, has made an impact on learning and teaching methods in higher institutions. However, to identify the impact of TEL, one needs to understand its effective educational contribution (Kirkwood and Price, 2014). Therefore, it is a bit precarious to generalise the impact, as this can be dependent on the context, teaching and learning strategy, as well as the objectives (Casanova, et al., 2011). For instance, an educator using technology to support pedagogy may perceive the impact of TEL quite differently from a student using technology to access learning resources. Overall, technology within a learning environment can impact student learning experience, pedagogic practices, and the learning environment.

### **2.3.1 Student Learning Experience**

One of the impacts of TEL in higher institutions, is its impact on student learning experience (Casanova, et al., 2011). The term learning experience is often used to describe the interactions, course or experiences in which learning takes place, irrespective of the setting (traditional or non-traditional) or the educational interaction, which can either be teacher centred or student centred (Partnership, 2013). According to Chowdhry, et al., (2014), technology has gradually been implemented to enhance student learning experience in a face-to-face environment, causing a shift from the traditional face-to-face method of teaching, to a technology assisted teaching and learning method known as blended learning. Thus, learning becomes more student-centred than teacher-centred, making students active learners, who define their learning strategy by determining what, when, and how to learn. This, according to Casanova et al., (2011) stresses the need for educators to reflect on the teaching and learning strategies supported by technology, on the learning experience, and realign their teaching practices with the needs of the students.

### **2.3.2 Learning Environment**

The introduction and adoption of TEL by many higher institutions has created two dimensions to higher education: in-campus and virtual campus. The drive towards a more technology-transformed learning environment has brought prevalent changes in academic culture which affects resident universities (Price, et al., 2005). Institutions are now redesigning their physical learning environments, to align with the new pedagogic approaches and technologies (Davies, et al., 2017). With such structure in place, TEL for in-campus environments, provides residential learners the opportunities to use learning technologies such as search engines, simulators, database, VLEs, course specific applications and software, to extend their normal classroom instruction (Price, et al., 2005).

Virtual campus is an emerging technology-based learning environment, used as a delivery mechanism for distance learning (Price, et al., 2005) often referred to as virtual learning environment (VLEs). Its primary purpose is to enhance existing academic practices and not to replace them (Trafford and Shirota, 2011). It serves as a platform that allows easy distribution of information; providing access to a wide range of electronic resources; allows easy communication; makes assessments easier and provides general management of academic duties (Trafford and Shirota, 2011). Institution's decision to go virtual, is often driven by the need to reduce cost. The absence of classrooms for instructions, can reduce the funding needed for online education providers, but adversely compromises the goal of maximizing learning through this platform (Stack, 2015). Irrespective of the institutions' motives for virtual campus, the focus should be on maximizing learning, to afford everyone, access to higher education.

### **2.3.3 Pedagogical Practices**

According to Kirkwood and Price (2014), most studies on the impact of TEL, focuses on the means through which teaching occurs, and the findings always centres around its use to replicate and supplement existing teaching practices, hence, transforming the roles and practices of educators and learners in higher institutions. The role of the student has shifted from passive learner to an active learner (Price et al., 2005), with technology providing access to wider sources of knowledge. Students are no longer passive, and can actively engage in learning, by researching topics online, collaborating with classmates on online platforms.

TEL has also changed the pedagogic practices as educators' role has shifted from being a bearer of knowledge to a facilitator of knowledge (Price et al., 2005). Additionally, the rise in distance learning and online courses, comes with certain implications for the educators' role, because in order to remain relevant as an educator in higher education, educators must be able to utilize these technologies in order to develop a well-structured web content for learners



(Price et al., 2005). Educators should be prepared to improve their ICT skills to meet the standards required for their roles. In developed countries, TEL has become an essential part of the learning system, as almost every higher institution, now provide a baseline level of TEL which generally consists of VLEs, access to online contents, electronic submission of coursework and plagiarism detectors, all to meet the requirement of student and staff (National Assembly for Wales, 2017).

## **2.4 Foundation of Mobile Learning**

The evolution of ICT has seen a move towards the development of more sophisticated, portable and inexpensive communication devices such as mobile phones, PDA's, Tablets (Wu, et al., 2012). Every improvement made on these devices as the years go by, comes with additional features such as Wi-Fi, 4G, cloud storage, emails, audio recorder, video communication, productivity software etc. for effective communication. This has no doubt caught the attention of education researchers on the ways to develop educational applications for mobile device to improve the quality of education (Kukulka-Hulme and Traxler, 2007; cited in Wu, et al. 2012). Over the last two decades, mobile technologies have gradually been introduced into educational contexts (Sung, et al., 2015). Many institutions seeking to enhance their teaching and learning methods, are taking advantage of research findings, which according to Sung et al, (2015), confirms that mobile technologies have great potential for facilitating more innovative educational methods.

Studies such as Sung et al., (2015); Valk et al., (2010); Hussain and Adeeb, (2009); found that the use of mobile technologies in education can improve access to learning and enable communication and interactions between students in remote destinations, and their tutors. In other words, students whose physical challenges, limits their access to classrooms, can still access proper education, and engage in classroom activities through mobile technologies. The concept of using mobile technology for learning has been conceptualized as mobile learning

or m-learning. This learning technology gives learners control of how and when they want to learn and from which location, they want to learn (Ally, 2009). Mobile devices, particularly smartphones and tablets as Vali (2015) explained, are changing our approach to learning. Students of all ages generally find learning on these devices more personal, accessible and convenient rather than being limited to a desktop (Vali, 2015).

The use of mobile technologies in enhancing learning, has received a lot of attention in developed countries (Valk, et al., 2010). In today's technology dependent society, at least 83% of adults between the ages of 18 and 29 as observed by Chen et al., (2015), owns a smartphone, and according to Brown (2015), the use of mobile technologies by students is constantly on the rise. A study conducted by EDUCAUSE Centre for Analysis and Research (ECAR) in 2016, revealed that most students own or have access to at least one form of mobile device. Although it increases student engagement, enrichment, and efficiency, there are concerns of classroom distraction, caused by in-class use of mobile devices for non-learning purposes (Brooks, 2016) such as social media, chatrooms and games. With the rise in mobile technologies and its capabilities in education, Buzzard, et al., (2011) suggested that rather than using mobile technology for only social and entertainment value, students can learn to use these technologies as a skill set for the future, and by doing so, they will learn more efficiently.

#### **2.4.1 Mobile learning definitions**

The term mobile learning, which started fully in the early 2000s (Sharples and Pea, 2014), has been used by many in TEL research. However, there are a various interpretation of what it means. As Seipold (2015) rightly stated, there are many attempts to define mobile learning but there seem to be no definition that is generally accepted. Kukulska-Hulme and Traxler, (2007) defines mobile learning in terms of learner's mobility; Hwang and Tsai (201, cited by Ferreira et al. 2013), defines mobile learning as "the use of mobile technologies to facilitate learning". Although Ally et al (2009) expressed that this definition is constraining and is tied to current

technological instantiations, which supports Kukulska and Traxler (2007) views on mobile education as learning delivered mainly by mobile technology, one cannot dispute the fact that the technology is an essential part of mobile learning. Just as Caudill (2007) emphasised, mobile technology, which consists of both hardware and networking applications, is a necessary component for the existence of m-Learning.

Many also debate if mobile learning is an advancement from e-learning or simply a tool that integrates with e-learning (Caudill, 2007). According to Thüs et al., (2012), mobile learning can be viewed as a subset of e-learning that includes the usage of mobile devices to enable learning anywhere and at any time. Overall, all these conceptualisations of mobile learning can be seen in Ferreira et al, (2013) study. According to Ferreira et al, (2013), with the evolution of mobile learning, several practices related to m-learning concept has emerged. Some of which includes: (1) *Mobile e-learning*, (2) *Learning in live classroom supported by use of mobile and wireless technology*, (3) *Increasing access*.

Although these practices share similarities with e-learning, there is a clear distinction between them. Korucu and Alkan (2011) noted that some of the major distinction between m-learning and e-learning are the terminologies used, the communication mode, and the learning environment. Table 2-1 presents a distinction between e-learning and mobile learning, based on Korucu and Alkan (2011), and Traxler’s (2009) studies.

**Table 2-1: Difference between e-learning and m-learning**

<b>E-learning</b>	<b>M-learning</b>
Learning resources are only accessible in class or through a computer	Accessible using mobile devices from any location
Requires bandwidth, broadband, and ICT infrastructure,	Operates on 3G, Wireless

Structured, interactive and formal learning	Informal, situated, portable and spontaneous learning
Face-to-face communication	Flexible communication

E-learning, just like m-learning, has received different definitions by various researchers and scholars, and it has been used interchangeably with other terms such as online learning, web-based learning, distance learning etc., yet no clear definition of the term, or what technologies constitutes e-learning has been clearly stated (Moore et al., 2010). However, understanding this concept can vary, depending on the context and the perspective in which it is defined. Within the higher education context, e-learning according to Usoro and Abid (2008) is a form of education used in higher education, contrary to classroom learning, that adopts ICTs such as Blackboard, to enable the delivery of distance, online or blended learning.

Singh et al., (2005) describes e-learning as a powerful learning tool to enable higher institutions meet the increasing demand for higher education, whilst geographically broadening learning. Thus, understanding e-learning as a tool encompasses the functionality of the different components of ICT such as the technology and network functionality, as well as the media type and platform in which they operate, and how they individually and collectively support learning. From the technology and network perspective, e-learning can be described as the use of computers, computer networks (internet and intranet), and other ICTs to enhance delivery of learning such as the presentation of learning materials on projector screens. The platform perspective can be understood as the media type and/or web-based platform on which learning materials can be readily accessed such as databases, web-browsers, the internet, CD-ROM, hard-disk, online etc. However, it is the combination of the ICTs, the network and the platform to access learning contents that facilitates e-learning.

Therefore, the distinction between e-learning and m-learning is the technological advancement and the shift in learning methods.

At a first glance, mobile learning is simply learning with mobile technology. But a closer look suggests that mobile learning presents new or contemporary learning methods (Seipold, 2014). The mobility of the device, and the development of mobile application (apps) specifically designed for learning, presents a more sophisticated form of technology enhanced learning. Considering the definitions of mobile learning, and its similarities to e-learning, it is obvious that the common goal is to enhance learning. What sets mobile learning apart from e-learning is its ability to provide anywhere, anytime learning without being constrained to static resources (Caudill, 2007).

Despite the extensive definitions of mobile learning, this research draws its definition of from Thus, et al., (2012) who defines mobile learning as the use of a mobile device with reliable network connection and internet access, to communicate with a mobile learning platform, in order to access and consume information in a creative way. Thus, this study defines mobile learning as the use of mobile devices operating on 3G, 4G, 5G, and/or wireless networks to enhance existing learning methods, by utilizing online platforms as well as mobile applications to promote interactive learning and collaboration, resource access and sharing, and real-time communication within the learning environment.

## **2.5 Potentials of Mobile Learning in Educational Institutions**

To harness the potential of mobile learning, one needs to fully understand its characteristics. Many studies examined in this review, have developed frameworks to identify the characteristics of mobile learning, Ozdamli and Cavus (2011) listed some of the characteristics as ubiquitous, blended, portable, private, interactive and collaborative. Similarly, Lan, et al., (2009) listed portability, social interactivity, connectivity, individuality, and immediacy. Overall, the common characteristics often discussed by researchers are portability, social interactivity, blended, connectivity, mobility, individuality and immediacy, as some of the characteristics of mobile learning. These characteristics highlights the positive attributes of

mobile learning in a learning environment, but to fully understand its potential, it is crucial to look at the broader factors that influences these characteristics, which is evident in Koole's 2009 FRAME model, see Figure 2-1.

Koole, (2009) developed a Framework for the Rational Analysis of Mobile Education (FRAME) model, and each of these characteristic can be categorised into three major aspects; device aspect (D) which refers to the physical and functional characteristics of the mobile device; learner aspect (L) which refers to the learner's cognitive abilities, values, motivation, memory capacity and prior knowledge; and social aspect (S) which describes the social rule governing conversations and collaboration amongst people. These aspects intersect and converges to portray an ideal mobile learning (Koole, et al., 2010).

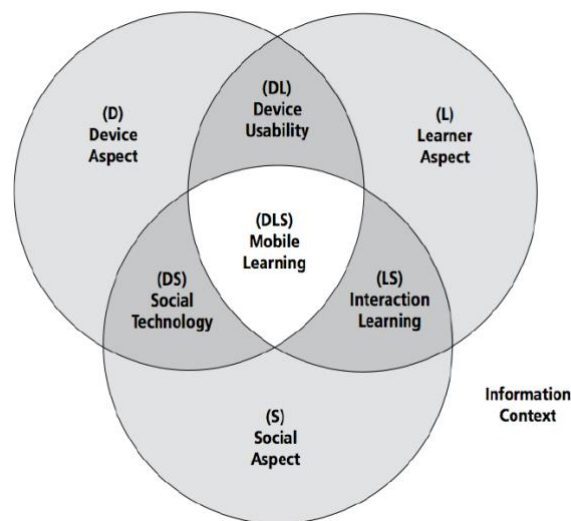


Figure 2-1: The Frame Model (Koole, 2009)

source <http://kooleady.ca/thoughts/?p=619> licensed under [CC BY 4.0 /](https://creativecommons.org/licenses/by/4.0/)

Based on the FRAME model described above, identifying the potentials of mobile learning in teacher education or any educational institution, depends on the characteristics of: (1) the device/technology, (2) the users, (3) the users' environment (Thüs, et al., 2012). The following sections will describe these factors in more detail, to understand how the potentials of mobile technologies in a learning environment can be harnessed.

### **2.5.1 The Device/Technology**

The device/technology in this context are mobile devices used to support and promote learning. Klopfer and Squire (2008, cited in Thüs, et al. 2012), described five characteristics of these mobile devices as: portability, social interactivity, context sensitivity, connectivity and individuality.

#### ***2.5.1.1 Usability/ Portability***

This often refers to the ease with which mobile learning technologies can be used. The usability of a device is usually defined by its portability, learnability, memorability and navigation (Koole, et al., 2010). Device portability is dependent on the physical attributes of the device such as size and weight, the number of peripherals, and the materials used in the construction of the device, which allows the user to move the device to any location, and information access compliments portability by enabling users move with the information (Koole, 2009). This falls under the device and the learners (DL) aspect of the FRAME model because, the usability of the mobile learning technologies, is dependent on the user's interaction with the device (Koole, 2009).

#### ***2.5.1.2 Social Interactivity***

Social interactivity explores how mobile devices enables effective communication and cooperation for individuals to exchange information and acquire knowledge (Koole, 2009). Mobile devices have the capabilities of capturing real time information and integrating connectivity and collaboration into class activities (Baran, 2014). Mobile technologies enable communication and collaboration between learners, educators and other systems irrespective of the location (Gikas and Grant, 2013). According to Nerantzi, et al., (2014), the main purpose of mobile learning is to bring learning communities together, add flexibility and openness to communication and collaboration, share, co-create, support, actively participate and engage in the learning process. With the prevalence of social media culture through mobile applications,

it is apparent that mobile devices have added a new social dimension of participating in learning that was not available (Clough, et al., 2009), by creating a socially based learning environments such as online platforms in which learners can acquire information and negotiate meaning (Kenny, et al., 2009). This type of learning relies on the social constructivist theory which emphasises that all cognitive functions, including learning are dependent on interactions with others (Draper, 2013).

### ***2.5.1.3 Context Sensitivity***

One of the important features of mobile learning is the context (Thüs, et al., 2012). Mobile devices can be used to gather real or simulated data related to location or individual. In addition to promoting collaborative learning through social platforms, mobile technologies can also provide personalised knowledge acquisition tailored to the learner's needs. Hence, context sensitivity on mobile technologies focuses on developing information to meet different learner's cognitive abilities, prior knowledge, situation in which they are learning and their devices, all known as context information (Koole, 2009; Thüs, et al., 2012). Context-aware mobile learning applications such as location tracking devices (Yau, et al., 2010), is influenced by the context information of the learner, which tracks the physical and virtual movements of the learner. The context is then retrieved and stored to establish a history of the learner's pattern to predict future movements and learning needs (Marzouki et al., 2019). It enables personalized, adaptive, and motivating learning experiences, which are tailored to their educational needs, and personal characteristics, in order to maximize their satisfaction, learning speed and learning effectiveness (Gomez, et al., 2013).

### ***2.5.1.4 Connectivity***

The connectivity of the device is a crucial element of mobile learning. It is the foundation to the entire concept of mobile learning as without connectivity of the device to a network, collaboration and information sharing cannot occur. There are three ways to look at connectivity with regards to mobile learning (Imtinan, et al., 2013): (1) Network connectivity



of the device, which includes connection using cellular and wireless network technologies, personal area network (PAN), 4G Wireless fidelity (Wi-Fi) etc; to enable users connect to other systems and users. (2) Mobile connectivity such as voice telephony, SMS; and connections to documents and information within and across systems. (3) Connectivity as mobile learning characteristic which refers to shared tools such as calendars and project management tools, authoring tools that enables collaboration, delivering and attending lectures etc. (Koole, 2009).

Overall, connectivity of mobile learning enables connection to databases, other mobile devices, and networks.

#### ***2.5.1.5 Individuality***

Mobile learning device are designed to support collaborative learning, but they also enhance a learner's sense of individuality, by enabling scaffolding to meet a learner's personal needs, as well as the support to undertake a specific activity (Thüs, et al., 2012). All learners are from different backgrounds with distinct learning needs (Imtinan, et al., 2013). Some lack motivation and depend on their educators to provide the motivation they need to learn, this support is known as scaffolding (Hayes, et al., 2006). Chen, et al., (2003), describes scaffolding as the interactive support that instructors, or more knowledgeable peers, offer learners to bridge the gap between their current skill levels and a desired skill level. With the ubiquity of mobile learning comes mobile scaffolding, which enables students receive the support they need through their mobile device from a more knowledgeable other, such as a peer, a tutor, intelligent learning system, mobile applications such as mobile social media, blogs, etc. (Hayes, et al., 2006; Ozlem and Kesim, 2008).

Mobile technologies present innovative learning opportunities that can impact the quality of education for any learning institution. However, mobile technologies cannot function independent of the user. Despite the characteristics of the device, the user's characteristic

influences their perception of the usability, individuality, and social interactivity of the mobile learning technology.

### **2.5.2 The Users**

Users are the key players in the use of technology, and in this context, they are the students and the educators within teacher education. When considering the adoption of mobile technology to teach and learn in a learning environment, the characteristics of the users are important factors to consider, especially when assessing the potentials of a new technology to support or enhance current practices, as it often forms their perception and acceptance of such technology. Some of these characteristics as Koole (2006) listed, are cognitive abilities, values, motivation, and prior knowledge. These can be summarised under digital literacy and competency (Yazon, et al., 2019), their digital identity, digital natives and immigrants (Prensky, 2001) and their access to technical capital as a motivator (Yardi, 2010). These are broader factors that can influence how users perceive the adoption of mobile technologies for teaching and learning purposes, and ultimately determine their attitude towards mobile learning.

#### ***2.5.2.1 Digital Literacy and Competency***

Exploring the opportunities and the possibilities of introducing mobile learning in a learning environment, necessitates an assessment of the level of digital literacy of students and educators in this learning environment are. Digital literacy is considered one of the key issues in education sector when it comes to TEL. The 2019 EDUCAUSE Learning Initiative (ELI) which investigates the key issues in teaching and learning, revealed that digital and information literacy maintains one of the top-five positions of key issues in teaching and learning, and several colleges and universities are developing or considering initiatives to promote the digital literacy of students, faculty, and staff (Pelzel, 2019).

The term “literacy” is an evolving concept with various definitions, yet often attributed to the ability to read and write (Yazon, et al., 2019), but it is also knowledge in specific areas or subjects, while competency can be understood as the cognitive ability and practical skills to effectively use, live by, and communicate such knowledge. Thus, digital literacy can be defined as knowledge of the functional use of digital technology, while digital competency is the ability to effectively use digital technologies for specific purposes. The advancements in technologies and the use of different types of media for different purposes has redefined digital literacy and competency to encompass a range of technical skills, cognitive abilities, and knowledge necessary to live, work and succeed in today’s digital world (Yazon, et al., 2019). Consequently, it is important to assess the digital literacy and competency of educators and students in this context in order to identify the potential of new technology in the learning environment.

Different frameworks have been developed as a model to understand the digital literacy and competence of students and educators. Sharpe and Beetham’s (2010) model known as the pyramid model (see Figure 2-2), is a simple hierarchical framework for understanding digital literacy of learners, which depicts digital literacy as a developmental process, starting with access at the bottom of the pyramid, followed by skills, practices and attributes/appropriation at the top (Sharpe and Beetham, 2010).

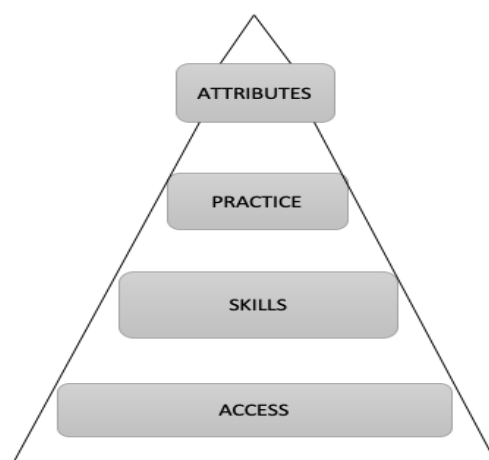


Figure 2-2: Model of Student Digital Literacies (Sharpe and Beetham, 2011, cited in Bennett, 2014).

Source: [https://journal.alt.ac.uk/index.php/rlt/article/view/1450/pdf\\_1](https://journal.alt.ac.uk/index.php/rlt/article/view/1450/pdf_1) licensed under [CC BY 4.0 /](https://creativecommons.org/licenses/by/4.0/)

**Access:** having access to technology, resources and services to support the use of the technology are essential requirements. This includes access to networked computers, access to wireless mobile devices, and learning applications or software. Without reliable, suitable and cost-effective access, none of the other attributes can be brought into play (Sharpe and Beetham, 2010).

**Skills:** at this stage users develop technical or IT skills required to operate the technology; specialist skills to use software applications for communication, processing, creating; and the ability to use search engines to locate and evaluate useful resources online.

**Practices:** this looks at users' ability to use technology for specific functions and purposes. Users are able to choose appropriate digital tool and strategies to respond to a particular need.

**Attributes:** The skills and practices of users leads to ability to creatively use technology to meet their needs and achieve their goals (Bennett, 2014).

Although the pyramid model provides a basic tool for understanding the stages to digital competence, it does however lack the inclusion of an important element in the process, and that is users' motivation. One can only become competent if driven by motivation, and the need to become digitally literate is determined by the current role, impact, importance of technology in their society, and the perceived value of technology. Despite the technological advancements in the society over the past few decades, several people still lack the digital skills to function in this digital society which can be understood as digital exclusion. According to French et al, (2018) a study revealed that around 11.3 million people in the UK lack at least one basic digital skill, and one of the key barriers associated with this is the lack of motivation or willingness to engage with digital technology. A Common variable identified in non-users of digital technology is their perception, which can include the lack of perceived value, fear of online safety, and lack of support. These perceptions are often driven by their age, the level of education, lack of confidence in literacy, attitude towards informal learning, employment, presence of children in home and cost, etc., French et al, (2018). The study further revealed

that non-users of technology for various reasons, are often proxy users of technology for transactional purposes such as online shopping and accessing public information, rather than for creative purposes.

The motivation for digital literacy and competency of learners according to Bennett (2014), is interwoven into each stage of Sharpe and Beetham's (2010) model. Students are motivated to use technology only when it is readily accessible, and the necessary support is available. Such access motivates student to learn how to use the technology, and the skills acquired motivates learners to apply them in their learning environment.

According to Bennett (2014), students' experience of using and applying the tools available to them in learning environments, drives their sense of belief, attitude and identity as digitally confident learners, attained at the attribute stage of the pyramid model. This attitude is what motivates learners to try new practices, learn new skills and improve access because, they have strongly developed understanding of the value and possibilities of using technology to support their learning.

Digital literacy and competence of educators is very crucial in the present educational system, as educators are increasingly required to not only teach students with digital tools, but to also facilitate students' digital competence (Yazon, et al., 2019). As professionals dedicated to teaching, they need educator-specific digital competences in addition to the general digital competences for life and work to effectively use digital technologies for teaching (Redecker and Punie, 2017). The European Framework for the Digital Competence of Educators (DigCompEdu) was designed to capture and describe these educator-specific digital competences.

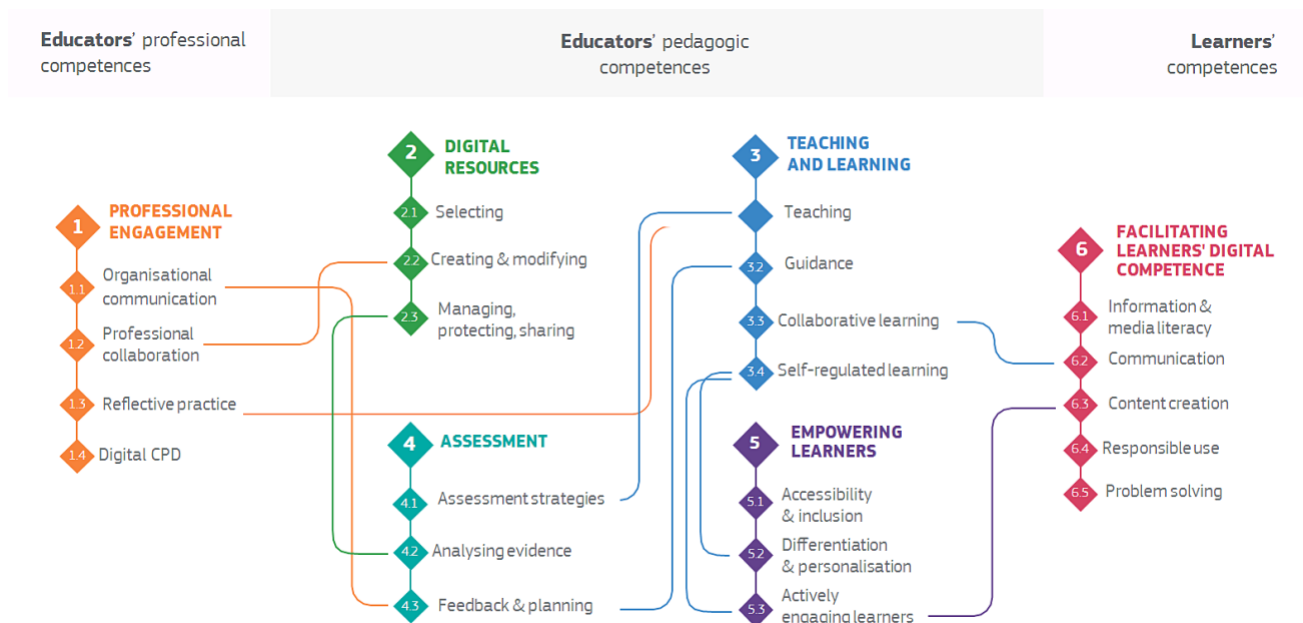


Figure 2-3: DigCompEdu Competence and their Connections (Redecker and Punie, 2017)

Source: <http://europa.eu!gt63ch> licensed under [CC BY 4.0 /](https://creativecommons.org/licenses/by/4.0/)

As depicted in Figure 2-3, there are 22 elementary competences organised in 6 key areas: (1) professional engagement, (2) digital resources, (3) teaching and learning, (4) assessment, (5) empowering learners, (6) facilitating learners' digital competence. These 6 areas are further categorized under educators' professional competences, educators' pedagogic competences, and learners' competences (Redecker and Punie, 2017). Consequently, educators' digital competence is expressed in:

- their ability to use digital technologies in professional engagement such as communication and interactions with students, colleagues and other stakeholders.
- the knowledge and skills required to find, use, create and share resources that best fit their learning objectives.
- ability to effectively orchestrate the use of digital technologies to teach, assess and empower learners to engage in their learning in any chosen pedagogic approach.
- enabling learners to creatively use digital technologies (Yazon, et al., 2019).

Educators with little or no knowledge or background in technology, must learn and develop digital skills to function in digital learning environment, which requires motivation and

willingness. The motivation for digital literacy and competence of educators, unlike the students is not driven by their identity as digitally confident educators, rather, it is driven by the perceived value of the technology in the learning environment. As Bennett (2014) discovered, educators learn and develop the necessary digital competences required to become efficient in their practice in order to meet the needs of the students, which is congruent with the DigComp framework. For educators willing to become digitally competent in their practice, it is important for them to understand their personal strengths and weaknesses (Redecker and Punie, 2017), to identify the areas they need to develop. Thus, the DigCompEdu proficiency progression model (Figure 2-4) is an effective tool to assess educators' digital competence proficiency level, starting from newcomer, and progressing to explorer, integrator, expert, leader and pioneer.

Educators can measure their proficiency level against each of the 6 elementary competence required. For example, an educator whose proficiency level is a newcomer, will not or very rarely use digital devices or digital contents in their teaching, while educators whose proficiency level is an integrator can organise and manage the integration of digital devices (e.g., classroom technologies, students' devices) into the teaching and learning process (Redecker and Punie, 2017).



Figure 2-4: DigCompEdu Proficiency progression (Redecker and Punie, 2017)

Source: <http://europa.eu/!gt63ch> licensed under [CC BY 4.0 /](https://creativecommons.org/licenses/by/4.0/)

Overall, digital literacy and competence of educators and students, is essential in the uptake of mobile learning in any learning environment. When students acquire the knowledge and skills to effectively use mobile technology to support their learning, it increases the motivation to learn new skills and practices, hence harnessing the value of mobile learning. However, to have digitally literate and competent learners, we need digitally competent educators with educator-specific digital competences, and an understanding of the value of technology in the



learning environment. Where such is lacking, educational institutions must commit to an effective continuous professional development training for its educators to learn the necessary digital skills required to deliver quality education for today's digital students.

### ***2.5.2.2 Digital Natives and Immigrants***

The distinction between the motivation behind learners' and educators' digital literacy and competence as discussed in the previous section, is the exposure to the technology and the use value of technology. It is evident that the present generation of students learning in the digital era, are more digitally literate than students in the pre digital era. As Prensky (2001) rightly divulged, our old educational systems were not designed to teach today's students, because the dissemination of digital technology has resulted to a great discontinuity of the old system. Institutions are now upgrading their learning environment to accommodate the needs of the present digital generation learners who, according to Prensky (2001), are called the digital natives. These are the generation of students born into the digital society, and their interactions with technology has become an integral part of their daily lives, making them extremely competent in the use of computers, video games, internet and social networking. However, those who were not born in the digital era have had to adopt, learn about, and consciously develop interest in new technologies, and they are known as digital immigrants (Prensky, 2001).

As seen in many educational systems, majority of the educators, and management are digital immigrants, and often perceive the traditional teaching and learning methods as a more effective pedagogic approach, and consequently, may have little or no value for digital technology in the learning process as much as their present students would. According to Prensky (2001), today's students think and process information profoundly different from their predecessors, and therefore struggle to function in the old method of learning. Contrastingly, educators who function better in the old system, struggle to teach a generation that only speak and understand the digital language, which creates a digital divide within the learning

environment. Nevertheless, the digital divide between these two generations of users only elucidates their acuity about digital technology, not necessarily a determining factor in the digital literacy or competence of users. According to Zur and Zur (2011), as much as most digital natives are assumed to be inherently technology-savvy by virtue of being born in the digital society, others may have no operational knowledge of computers or interest in technology. Also, digital immigrants fall into different categories of adopters based on their attitude and capabilities, such as technology enthusiasts, reluctant user, and avoiders. This further proves that some people are more technologically adept than others, irrespective of their digital identity. Technology adeptness is not based on age or the generation of the user, rather, it is based on their interactions and attitude towards digital technologies (Zur and Walker, 2015), implying that a native can be an avoider, or an immigrant can be an innovator. Thus, the obstinate dichotomy of digital natives and immigrants within the learning environment should cease, as digital literacy is not an innate ability, but rather a skill that is learned or acquired (Nyikes, 2018).

Overall, the digital literacy and competency of users of technology is paramount for its potential to be fully harnessed within the learning environment. Irrespective of the digital origin of the users, whether immigrant or native, one can only become digitally literate if motivated, which is essentially driven by access to technology, access to support and services needed, and understanding the use value of such technology. Digital literacy is learned, and should therefore be understood as a continuum, since digital technology keeps evolving.

### ***2.5.2.3 Technical Capital***

One of the key motivators for learners' digital literacy and competence is access to the technology, resources, knowledge, technical support and necessary training required to influence the use of mobile technology within and outside the learning environment. Yardi, (2010) defines technical capital as the "availability of technical resources in a network, and the mobilization of these resources in ways that can positively impact access to information

and upward mobility”, which is inspired by Bourdieu’s concept of cultural capital. Hayhoe (2015, citing Bourdieu 2010) refers to Bourdieu’s cultural capital as learning through social agencies or community through the internalization of subconscious habits (habitus) , as well as conscious knowledge on the prevalent culture, including knowledge on the use of and access to prevailing technologies. This suggests that people often learn from knowledgeable others around them either consciously or unconsciously, and cultural capital in its embodied form, requires personal investment in time and effort to acquire certain skills. Thus, acquiring knowledge of the use of technology is a type of cultural capital (Hayhoe, 2015). Yardi’s (2010) technical capital is a techno-social adaptation of Bourdieu’s cultural capital (Hayhoe, 2015), which focuses on one’s access (connection) to people with embodied (skills) or institutionalised (certified) techno-capital (technical knowledge). According to Brock, et al., (2010), technical capital “accrues through education, economic means, social networks that include others knowledgeable about information technology, and unrestricted access to information technology”.

As Yardi (2010) rightly articulates, learners’ technical attitudes and competency are fundamentally social and are strongly influenced by people around them. Therefore, technical capital is used to measure their access to technical expertise within their social networks (i.e., their relationship with their community, parents, teachers, siblings and friends). To better assess technical capital of users, Yardi (2010) listed some pertinent questions that help understand a learner’s access to technical resources, such as:

1. Who would you go to for help if you have a problem with computers or technology?
2. Are there also people who come to you for advice regarding problems they have with computers or technology?
3. Who would you ask if you had to borrow some small piece of technology, like a cell phone or an mp3 player?

4. Suppose someone asked to borrow a large item from you, like a laptop. Whom would you trust the most to lend it to?

The degree of technical capital within a user's community can influence their perception, interest and ultimately the adoption of mobile learning. Mobile learning requires not only technical skills to use the device, but also digital competence to effectively use it for learning purposes. When a learner has access to resources, and is surrounded by peers, family members and educators, or forms social relationships with people who possess adequate technical competence to use mobile technology for learning, it drives the motivation for inclusivity to attain a positive social identity among their peers or group. Adversely, the absence of such resources results in exclusion, placing non-users at a huge disadvantage with less access to education, training, social status, causing a digital divide within their class community. Therefore, technical capital as well as digital literacy and competence are important factors to consider in the integration or adoption of new technology in a learning environment. The digital literacy of users and members of their immediate community increases the level of technical capital available to them, which is a motivator that can drive their interest in becoming digitally literate and embracing innovative technologies in their institutions.

### **2.5.3 The User Environment**

The users' environment plays a pivotal role in the uptake of new technology as it influences the users' digital literacy, and ultimately their perception and interaction with the technology. Users' environment within this context is the immediate environment where the technology is/would be used, which in this case is the educational institution. There are several factors within the environment that influences the adoption of mobile learning, for example, the facilitating conditions (the infrastructure), pedagogical approach, technology integration level, as well as the social factors (social influence), and government support. Some of the factors such as "facilitating conditions" and "social influence" were adopted from Venkatesh et al

(2003) Unified Theory of Acceptance and Use of Technology (UTAUT) model. Although this study will not use this model for analysis, its constructs are used to give insight into some of the social factors that influences the adoption of mobile learning.

### ***2.5.3.1 Facilitating Conditions***

Teo, (2010) defined facilitating conditions as perceived enablers or barriers in the environment that influence a person's perception of ease or difficulty of performing a task. It is the availability of organizational and technical infrastructure to support a new technology. The infrastructural requirements for the technology may differ depending on the technology to be used considering that the infrastructure to support e-learning, which includes computers, good power supply, reliable LAN or wireless network connection, computer lab etc., may differ from that of mobile-learning. In general, e-learning and mobile learning infrastructure are categorised into, hardware (computers and mobile devices, server, database, bandwidth, Wi-Fi, and server configurations), software (learning management system), mobile learning applications, and system support (administrative support, technical support, LMS support, content management system staff and student training, etc.). While computers and computer rooms are essential in e-learning, mobile device is the fundamental hardware infrastructure to support learning. For mobile learning to be effective, users must have access to, or own a mobile device. Also, reliable internet connection and broadband speed is required at all times, otherwise the concept become inefficient (Chavoshi and Hamidi, 2019).

The feasibility of mobile learning is then determined by users' access to and ownership of mobile devices such as smartphones and tablets, and the affordability of these devices for educators and learners without one. Additionally, mobile devices operate on different network platform such as 3G, 4G and recently 5G, provided by network service providers, which requires users to obtain a network data plan for access to the internet. Alternatively users can use Wi-Fi where available to access online resources. Overall, without the necessary

infrastructure to support mobile learning within the learning environment, its adoption will be futile.

### ***2.5.3.2 Pedagogical Approach***

The consideration to adopt mobile learning requires an assessment of the pedagogical approach. The methods used by educators within the classroom should easily be transitioned to, and be effective within a mobile learning environment. For example, an instructivist pedagogical approach, which is a teacher-centred approach, may not be as effective in a mobile learning environment as constructivist (student-centred), and social-constructivist (learning-centred or collaborative learning) approach (Ozdamli, 2012). The pedagogic approach often determines the design and type of contents used in a lesson. For instance, lecture manuals or textbooks will be considered unsuitable for practice based lessons, rather an interactive content will promote students engagement in the learning. Therefore, learning contents should also be optimized for mobile learning environment. While traditional contents such as textbooks and handouts are primary resources used in face-to-face classrooms, learning contents can be presented in a variety of ways on mobile learning platforms. Contents can include text and images, multimedia contents (video, audio and animation) and collaborative content (Chavoshi and Hamidi, 2019).

Overall, the adoption of mobile learning within an institution requires extensive analysis and assessment of its infrastructure, and its current pedagogical approach. This is to determine if the required infrastructure to support mobile learning is available, and if the current pedagogical approach can be effective within a mobile learning platform.

### ***2.5.3.3 Technology Integration Level***

Technology integration level can be understood as the rate in which technology is currently used within the curriculum. Hertz, (2011) describes technology integration as the integration of technology in the classroom rather than teaching it as a class. In other words, technology integration level is the frequency of use for learning. She further outlined the levels of

technology integration as sparse, basic, comfortable, and seamless. Sparse use of technology refers to the rare use or availability in the classroom; basic refers to occasional use such as access to the computer lab occasionally. Comfortable use of technology is when technology is used in the classroom on a fairly regular basis, using variety of tools to create projects and show understanding of content; while seamless is the daily use of technology in the classroom to complete assignment and tasks, as well as using tools to create projects that shows deep understanding of content.

Assessing the current technology integration level in the learning environment can uncover users' attitude or institutional culture towards new technology.

#### ***2.5.3.4 Social Factors***

The social factors cannot be overlooked when considering the uptake of mobile learning. Many studies have tried to identify how social factors influence the adoption and acceptance of mobile learning using Venkatesh et al (2003) Unified Theory of Acceptance and Use of Technology (UTAUT). One of the key constructs within the model is social influence, which is defined as “the degree to which one feel the importance of a new technology is based on other’s belief”. In a society where the social culture of image and identity is prevalent, young learners and most adults are often drawn to trends, especially when the trend is useful and gives them a sense of identity. Therefore, the external and institutional influence can encourage the use of mobile learning amongst learners and educators, and important members of the students’ community such as their educators, parents, and classmates, can drive their interest in mobile learning (Chavoshi and Hamidi, 2019). As much as social influence can encourage users to adopt mobile learning, the lack of cultural and technical capital amongst these users’ community might have an adverse impact on their acceptance level. Additionally, lack of financial resources to purchase mobile technology can be a demotivator. Many institutions in developing countries such as Nigeria do not have the budget to provide mobile devices to all

learners, which requires parents' and government's support in purchasing these devices for learners for effective implementation of mobile learning (Ali and Arshad, 2016).

#### ***2.5.3.5 Government Support***

It is evident that some of the factors that can illuminate the potentials and adoption of mobile technology, is greatly influenced by its environment. Concepts such as mobile learning are best adopted by educational institutions when they become policies. Policies for education which provides influential context such as goals and standards, curricula and teacher policies, set the facilitating conditions within which educational practice occurs (Oyelola, 2015). These policies are formed by the government to provide quality education for its people. UNESCO, (2013) believes that mobile technologies can expand and enrich educational opportunities for learners in diverse settings, and thereby urges policymakers to adopt their policy recommendations. Current government policies on technology integration in education should be assessed to reveal government's attitude towards TEL. UNESCO's policy recommendation includes:

***Creating or updating policies related to mobile learning:*** it is important to examine the unique educational potentials and challenges offered by mobile technology and, when appropriate, incorporate these understandings into broader ICT in education policies. It urges institutions to avoid the prohibitions of mobile devices unless such prohibitions are implemented for well-considered reasons. Guidance on how new investments in technology can work in conjunction with existing educational investments, and initiatives should also be provided.

***Training teachers to advance learning through mobile technologies:*** government should prioritize the professional development of teachers, as the success of mobile learning hinges on teachers' ability to maximize the educational advantages of mobile devices. Providing the necessary technical, as well as pedagogical training to teachers when introducing mobile learning solutions and opportunities is essential. It also encourages teacher training institutes to incorporate mobile learning into their programmes and curricula and provide opportunities



for educators to share strategies for effectively integrating technology in institutions with similar resources and needs.

***Expanding and improving connectivity options while ensuring equity:*** by taking stock of existing ICT infrastructure, the government can establish realistic targets for improving this infrastructure incrementally, devoting particular attention to underserved areas. It further suggests that government should also support the provision of robust and affordable mobile networks within and across communities, especially in educational institutions such as schools, universities and libraries. The high cost of these technologies has become a deterrent in its adoption. Therefore, government should consider providing full or partial subsidies for access to mobile data and broadband services. According to UNESCO (2013), many governments offer ‘e-rate’ subsidies to promote internet access for educational purposes via computers. Thus, governments should now consider sponsoring ‘m-rate’ subsidies to promote mobile access to the internet and support efforts to build local and ad hoc networks to support mobile learning, especially in settings where larger networks are unavailable.

***Develop strategies to provide equal access for all:*** as earlier mentioned, mobile learning requires learners to own a mobile device to facilitate access to learning technologies. For some learners who cannot afford one, government can ensure equal access to mobile technology and participation in mobile learning for all students and teachers, by adopting measures to provide mobile hardware and connectivity to learners who do not have a personal device. A principal advantage of mobile learning as UNESCO (2013) explains, is that it creates educational opportunities inside and outside of schools. If students cannot take full ownership of their devices, they are unlikely to adopt them as personalized learning tools and use them in informal contexts. Thus, policymakers should encourage government departments and educational institutions to negotiate with vendors and leverage the purchasing power of large numbers of learners.

***Raise awareness of mobile learning through advocacy, leadership and dialogue:*** according to UNESCO (2013), negative social attitudes regarding the educational potentials of mobile technology constitute the most immediate barrier to the widespread embrace of mobile learning. Therefore, highlighting and modelling how mobile technology can improve teaching, learning and administration can promote its adoption in educational setting (UNESCO, 2013). Overall, the potentials of mobile technology in enhancing teaching and learning are enormous, however harnessing such potentials involves a great depth of study and an investigation of the learning environment and the users of the technology, otherwise its adoption will be considered a failure and an ample waste of resources. Having discussed the different characteristics of the device, the user, and the user environment when considering the uptake of mobile technology in a learning environment, one needs to also consider the challenges with mobile technology for learning.

## **2.6 Challenges with Mobile Technology in Education**

As earlier mentioned, mobile technologies present immense opportunities for learners, educators and institutions. Having outlined the characteristics of mobile technologies such as the low cost of mobile devices and wireless technologies, and the mobility of the device and increased learner engagement (Cobcroft, et al., 2006), the digital fluency of the users, and the environmental and social factors that can influence the adoption of mobile learning, its implementation can still be problematic. Several studies including Al-Hunaiyyan, et al., (2016); Cobcroft, et al., (2006); and Haji, et al., (2013), have identified various mobile learning challenges in different contexts. Al-Hunaiyyan, et al., (2016), listed some of the challenges as: Management and Institutional Challenges; Design Challenges; Technical Challenges; Evaluation Challenges; and Cultural and Social Challenges.

### **2.6.1 Management and Institutional Challenges**

Change management is one of the major concerns for higher institution when implementing mobile learning. This includes change in pedagogy, processes and learning activities which affects students, educators and families (Al-Hunaiyyan, et al., 2016). A change in a system or process are most often spurned by the users and adopting mobile learning strategy is a major change to the learning approach, which can take a while for educators and learners to adjust to. Nonetheless, strategic change management approach, can ease educators and learners into accepting the change (Al-Hunaiyyan, et al., 2016). Another aspect of management and institutional challenge that can affect the adoption of mobile learning is the attitude and perception of management towards accepting new technology.

### **2.6.2 Design Challenges**

The features of mobile devices especially the size provides mobility for learners. Thus, instructional and user interface design are important factor for a successful learning application, as the organization of visual elements and media on the mobile screen can impact the ease and quality of learning (Al-Hunaiyyan, et al., 2016). However, the challenge is creating learning content and learning materials which can be optimized for mobile users (Bradley, et al., 2009). A study conducted in Zanzibar, as Haji, et al., (2013) observed, is that universities do not have mobile web applications in place. This is because their existing web-based applications were not designed to be compatible with hand-held devices. To address this challenge, Kaliisa and Picard, (2017), suggested learning management systems should be designed to be compatible with mobile devices. Poorly prepared learning material is a challenge linked to instructional design. This is because of lack of knowledge on how to develop mobile learning content. Thus, training educators on how to use mobile learning technologies to create learning materials will prepare them and help address this challenge (Asimwe, et al., 2017).

### **2.6.3 Technical Challenges**

Technical challenges are eminent factors that can affect the adoption of new learning technologies. As mentioned in previous sections, the lack of technical and communication infrastructure such as adequate bandwidth and end user support can frustrate the use of mobile learning technologies. Additionally, the varieties of mobile devices can raise compatibility issues for some users, as improper software or mobile application development for mobile learning may encounter functionality issues, making the app unusable for some mobile devices, therefore rendering the concept of mobile learning useless. Kaliisa and Picard (2017) suggested that in order to address these challenges technical support should be provided to students and educators on how to use and navigate through mobile learning platforms.

### **2.6.4 Cultural and Social Challenges**

Another challenge that affects the adoption of mobile technologies is the cultural and social norms and concerns of its impact. A study into higher institution in Kuwait revealed that culture and religion as well as human perception has a huge impact on the adoption of mobile learning (Al-Hunaiyyan, et al., 2016). The change that mobile technologies will have on learning practices, has become a growing concern for educators and learners with regards to privacy issues; data security; cyber-bullying and access to mobile devices, as student and educators must own a mobile device (Al-Hunaiyyan, et al., 2016). To address these challenges, a careful study of the culture, the beliefs and traditions of social setting must be conducted to identify the basis of users' perception. The finding and concerns of users must be carefully considered and addressed during the design and implementation process of mobile learning.

### **2.6.5 Digital Divide**

One of the challenges that can affect the adoption of mobile learning is the digital divide amongst users, as some users are more digitally literate than others, which can often affect the acceptance of change in pedagogic practice within learning environments. As seen in previous

discussion on digital literacy, several factors such as access and perceived use value can create digital divide amongst users within a learning environment. Another form of digital divide is device ownership. The digital gap between owners of mobile devices (smartphones, tablets and iPads) and non-owners in the classroom can result to an unconscious digital segregation between learners as non-owners are unable to participate in the learning process in a mobile learning environment. This segregation can, as a result, create a negative social identity for such learners (Hayhoe, 2015). Making mobile devices available in the learning environment to enable non-owners of mobile technologies participate in the learning, is one way to address the challenge of digital ownership divide.

## **2.7 Mobile Learning in Teacher Education**

Teacher education is the mobilising environment for lasting and sustainable educational change and innovation (Hall and Connolly, 2019). However, the divergent nature of the structure of teacher education from different learning institutions and countries, makes the concept of designing effective mobile learning structure complex. Nevertheless, the antecedents of this study continually suggest that digitally competent educators are the catalyst for successful implementation and adoption of mobile learning. This calls for a re-evaluation and the re-structuring of teacher education curricula to include preparing and training pre-service and in-service teachers on how to effectively teach with mobile technology.

Burke and Foulger (2014) conducted a study of four institutions who have embedded the teaching of “how to use mobile technology” in their teacher education curriculum. The study explored the motivators that triggered the decision to include the teaching of mobile technologies into their curriculum, the method used to accomplish full implementation, the role of institutional characteristics, and the challenges encountered during the adoption process.

### **2.7.1 Motivators and Method**

The findings from Burke and Foulger's study revealed that an instrumental motivator for the change in curriculum is the institutional belief in innovation and commitment to the use of technology. The dedication of the management of an institution and the government to promote innovation in teacher education, is the motivation that drives investment in technology, and in training on the use of such technology to enhance teaching and learning. This forms the basis of the inclusion of this fundamental training in their curriculum. The study revealed that investing in learning technologies and enforcing engagement with online LMS such as Blackboard learn, Moodle, etc., creates expertise within the faculty, making the teaching of mobile technologies a natural progression from teaching the use of computers and laptops. This suggests that the utilization of existing technology to facilitate learning in teacher education makes transitioning to mobile learning less problematic.

The method of implementation is dependent on the structure and resources available to the institution. Some institutions believed that giving faculty members personal iPads to use enabled them to discover on a very individual basis, the potential a mobile device has as a tool for teaching and learning. Burke and Foulger, (2014) reported that faculty members' confidence with mobile learning technologies allowed the development of a curriculum that integrates the teaching of mobile technologies to happen smoothly. Another institution disclosed that the introduction of educational technology course early in their curriculum sequence, with the first units including the use of mobile technologies, required students to learn how to use mobile devices with their future students, and integrate mobile learning into whole-class, small- group, and individual instruction.

Access to robust wireless networks in the classroom, and mobile technologies for students without a device has proven to be an effective way to implement and enforce teaching with and learning how to use mobile technology in teacher education. For some institution, purchasing an iPad with video capabilities is a pre-requisite for enrolment. As UNESCO

(2013) suggested, some institutions provide grant that fund the acquisition of iPads for students in junior-level technology courses who cannot afford one.

Overall, the belief that all faculty members are expected to use and teach the use of mobile technology in their courses, is not only a method of implementation, but also a motivating factor.

### **2.7.2 Internal Institutional Characteristics**

Commitment to the use of technology and administrative support are internal institutional characteristics that are crucial in mobile learning adoption (Burke and Foulger, 2014). Embedding the teaching of the use of innovative learning technologies in curriculum and within the learning environment such as the use of LMS; the availability of technical support for faculty members; access to funding for the acquisition of innovative technologies and technology support; commitment to professional development and creating support initiatives, are indicators of an institution's commitment to the use of technology to enhance teaching and learning. Furthermore, institutional belief system in the power of educational technology is also an internal institutional characteristic that promotes the uptake of innovative learning technologies (Burke and Foulger, 2014). This suggests that Institutions that embrace technology and understand its value, will be committed to harnessing its potentials in order to provide good quality education.

Overall, the availability of generous funding for technology, the desire and the efforts to teach about the use of mobile learning technologies by important members of the management such as the Provost and the Dean of faculty, and the support of the initiative by the IT department are listed as institutional characteristics for success. Furthermore, the flexibility of faculty members and the willingness to give up some control of student learning and embrace change are also important.

### **2.7.3 Implementation Challenges and Advice**

Despite the different strategies adopted to promote a smooth transition to, or adoption of mobile technology use in teaching and in curriculum, some challenges were reported. According to Burke and Foulger (2014), faculty knowledge regarding teaching the use of mobile technology is limited. The study revealed that though students may have extensive technology skills, students' comprehension on how to use mobile technologies to support teaching and learning is a challenge, indicating the lack of digital competence as described by Redecker and Punie (2017) to utilize their digital skills to achieve learning outcome. This revealed the need for educators in teacher education to understand the instructional technologies better than their students to ensure the most optimal learning with mobile devices. Again, this buttresses on the need for educators to possess educator-specific digital competence to facilitate learner's digital competence (Redecker and Punie, 2017). According to Burke and Fougler (2014), one institution suggested that to address this issue students should learn how to use mobile technology early in their curriculum through the introduction of technology-based courses at the start of their program.

Furthermore, students access to or ownership of a mobile device is a prerequisite for mobile learning. However, financial difficulties can prevent some students from purchasing one. This seems to be a common challenge with mobile learning, and as Burke and Fougler (2014) reported, soliciting for and providing access to grants to enable these students purchase a mobile device is one way of addressing this challenge.

## **2.8 Summary**

Mobile learning has received a lot of attention in the past few decades as part of TEL research. Their findings continue to illuminate its positive impact in delivering quality education for learning institutions. Although these studies continue to showcase its impact, few studies have also identified challenges with TEL to include infrastructural, technical knowledge of



educators, and users' attitude towards technology acceptance. However, there seem to be a literature gap in studies documenting the challenging implementations of TEL.

Mobile learning as a branch of TEL, appears to have addressed the infrastructural challenge, offering ubiquitous learning because of the mobility and portability of the device. However, harnessing the potentials of mobile learning requires the human and the environmental factors. It is evident in this study that without the digital literacy and competence of the users, especially educators, mobile technology will always be just another communication device. To attain a level of digital competence for effective use in teaching and learning, users need to be motivated towards technology, which is primarily driven by the environmental factors. The studies reviewed in this chapter revealed that motivation towards technology is driven by the perceived use value, access to capital (technical, social and cultural) technical support, as well as social influence. The exact hierarchy of what environmental factor precipitates the other to motivate the adoption or use of mobile learning, is not articulated in the study because of the literature gap in user motivation towards technology, as it has not yet been investigated. Nevertheless, Bennett (2014) revealed that motivation differs for both students and educators. Educators' competence is fundamental for successful mobile learning adoption, hence the importance of restructuring teacher education to include teaching with mobile technology and including how to teach with mobile technology in their curriculum. This requires an institutional culture of embracing technological innovation in education, good leadership to support technology initiatives, funding to support infrastructure, professional development, and acceptance by stakeholders, (government, parents and students). For clarification, institutional cultures are shared ideas, values, and standards that permeate the everyday lives of its members, propagated by institutional indoctrination, actions, and leadership (Simone, 2009). It is what determines the perception and attitude of members of the institution towards concepts such as ICT or mobile technologies for teaching and learning.

Finally, though very little studies revealed the successful implementation and management of mobile learning such as Burke and Foulger's (2014), there is a considerable literature gap on how mobile learning contents are developed for teacher education, which is an area of research that needs to be explored to support existing and future mobile technology for education research.

In the following chapter we will review the contextual literature in detail to identify the environmental factors such as government policies on technology in education, level of technology integration, as well as the attitude and perception of policymakers that can influence the adoption of mobile learning in teacher education in Nigeria.

## **CHAPTER 3: TECHNOLOGY ENHANCED LEARNING IN NIGERIAN COLLEGES OF EDUCATION**

### **3.1 Introduction**

As discussed in the previous chapter, the mobilizing foundation for propelling change in teaching and learning practices is teacher education. This chapter discusses the current state of TEL, followed by an overview of education policies on the implementation of ICT to enhance learning in Nigerian higher institutions, particularly colleges of education which is a teacher training institution. To identify the potential of integrating mobile technologies into teaching and learning practices, an evaluation of the application of ICT in Nigerian colleges and institution to enhance learning was carried out, while investigating the research direction of mobile technology in teaching and learning in the country's higher education sector.

Assessing the impact of TEL and adoption of mobile technology to enhance learning is intended to generate insight into its potential in Nigerian teacher training institutions. From the studies examined in the previous chapter, it is evident that mobile technology has the potential to enhance teaching and learning, which will not only improve students' ability to learn, but can also improve the quality of education which can boost the country's economy (West, 2013). Precisely, the integration of mobile technologies in learning process can improve communication and facilitate access to learning recourses, as well as creating a flexible approach to learning where learners can learn anytime and anywhere (Kaliisa and Picard, 2017).

### **3.2 Overview of Education Policy on Implementing ICT in Nigeria's Tertiary Education.**

Education is a fundamental human right and is enshrined in the 1948 declaration of human rights (UNESCO, 2017). The need for quality education cannot be overemphasized, which is

one of the United Nations sustainable development goal. The goals are to provide quality education, by ensuring inclusive and equitable education, as well as promoting lifelong learning opportunities for all. As higher institutions in developed countries such as UK, United States etc., continue to explore and adopt current trends in ICT such as mobile technology to improve the quality of education and learning experience (Davidson and Lazaros, 2015), this is not the case in higher institutions in a developing country like Nigeria. The use of mobile technology as a learning tool in Nigerian higher institutions is still in its infancy (Oyelere, et al., 2018) despite its high presence in the country, with an estimated 15-20 million smartphones registered to various mobile network operators as of 2014, and a total of 152,614,413 active mobile lines as well as 93,524,398 active mobile internet connections in 2016 (Adegboye, 2016). The high usage statistics of mobile technology in the country should be considered as an opportunity for learning institutions in Nigeria to begin to explore the possibilities of turning these devices into powerful learning tools. This calls for the need to establish, solid national legal policy frameworks, which will create the foundation and conditions for the delivery and sustainability of quality education (UNESCO, 2017).

### **3.2.1 National Policy on Education**

Studies have shown that Nigeria has expressed commitment to education, which has accounted for various policy initiative such as National Policy on Education (NPE) by the government, as education is considered as an instrument pre-eminent for effective national development and social change (Bolaji, et al., 2015). Yet, regardless of the indisputable evidence, that education is crucial to the development of the nation, access to quality education is still a challenge in Nigeria (Odukoya, et al., 2018). These challenges affect all levels of education including tertiary education, which is made up of colleges of education, polytechnics, universities etc., (NPE, 2013).

Quality in higher education refers to the value of the inputs into higher education systems,

educators, instructional facilities and evaluation procedures which translates to the outputs (Asiyai, 2013). As seen in the policy document, one of the goals of tertiary education in Nigeria is to “provide accessible and affordable quality learning opportunities”, to be achieved through quality teaching and learning, and high standards in the quality of facilities, services and resources (NPE, 2013 p.26). It is evident through the NPE document that the Nigerian government has keen interest in providing quality tertiary education. However, for more than 40 years since the policy came into existence, Nigeria has been unable to successfully implement them (Odukoya, et al., 2018).

### **3.2.2 ICT Policy in Education**

The Nigerian government is not oblivious of the role of ICT in higher education. As part of her education reform effort, ICT was implemented at all levels of education to improve teaching and learning, enhance higher education research, enhance collaboration and improve the overall quality of education (Asiyai, 2013). As Odukoya, et al., (2018) revealed, the Federal Executive Council approved a national IT policy in March 2001 and established National Information Technology Development Agency (NITDA), charged with the responsibility of implementing the policy in the country.

The Federal Ministry of Education is responsible for the implementation of ICT policies in education and is advised by the National Council on Education, which is made up of the Federal Minister for Education, the State commissioners of Education and a Joint consultative commission on education who are essentially education officials. As stated in the policy document, some of the objectives includes:

1. To integrate ICT into the national education curriculum.
2. Introduce mandatory training and appropriate courses for ICT at all tiers of education.
3. Foster an ICT driven educational administration environment.
4. Promote the development of instructional materials in electronic format.

To meet the objectives the strategies outlined includes:

1. Provide personal computers in public places (e.g., post offices, schools, public libraries, etc.) in small and large communities to help low-income segments of society gain access to the internet and for educational purposes.
2. Promote the incorporation of ICT within the education curriculum at all levels.

However, due to the challenges in the system, such as the lack of proper infrastructure to support the use of ICT in Nigerian schools (Egoeze, et al., 2014), implementation of these policies is unsustainable.

### **3.3 Evaluation of ICT implementation in Nigeria's Colleges of Education.**

The Federal Colleges of Education is an important part of Nigeria's tertiary education. This is because it is a government owned teacher education institution designed to train pre-service teachers (Garba, et al., 2013). Since the implementation of ICT in education begins with the teachers, it is imperative that pre-service teachers training to become teachers, receive adequate training on using ICT to enhance teaching and learning. Moreover, teachers trained using ICT resources will certainly adopt same practice in their teaching after training as opposed to teachers who trained without them (Onwuagboke, et al., 2015). Although most colleges of education in Nigeria have established ICT centres equipped with basic computing and communication devices to cater for the ICT needs of the staff and students within the college, ensuring effective instructional delivery is still far-fetched (Onwuagboke, et al., 2015). The level of technology integration in pedagogical practices and the level of training to do so is considerably low (Garba, et al., 2013). This is mainly because educators in colleges of education in Nigeria are accustomed to the traditional face-to-face mode of delivering lessons which does not promote an interactive teaching and learning environment (Onwuagboke, et al., 2015).

### **3.3.1 Current state of ICT Integration**

Various studies assessing the level of integration of ICT into teaching and learning, in colleges of education across the country, observed that some colleges lacked proper ICT infrastructure and in cases where there were ICT centres, they were non-functional due to lack of use or poor maintenance. Ajayi (2008, cited in Onwuagboke, et al. 2015) reported the lack of ICT infrastructure in south-western Nigeria; Jude and Dankoro, (2012, cited in Onwuagboke, et al. 2015) also mentioned the lack of ICT facilities in the college of education Katsina-ala Benue state. Toyo, (2017) also found that ICT is mostly used for typing and saving documents in college of education Agbor and Warri in Delta state. This suggests that ICT has not been used effectively in teaching and learning in these colleges.

### **3.3.2 Factors affecting the integration of ICT in Teaching and Learning**

Considering the little or no integration of ICT in teaching and learning in these teacher education institutions, studies such as (Toyo, 2017); Onwuagboke, et al., 2015; Asiyai, 2013; Matthew et al., 2015), have identified some factors that deprive learners in these institutions of the benefits of an ICT enriched learning.

**Poor power supply:** this is one of the major constraints to the use of ICT in these institutions. As Airoboman, et al., (2016) rightly said, the energy production level of any community dictates its level of development. The effective use of ICT is dependent on the availability of energy as ICTs are powered directly and/or indirectly by one form of energy or another (Toyo, 2017). The lack of steady power supply in the country has driven individuals and organizations to resort to alternative power supply such as diesel engine generators because it is the quickest and expensive way to supplement for the instability in power supply (Airoboman, et al., 2016). Yet, the high cost of fuelling and maintaining these generators, makes powering ICT centres challenging for colleges of education.

**Poor Funding:** lack of adequate funding remains a challenge for colleges of education. According to Okeowo, et al., (2018), Nigerian colleges of education are not funded well. Colleges of education, which remain the bedrock of teacher training in Nigeria, is where the future teachers are trained. The training they receive determines the future of our education system. In 2018, as Okeowo, et al., (2018) reported, the sum of N48.3bn was allocated to 21 colleges of education which is an average of 2.3bn to each college. This is low when compared to funding allocations to universities which stands at N278.1bn. It does, invariably affect the institutions' ability to afford adequate ICT equipment and power supply to power the equipment.

**Lack of ICT facilities and infrastructure:** this is another factor that affects the use of ICT in Nigerian colleges of education. To integrate ICT in teaching and learning, hardware, software and network infrastructure must be available (Agbo, 2015). Despite the strong ICT policies in place, colleges of education still struggle with lack of proper ICT infrastructures (Garba and Alademerin, 2014) such as computers, projectors, inadequacies in the use of learning software, internet or wireless connection, to enable access to online resources (Asiyai, 2013). Moreover, the classrooms are not designed, and equipped to support these technologies.

**Lack of technically experienced educators:** This is yet another challenge of ICT integration. As facilitators of knowledge, educators have a role to play in determining the quality of education because they transmit educational policies into practice and action (Asiyai, 2013). According to Garba, et al., (2013), most educators in Nigerian education at all levels lack the essential experience and competence in the use of ICT for either educational or industrial purposes. Since the success of ICT integration in pedagogic practices is dependent on the level of ICT proficiency of educators, it beckons the need for effective and innovative use of technology in teacher training colleges such as this (Garba, et al., 2013).

Having identified some of challenges of ICT integration in teacher education colleges, it is apparent that factors such as poor power supply and inadequate infrastructure can be solved



with mobile technologies, due to its low maintenance nature. Thus, its potentials in enhancing learning should be explored.

### **3.4 Integration of Mobile Technology in Teaching and Learning in Nigerian Colleges of Education**

Mobile learning, is a new concept in Nigerian tertiary education, gradually picking the interest of the governments and private organizations. Since the challenges of integrating ICT in teaching and learning has trumped its potentials, mobile technologies are considered an alternative for facilitating pedagogic practices in Nigeria. This is because of the affordability, accessibility and ubiquity of mobile devices (Adedoja, 2016). According to UNESCO (2013), UNESCO and Nokia started a mobile technology project in Nigeria with the aim to enlist technology in the global effort to promote literacy and equitable access to education. This is possible because majority of Nigerian educators as reported by UNESCO, (2013), own or have access to a mobile device. Thus, learning platforms that exploits these devices, can potentially reach not just thousands, but tens of thousands of educators and students, which could greatly impact the country's higher education system. Furthermore, according to Okonji, (2015) the managing director, Samsung West Africa (2015), announced that the company introduced several devices that would enhance teaching and learning in the 21st century, and advised schools to take advantage of this new technology. This is an indication that attempts have been made by private sectors to bridge the technological gap in tertiary education.

The concept of mobile learning has indeed caught the attention of several institutions around the world and has been explored by other learning institutions in Nigeria, particularly universities (Chaka and Govender, 2017). However, the seeming gaps in literature assessing the potential of mobile learning in Nigerian colleges of education is an indication of its regressive approach towards current trends in learning technologies. A study conducted in Kogi state college of education in Nigeria, indicated that colleges are unprepared for learning

with technology. The study revealed that while students and educators are aware of the use of mobile technologies as a learning tool, they are not used in teaching and learning due to lack of knowledge and training on the technological benefits of mobile devices and how it can be used (Omede, 2014). As Baran, (2014) expressed, with the extensive use of mobile devices in education, teacher educators are expected to indicate more interest in testing the strategies for implementing mobile devices in their courses and professional development programs. Considering that colleges of education are teacher education institutions, it is imperative that pre-service and in-service teachers, understand the potentials of mobile technology in education, and how to integrate it into pedagogic practices.

Mobile learning can be integrated into teacher education in several ways. Two major integration approaches identified by Ktrioudou and Eteokleous (2005, cited in Ozdamli and Cavus 2011) are mobile device as: (1) a supportive tool and (2) as an instructional tool. A review of mobile learning research by Baran (2014), revealed several pedagogic advantages of mobile learning in preservice teacher education, which can be divided into these two approaches. Using mobile technology as a supportive tool allows connectivity, collaboration Information search; and as an instructional tool, mobile technology enables flipped classroom models (E.g., blended, active and collaborative learning), engagement with mobile contents as well as evaluating student performance (Baran, 2014; Ozdamli and Asiksoy, 2016)

Overall, with recent emphasis on using mobile technologies in education, the need has emerged to prepare educators especially in Nigerian colleges of education, with effective skills on integrating technology into classroom teaching. To achieve this, Baran (2014) suggested that educators need to train on how to integrate mobile technologies in the classroom and enhance teacher learning by using mobile learning. Stakeholders and education providers need to consider adopting Baran's (2014) method to train pre-service and in-service teachers in Nigerian colleges of education with mobile technologies and train on how to support pedagogic practices with mobile technologies. Once educators understand the benefits of

mobile technologies, they can begin to integrate them into classrooms as both instructional and supportive tools to meet the learning needs of their students, thereby implementing the ICT policies in education and improving the overall quality of education in the country.

### **3.5 Perception of Stakeholders on Integrating Mobile Learning in Nigerian**

The potential of mobile technology in teaching and learning has been explored by many researchers and frameworks and methods of integration has also been designed and developed by various scholars. Yet, its integration into tertiary education in Nigeria is still at its infancy. There are several factors affecting the adoption of mobile learning, and they are dependent on the context, the country or location of the institution. Osang, et al., (2013) iterated that factors such as learning environment, perception and motivation of the educators, security challenges, and cost of bandwidth to support mobile learning etc., are factors to pay attention to if adoption of mobile learning is to be considered. One of the common factors, also identified by Chaka and Govender, (2017) that affects the integration of mobile technology into teaching and learning in colleges of education, is the perception and attitude of students and educators towards mobile learning. Despite the numerous prospects of mobile learning in education, Ayoade (2015) opined that the challenges of mobile technology such as small screens, limited processing power, and small keyboards, has prompted users' negative perceptions towards using these devices for education purposes, making the adoption of mobile learning difficult. The integration of mobile technology into pedagogy is dependent on the perception and attitude of educators, learners, and other stakeholders. This is because stakeholders' perception and role in policy decisions and implementation has been recognized as the key instrument in ensuring the quality of education (Adedoja, 2016). The successful implementation of mobile technologies in learning institutions as discussed in Chapter 2, requires vision to embrace innovation, good leadership, management and government's support of technology initiative. When stakeholders share such vision, embracing the technology is less problematic, because

technology acceptance comes naturally when its value is understood. The users' perception of the role of technology and its value in improving their teaching or learning practice is a motivator for technology acceptance.

Although mobile learning is yet to be implemented in colleges of education in Nigeria, Chaka and Govender's (2017) study revealed that many students are optimistic about mobile learning and have therefore expressed their readiness to adopt it. Another study by Adegbiya and Bola, (2015) revealed the perception of Nigerian students towards mobile learning. The study indicated that most students have personal access to cell phone, Android tablets, smartphones, Mp3 players and laptops in their learning environment and they are favourably disposed to the adoption of mobile technologies for learning. Additionally, Adedoja (2016) in a similar study also revealed that stakeholders in education perceived the adoption of mobile technology as an instrumental driver of basic education in Nigeria. It is evident through these studies that students and other stakeholders are open to adopting mobile technologies for learning. Adversely, Adeyemo and Babatunde (2018) expressed concerns on the possible use of mobile devices for examination malpractice known as 'mobile assisted cheating or e-cheating' during examination. Its misuse in the classroom for purposes other than learning can create a negative perception about its potentials. Nevertheless, appropriate regulations regarding its use will curb the misuse of mobile technology in the classroom.

Incidentally, Nigerian policy makers are gradually developing interest in the digitalization of teacher education and a review of its curriculum, as the Nigerian Senate President according to Vanguard Newspaper (2020), has urged the Federal Government to carry out a holistic review of the country's education curricular, stating the outdated curriculum's inability to meet the desires and needs to produce manpower for the 21st century economy. He suggested that digital education should permeate all strata of the country's education system, and further reiterated that the country needs teachers that are up to date in digital training and cannot

continue to use the analogue system to train pre-service teachers who will themselves use the same analogue method in their teaching method (Vanguard Newspaper, 2020).

### **3.6 Summary**

Mobile technology has in many ways presented new learning opportunities such as mobile learning and has influenced pedagogic practices in institutions around the world, making it a powerful learning tool. While several attempts have been made to overcome the learning and technological challenges in the Nigerian tertiary education, the focus seem to be more on the universities and less on the colleges of education. Colleges of Education have distinctive learning environments, structure and objectives which is quite different from universities. The importance of teacher education in detecting the future of mobile learning in Nigerian schools should not be undermined. The finding in this chapter reveals that college of education institutions including this study's context, are struggling to fully implement existing ICT policies. Yet, little or no effort has been made towards assessing the potential and feasibility of adopting mobile technology to address the challenges that are affecting the effective attainment of the policy objectives (Chaka and Govender, 2014). Thus, the purposeful exclusion of mobile learning policy in the Nigerian policy on Education document is fathomable.

It is evident at this stage of the study that the institutional culture within teacher education have direct influence on technology adoption, which results in users' perception and attitude towards technology. As the literature suggests, user's attitude and perception are a result of their experiences with existing technology, their lack of digital literacy and competence, and the lack of perceived value, especially by educators and relevant stakeholders.

When policymakers and institutional management lack the vision and digital competence to embrace technology in the learning environment, new policies that enforces its implementation will not be formed. There is need to include digitally competent stakeholders, such as educators

and learners in the joint consultative committee on education, as they bring a fresh and relatable perspective to policy formations dialogue on emerging technologies that can enhance their pedagogic practices and learning. Additionally, since the success of mobile technology in education requires redesigning teacher education curriculum to include subjects on how to teach with mobile technology and inculcating the use of mobile technology in their everyday teaching and learning practice, the use of ICT and mobile technologies to facilitate presentation, access to resources and preparation of digital resources should be considered as essential requirements for educators. The shared vision of a digitally transformed teacher education by policy makers, the Federal Minister for Education and other relevant stakeholders are fundamental for such change to occur.

Change in the learning structure and curriculum of teacher education institution is influenced by government policies and implemented by institutions, which ultimately influences the users (educators and learners). The following chapter will discuss the philosophical paradigm, and the theoretical framework that guides the understanding of how the relationship between the user and the environment forms institutional culture that can either encourage or discourage change to embrace mobile technologies in teacher education.

## **CHAPTER 4: RESEARCH THEORY AND PARADIGM**

### **4.1 Introduction**

The purpose of any research is to search for knowledge, create new knowledge and/or contribute to existing knowledge on a subject or an area where little or nothing is known, through a systematic method of acquiring information. Knowledge can be gained by investigation, collection and interpretation of facts. This chapter will start by discussing the concept of knowledge, what it is and how knowledge is acquired. Thereafter, the fundamental philosophical principles of research are discussed alongside the philosophical paradigm that underpins this study. Additionally, a critical evaluation of the theoretical framework that guides the research is presented.

### **4.2 Knowledge Acquisition**

The study of knowledge is a recurrent subject and one that philosophy has been refining since the time of Plato (Pardi, 2019). There seem to be no universal definition of knowledge. Many philosophers have attempted to define knowledge, leading to the proliferation of different viewpoints on the concept. The knowledge pyramid which is made up of Data-Information-Knowledge-Wisdom DIKW (Frické, 2009), represents the way knowledge and ultimately wisdom is acquired through research. There have been quite a few modifications to this model. According to Bellinger, et al., (2003) a fifth level was added to this pyramid called Understanding. Through understanding, one can take knowledge and produce new knowledge from the previously acquired knowledge. One can also build upon currently held information, knowledge and understanding itself, to undertake useful action (Bellinger, et al., 2003).

The process of knowledge acquisition takes a researcher on a journey from inquiry to understanding, and in this study, the process is guided by the researcher's philosophical view alongside the framework adopted for the design of the study.

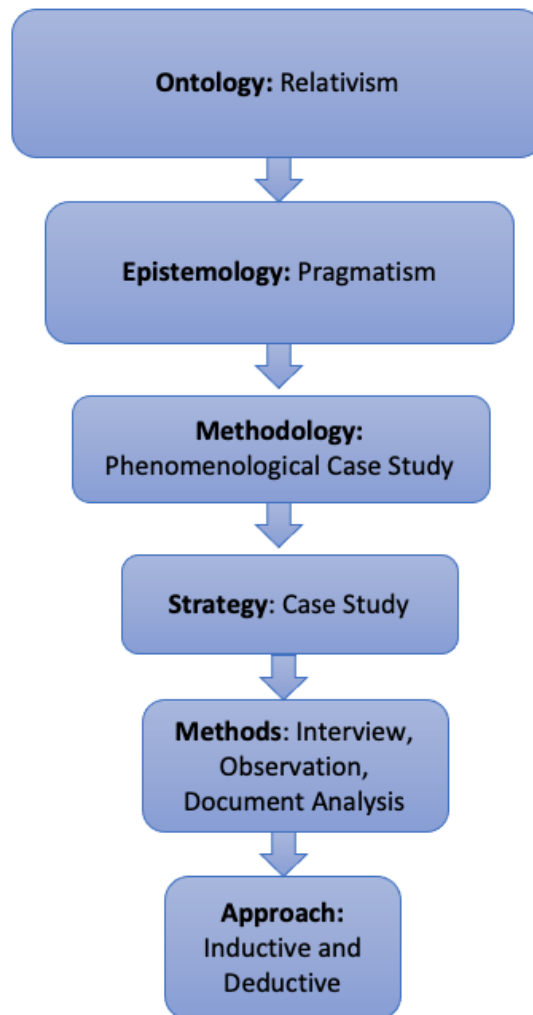
### 4.3 Philosophical Perspective

Many great philosophers and scholars such as Plato, Einstein, Aristotle, Socrates and many more have given different meanings to the word philosophy. The most common understanding from these definitions is that philosophy is the process or the science of acquiring knowledge. Comprehensively, philosophy is a process of discovering fundamental truths about oneself, the world, their relationship to the world as well as others.

With respect to research, research philosophy as Saunders, et al., (2017) describes, is what researchers do while conducting a study to develop new knowledge. It is possible that a researcher's pre-conceived notion can influence the way new knowledge is developed. Therefore, researchers need to evaluate their research paradigm in comparison to others adopted in similar studies. According to Saunders, et al., (2009) well-thought-out paradigm will constitute a credible research philosophy, which will strengthen the methodological choice, research strategy and data collection techniques and analysis procedures of the research. These paradigms include epistemology, which refers to study of knowledge; ontology which refers to the study of the nature of reality and ethics which is concerned with the way our values affect how research is conducted (Saunders, et al., 2018).

With the plethora of philosophical paradigms which represent a structured architecture in acquiring knowledge, much thought must be put into these aspects of research, as it provides a better understanding of the researcher's paradigmatic position. Adapting Dudovskiy, (2018) "Research Onion", Figure 4-1 below illustrates the research paradigm and the structure that guides this study.





**Figure 4-1: Research Paradigm and Design**

### **4.3.1 Pragmatism**

Considering the baffling range of philosophical paradigms, the approach taken with respect to this study is that of pragmatism, based on an ontological view of relativism. Ontology is an umbrella term for beliefs about reality. It is the consideration of the researcher's beliefs about reality, based on the concept that what is real or true determines what is known about reality (Killam, 2013). Relativism belief is that what is real depends on the meaning you attach to truth, and truth does not exist without meaning. Overall, relativist believe that reality is created by how we see things and it evolves and changes depending on your experience (Baghrmain, 2015), which is congruent with pragmatism epistemological position. According to Creswell and Clark (2011, cited in Kaushik, et al. 2019), pragmatism paradigm believes that there can be single or multiple realities that are open to empirical inquiry, and a pragmatist researcher's

choice of one version of reality over another, depends on how well that choice would yield desired outcomes (Tashakkori and Teddlie 2008, cited in Kaushik, et al. 2019). This means that a pragmatist would view an object differently from a positivist would, and the meaning they would attach to that object will be based on its utility. Therefore, rather than giving meaning to an object based on what it is or what it is being used for, a pragmatist would define it based on how it would help them achieve his/her purpose.

In identifying the epistemological position of the researcher, it was worth understanding the different paradigms adopted in similar context of the study, in this case, educational technology research. Several studies that have investigated the adoption, impact and potentials of learning technologies such as this (Hardman, 2015); Makhasane and Fru, 2017), have benefited from constructivist or constructivist-interpretative paradigms, which allows researchers understand the socially constructed realities of concepts. While socially constructed beliefs do form an angle to understanding these concepts, it relies on human perspective, shaped by experience and knowledge constructed by society. Dewey's pragmatism also relies on human actions and experience to obtain knowledge, but the emphasis is on the actions, experience and experimentation.

Pragmatism according to Ormerod (2006) is a one of the philosophical paradigms which originated from William James (1842-1910), Charles Sanders Peirce (1839-1914), John Dewey (1859-1952), and Herbert Mead (1863-1931), and each of these philosophers gave different meanings to pragmatism. The term "pragmatism" as Nubiola (2015) explains, alludes always to the concept of experience. The consideration of pragmatism for this research was based on Dewey's views which leans towards its application to practical issues, its method of inquiry, and because it encourages the use of mixed methods in research. As Ormerod (2006) pointed out, Dewey regarded knowledge as an instrument for action rather than an object of disinterested belief. Knowledge can be obtained through inquiry, and research is a form of inquiry conducted in a systematic way to obtain new knowledge, hence the need for all the

epistemological debates. This study has adopted Dewey's pragmatism method of inquiry as the foundation of obtaining knowledge. His method is made up of the following steps:

1. Recognizing a situation as problematic.
2. Considering the difference, it makes to define the problem one way rather than another.
3. Developing a possible line of action as a response to the problem.
4. Evaluating potential actions in terms of their likely consequences.
5. Taking actions that are felt to be likely to address the problematic situation (Morgan, 2014 p.3).

Pragmatic research is considered a philosophical paradigm that underpins mixed method study such as this, as well as being a problem-oriented philosophy which considers practical and logical approach to solving a problem (Creswell and Clark, 2011). According to Kaushik and Walsh (2019) pragmatism focuses on human actions and the notion that humans can never be separated from their past experiences and from the beliefs that have originated from those experiences, which indicates that actions and experiences shapes the knowledge that is obtained. Therefore, conducting a study which focuses on both experience and human actions to obtain knowledge, requires an action-oriented theory to guide such study, hence the adoption of activity theory for this research. Furthermore, the notion of learning through actions, places the focus of a study on the actions, actors, conditions for and the consequences of actions, activities, as well as practices, which are the key elements of the Vygotsky's activity theory system adopted in this study. Thus, this study relies on the experiences and actions of learners, educators and other stakeholders regarding the implementation of ICT and digital technologies within their learning environment, to obtain new knowledge that can solve problematic situation in teacher education institutions in Nigeria.

Overall, the importance of epistemology is to define the concept of knowledge and how its obtained. Therefore, the conceptualization of how ICT is used by educators to enhance learning, and the potentials of mobile technologies in the learning environment to promote

collaborative learning, is based on the method of inquiry, guided by this philosophical paradigm and the cultural-historical activity theory (CHAT) framework.

#### **4.4 Theoretical Framework: Cultural-Historical Activity Theory**

Based on the philosophical paradigm, Cultural-Historical Activity Theory (CHAT) has been adopted as the theoretical framework and a complementary theory to support the epistemological foundation of this study. It is the tool that guides the process of enquiry and analysis of the learning environment.

According to Hasan and Kazlauskas, (2014) CHAT is based on the works of the Russian psychologist Vygotsky and his student Leontiev in the 1920s, who believed that human interactions with their environment are mediated by signs and tools. It was later modified by Engeström, (1987). The theory provides an analytical lens to understand the learning environment mediated by tools through observation, documentation and analysis (Engeström, 2001). By adopting a CHAT approach to this study, we can document and describe different activity systems to gain contextual understanding of activities, the interwoven relationships between the different activity systems, and the impact of policies on these systems.

##### **4.4.1 CHAT Elements**

CHAT theory uses a body of work comprising seven different elements as units of analysis to analyse activities. In the three-phase theory (first, second and third generation), the first generation developed by Vygotsky was made up of the triad of *subject*, *object* and *tool* where the *subject* is the person being studied, *object* is the intended activity and *tool* is the mediating tool through which the action or activity is executed (Hasan, 1998 cited in Hashim and Jones 2007). However, the limitation of this was the emphasis on the individual as the unit of analysis. Hence, Leontiev's (1979) collective model, also known as the second-generation theory, was developed, which incorporated other units of analysis. These units of analysis also known as elements included *rules* which governs individual behaviour, *division of labour*

which is a distribution of operations amongst community, and *community* which are primarily the stakeholders within each activity system. This expands the unit of analysis to provide a better understanding of how collective action by social groups can mediate activity. Thus, the elements of this expanded activity theory are *tools, subject, object, rules, community division of labour*, with each holding a cultural and historical fact (Foot, 2014), are analysed wholly to produce an *outcome* (Hashim and Jones 2007).

In an activity system, these individual elements are mediators within the system. Primarily, as Bandara, (2018) noted, one of the assumptions of CHAT is that the subject is the central driving character of the activity towards the object. This is because the activities, with the help of tools, answers definite needs of the subject towards the object to achieve an outcome, the result of its satisfaction (Foot, 2014). The mediation within an activity system is based on the interactions and relationships between the elements of the activity system. Essentially, the relationship between an individual and their environment is considered through the component of community, which means that a subject function as part of a community and is mediated by rules. Also, the relationship between object and community is mediated by the division of labour (Hettinga, 1998 cited in Hashim and Jones 2007), and the tools influences the interaction between the subject and the object (Hashim and Jones, 2007). The mediating tool used by the subject is often dependent on the object of the activity. Most times, the tools are reconstructed continuously to fit the actions of the subject towards the object. In some cases, new tools are developed by both the subject and the community to meet the object of the activity system, which can often transform the activity system or become the object of the activity system (Lim and Hung, 2003). For instance, in the activity system being studied, ICTs such as computers, software and internet facilities, are tools designed to facilitate teaching and learning within the classroom. It becomes an object when the tool fails to facilitate learning, shifting the focus of the subjects from its initial object of learning with existing tools, to a new

object of sourcing an alternative technology to support learning. It is through the interactions between these elements that contradictions are identified.

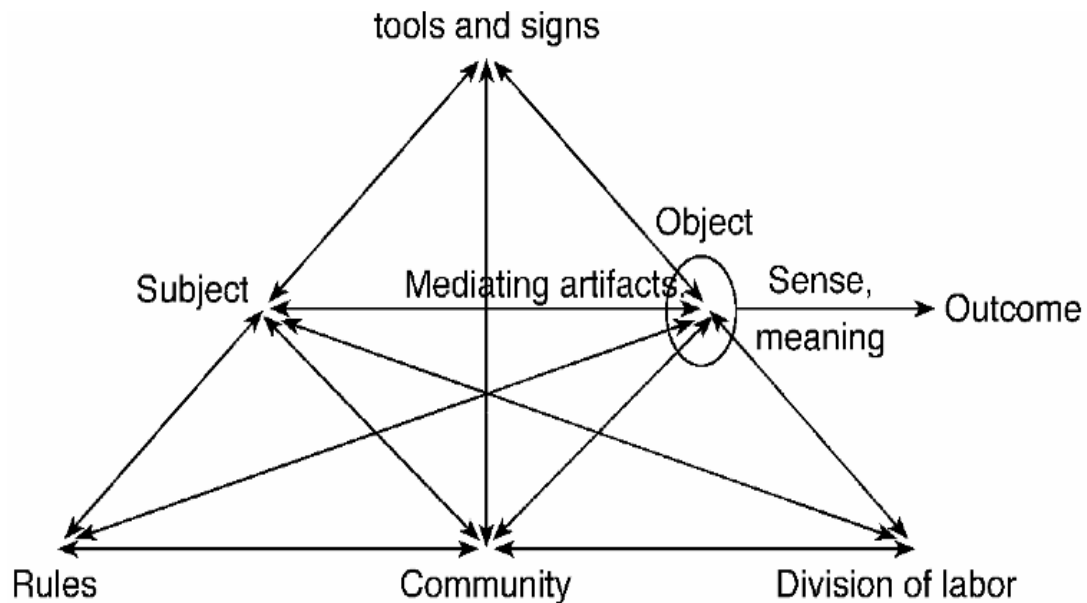


Figure 4-2: The Structure of the Human Activity System (Engeström, 2001, p. 135).

Source: <https://www.tandfonline.com/doi/pdf/10.1080/13639080020028747?needAccess=true> Copyright © 2021 by Imprint. Reproduced by permission of Taylor & Francis Group.

*“An activity system is built around its object. But activities are open systems that depend on one another, forming various kinds of networks and partnerships around partially shared objects (Engeström, 2009, p.24)”.*

#### 4.4.2 Contradictions in CHAT

CHAT is based on the relationships between its elements and the contradictions that may occur to cause a breakdown in these relationships (Foot, 2014). Contradictions are best described and understood as tensions within and between the components or elements of an activity system (Barab, et al., 2004). It is the key to understanding what triggers certain actions. According to Engeström, (2001) contradictions may occur between systems with different goals, accountability and responsibilities, or may occur in the way tools, the subjects and objects are seen (Engeström, 2001; cited in Lisa and Punya 2004, p.38), which can result in tensions, but can also bring transformation to the activity system. Contradiction or disturbances might occur when certain rules hinder a tool’s capacity to mediate the subject towards their

object (Lim and Hung, 2003). It is the contradiction between internal possibilities and external needs that constitutes the driving force of development (Engeström, 2001).

The extent to which contradictions can affect an activity system, depends on the level of contradiction identified. There are 4 levels of contradictions as defined by Engeström, (2001) as primary, secondary, tertiary, and quaternary contradictions. In most activity systems, each level of contradiction precipitates changes that can lead to another level of contradiction.

**Primary contradictions** are contradictions that occur within each of the elements of the activity system (e.g., within *tool*), for instance, if there are compatibility issues within the mediating tool. This often leads to secondary contradictions.

**Secondary contradictions** occur between two or more element of the system (e.g., between *subject* and *community*). This contradiction, based on the example above, would be when educators are unable to effectively use the *tool* for a lesson (object) due to the primary contradictions within the tool (Subject-tool-object contradiction).

According to Bonneau, (2013) tensions related to secondary contradictions can be resolved by incorporating new elements into the activity to reconfigure it e.g., division of labour (DOL) can enable other members of the community such the IT department, design the learning materials to bypass the compatibility issues. This can lead to tertiary contradiction.

**Tertiary contradictions** occur between a newly established mode of activity and remnants of the previous mode of activity. The essence of the new mode of activity is to resolve the secondary contradictions, this can often mean defining rules and structure to guide the actions of the community. This often results in resistance between members of the community who are accustomed to the previous mode of activity.

**Quaternary contradictions** occur between a newly reorganized activity system and its neighbouring activity system(s). Reorganizing the activity system to create a new mode of activity, often changes the object of that system. When two activity systems have shared objects, changes in one system will invariably affect the other. Hence, when a change in object,

is not jointly formed by these activity systems, quaternary contradictions are bound to occur, leading to breakdown in relationships.

Identifying contradictions in an activity system requires strategic line of questioning that will enable the elicitation of data, rich enough to reveal different levels of contradiction within the system. Cheung and Vogel, (2012) developed a technique for generating research issues to reveal secondary contradictions that impacts the way the subjects and community mediate towards their object. They are listed as follows:

1. What *Tools* do the *Subjects* use to achieve the *Object* and how? (*Subject-tool-object*)
2. What *Rules* affect the way the *Subjects* achieve the *Object* and how? (*Subject-rule-object*)
3. How does *Division of Labour* influence the way the *Subjects* satisfy the *Object*? (*Subject-division of labour-object*)
4. How do the *Tools* in use affect the way the *Community* achieve the *Object*? (*Community-tool-object*)
5. What *Rules* affect how the *Community* mediate towards the *Object* and how? (*Community-rule-object*)
6. How does *Division of Labour* affect the way the *Community* achieve their *Object*? (*Community-division of labour-object*).

Once an activity system is understood by identifying the contradictions that leads to the production of the new object, the activity system is then redesigned, which is understood as expansive learning. This means that contradictions alone are not necessarily a sufficient engine for expansive learning as Engestrom and Sannino, (2010) pointed out, they become actual driving forces of expansive learning, when they are handled in such a way that leads to the identification of a new object that is turned into a motive.

Transformation according to Devane and Squire, (2012) enables the community to widen its object and possibilities for action by redesigning its own activity system, which can include



re-mediating the activity with new tools such as new digital technologies. In this study's context, there are challenges that have affected ICT implementation in the classroom, which has prompted educators and students to question the viability of the current technology to support their activities. If handled properly, it could lead to the transformation of the object of their activity system. The transformed object can be remediated with a new tool (mobile technology), creating a new pattern of activity towards the object (Engestrom and Sannino, 2010). Based on the description of the theory, the following section discusses how CHAT is applied in the context being studied.

#### **4.4.3 CHAT in Context**

CHAT is considered an appropriate theory to use in this study as it helps to unravel the various experiences and views of stakeholders in the federal college of education being studied. According to Cheung and Vogel (2012), this theory can be used to analyse educators' practices regarding the use of tools and technologies to support learning. It can be used as an interpretative tool to understand the social and cultural issues that affect the learning environment, and it can also be used as a practical tool for guiding the design of resources to support learning on mobile technology platforms. Primarily, CHAT is employed in this study as an interpretative tool for understanding the social and cultural issues that affect the implementation of ICT in teaching and learning in the college, whilst investigating the potentials of mobile technology in teacher education. Its findings can inform the design of a context aware mobile learning application (Uden, 2007) for this institution or similar contexts. According to Devane and Squire (2012) social context captures the ways social structures including formal or informal rules and division of labour, mediates activity. Thus, this study requires an in-depth study of the social and cultural norms, and how government and organizational policies on ICT integration influences its adoption.

This study has identified three activity systems which are *classroom*, the *college environment* and the *ICT department of the Federal Ministry of Education activity system*. The elements of

these activity systems are described in Table 4-1. This structure was adapted from Lim and Hung, (2003) to get a broader picture of how the government’s ICT objectives influences its implementation, alongside its impact on the teaching and learning activity in the classroom. This will help in identifying the internal and external contradictions within the activity systems.

**Table 4-1: Activity Structures for College environment, The classroom and FME**

<i>Subject:</i> ICT department: Federal Ministry of Education	<i>Subject:</i> College of Environment: management	<i>Subject:</i> The Classrooms: Educators, Students, dept admin
<p><b>Object:</b></p> <p>Objectives of the FME: Improving educational outcomes, using the best breed of technologies to deliver educational-related materials and solutions for the enhancement of educational administration, knowledge and performance of learners, and access to education and information.</p>	<p><b>Object:</b></p> <p>Objectives of the college with respect to ICT integration?</p> <ul style="list-style-type: none"> <li>• To enable students to acquire knowledge in information technology.</li> <li>• Impact into students the science of teaching so that they can function well when they go to the junior secondary schools as teachers.</li> </ul>	<p><b>Object:</b></p> <p>What is/are the objectives of the classroom</p> <ul style="list-style-type: none"> <li>• Communicate with peers and educators, and gain access to resources to pass exams</li> <li>• Obtain the NCE to become qualified teachers.</li> <li>• Train and produce qualified teachers.</li> <li>• Provide structure and guidance to support student learning and</li> </ul>

		enhance educators' teaching practice.
<p><b>Tools:</b></p> <p>Mediate between ICT-dept FME and its objects listed above.</p> <p>Development tools:</p> <p>Restructured teaching and learning environment and administration to be ICT enhanced.</p> <p>ICT training including content development and delivery for all staff.</p> <p>Training guides and information manuals.</p> <p>Computer Tools:</p> <p>E-resources</p> <p>Multimedia classrooms</p> <p>ICT learning centres</p> <p>ICT resources to administration.</p>	<p><b>Tools:</b></p> <p>Mediate the College towards object of ICT integration –</p> <ul style="list-style-type: none"> <li>• ICT Centres</li> <li>• LAN</li> <li>• Technology enriched curriculum</li> <li>• Workshops for PD</li> <li>• Teachers' conferences</li> </ul>	<p><b>Tools:</b></p> <p>These tools are directly related to curriculum content, classroom discourse and communication, classroom management, and assessment:</p> <ul style="list-style-type: none"> <li>• Computers in administrative office in departments.</li> <li>• Projectors</li> <li>• Textbooks, manuals and personal mobile devices.</li> <li>• White boards</li> <li>• Curriculum Design</li> <li>• Timetable</li> <li>• Continuous assessments</li> </ul>
<b>Rules:</b>	<b>Rules:</b>	<b>Rules:</b>

<p>Rules are the procedures and policies that mediate between ICT-dept FME and the community.</p> <p>Policy direction on ICT development and deployment</p> <p>Compliance monitor of minimum standards of ICT in education (infrastructure, curriculum and professional development).</p> <p>Implementation guidelines</p> <p>Financing models for ICT in education</p> <p>Regulatory conduct on use of ICT in education</p>	<ul style="list-style-type: none"> <li>• Standards for curriculum integration and administration of facilities, acquisitions and budgets</li> <li>• Staff training Policies</li> <li>• Curriculum changes</li> <li>• Examinations</li> <li>• League table (Do the rules become the object eventually?)</li> <li>• Standards set by various stakeholders – board of directors, parents, alumni</li> <li>• Implicit rules and explicit beliefs about learning and ranking, etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Grading rules: what makes up part of assessment?</li> <li>• Assignments and examination rules</li> <li>• Standards set by various stakeholders – board of directors, parents and alumni</li> <li>• Implicit and explicit beliefs of learning, performances, etc</li> <li>• Expected student behaviour</li> <li>• Class attendance</li> </ul>
<p><b>Community:</b></p> <p>Federal Ministry of Education</p> <p>Institutions</p> <p>Suppliers and development partners (hardware/software) and services (training,</p>	<p><b>Community:</b></p> <ul style="list-style-type: none"> <li>• Federal Ministry of Education</li> <li>• National Commission for Colleges of Education</li> <li>• College management and administrators</li> </ul>	<p><b>Community:</b></p> <ul style="list-style-type: none"> <li>• Educators</li> <li>• Students</li> <li>• Department/Faculty administration</li> </ul>

contractors, solution providers) Heads of institutions Education parastatals NITDA	<ul style="list-style-type: none"> <li>• Staff (academic and non-academic)</li> <li>• ICT centre director</li> <li>• Students</li> </ul>	
<b><i>Division of Labour:</i></b> Different division with different responsibilities working together to achieve the object of ICT-dept FME. These branches and their functions include: ICT Education Division: Curriculum and training branch ICT policy, standards and compliance branch Hardware and Software Management Division Hardware Management Software Management	<b><i>Division of Labour:</i></b> Different responsibilities of different participants: <ul style="list-style-type: none"> <li>• College Administrators</li> <li>• ICT-Director,</li> <li>• Academic and non-academic staff,</li> <li>• the students,</li> <li>• technical support staff,</li> <li>• the administrators and leaders.</li> </ul>	<b><i>Division of Labour:</i></b> Division of labour between teachers and students/ students and students: <ul style="list-style-type: none"> <li>• Different responsibilities of different participants – the teachers, and the students</li> </ul>

Based on the description in the table above, it is apparent that these activity systems have closely related objects. However, the object of the classroom is influenced by the object of the college management, which is informed by the object of the Federal ministry of education.

These objects are in respect to the *tool* that can be used to enhance learning, signifying that these systems realise the potentials of technology.

To capture the dynamics of ICT in this learning environment, the relationship between the classroom activity system and the college activity system is examined to identify the contradictions within and between the different elements currently affecting the implementation of ICT in the classroom, alongside possibilities for the transformation of the objects through expansive learning process (Engeström and Sannino, 2010). Since the general objective of the college is training students to become teachers, fundamentally, an assessment of the level of ICT integration in the classroom and curriculum, as well as the cultural and historical factors within the college that has impaired this integration process must be carried out. Therefore, the classroom activity can be considered as the unit of analysis. However, the different objectives between learners in the classroom activity, with respect to use value (direct benefit of the activity outcome for participants) and exchange value (its worth when exchanged) indicates the presence of primary contradiction (Foot, 2014), spurring the consideration to examine the teaching and the learning activities as two separate activity systems within the college. This would require the adoption of Engeström's, (1999) joint activity system as the unit of analysis in the third-generation activity theory.

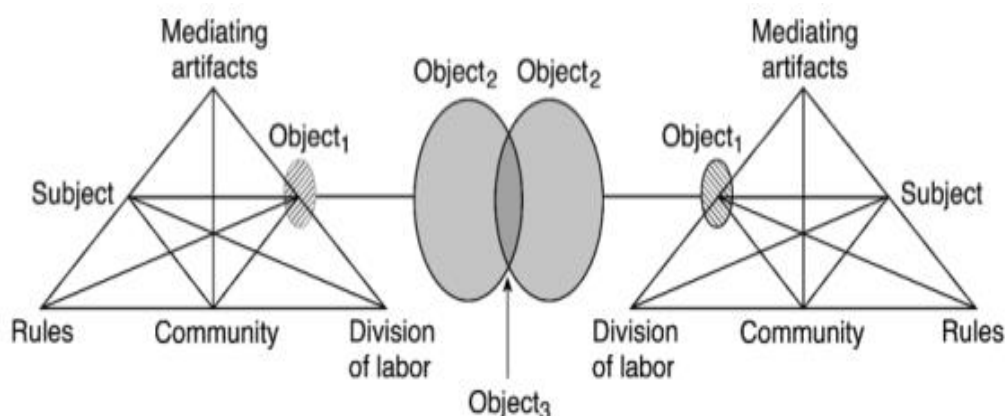


Figure 4-3: Joint Activity System (Engeström, 2001, p.136)

Source: <https://www.tandfonline.com/doi/pdf/10.1080/13639080020028747?needAccess=true> Copyright © 2021 by Imprint. Reproduced by permission of Taylor & Francis Group.

The third-generation activity theory is designed to facilitate understanding of relationships, dialogues and multiple perspective of two or more interacting activity systems. This model is espoused to represent a joint activity system between the *teaching activity system* and the *learning activity system* as the unit of analysis, (see Table 4-1). Based on Engeström, (2001) description of transforming objects, the object 1 of each activity system represents the educators' need to provide quality teaching that learners need to become teachers; and for the learners, communicate and collaborate with peers and the tutors, gain access to learning resources to pass exams, and obtain the qualification to teach. This can lead to a collective meaningful second object of enhancing teaching and learning with ICT whilst impacting into students the science of teaching with ICT that can prepare them to be teachers themselves. When these activities are viewed jointly, the object of the activity can produce a jointly constructed third object of promoting a technology integrated learning environment, which brings transformations that can satisfy the objects of both activities. This process is often described as expansive learning. It will be presumptuous to anticipate a transformation of object in the learning environment, or to project this idea into the study at this stage, however this can be summarised using Engstrom's (2001) five principles. The five key principles that guides the study of expansive learning in the third-generation activity theory, are described as follows:

1. ***The unit of analysis*** is a collective, object oriented and artefact-mediated activity system.
2. ***Multi-voicedness*** of an activity system indicates the multiple perspectives of the community because of division of labour amongst the participants of the system.
3. ***Historicity*** of the activity system leads to the understanding of the problems and the potentials of the activity system.
4. ***Contradictions*** can result in tension but can play a fundamental role in the developments and changes in the activity system.

5. *Expansive learning* allows for an expansive transformation of the activity system through reconceptualization of the object of the activity system (Engeström, 2001).

The adoption of these principles will enable the researcher to systematically find contradictions in these activity systems, assess how these contradictions can/have been resolved, and if the resolution precipitates transformation of its object (Devane and Squire, 2012), which presents an opportunity for mobile learning technologies. Transformation such as this, can lead to re-defined pedagogic practices and suggest direction for instructional design within the new activity system (Devane and Squire, 2012), that can only be consolidated by the college management. This is because the traditional learning method puts students as system dependant learners, who depend on resources from the educators, the college, and the ministry of education, and does not challenge learners to do more because of limited access to resources and technological tool to support a collaborative and independent learning method.

#### **4.4.4 Expansive Learning Cycle**

Engeström (2001) defines expansive learning as the transformation of an activity system by individuals in a collective activity. It is the process of learning or discovering an object that is not in practice and use it in practice (Scollard, 2020). To develop these practices, expansive learning cycle is adopted to allows actions to be learned, needs to be identified, analysed and modelled for implementation and consolidation.

Expansive learning cycle is used in this study as an analytical and explanatory tool, to understand the challenges of ICT implementation by identifying sources of breakdown in coordination of actions, to recognise the opportunities for expansive change in the college learning system for the adoption of mobile technology in their teaching and learning methods.



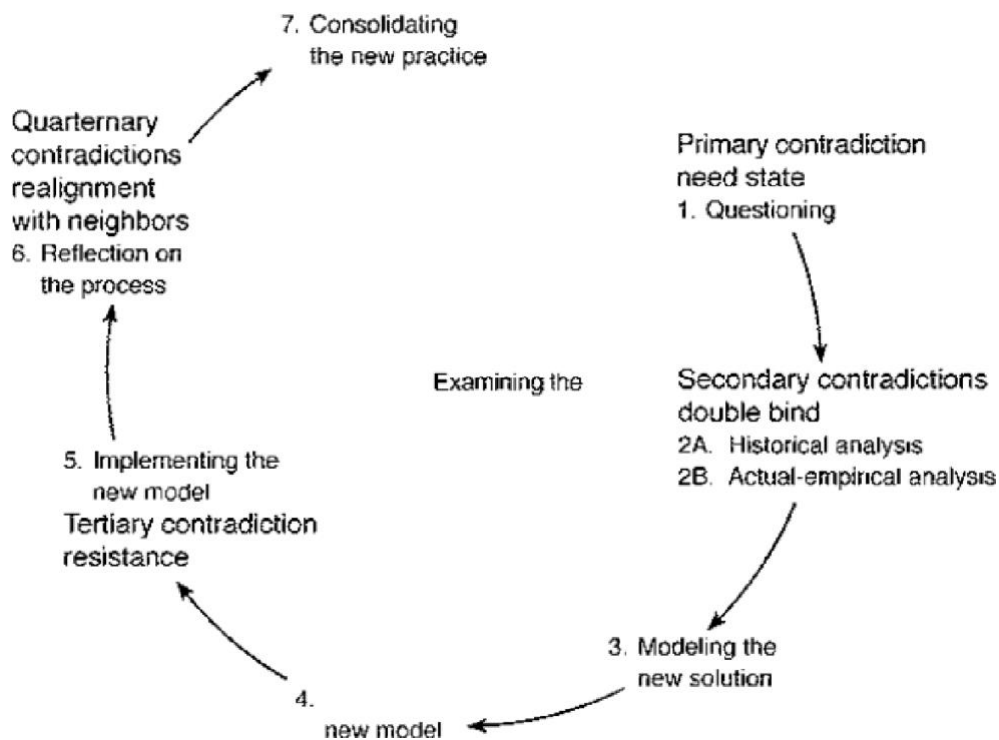


Figure 4-4: Expansive Learning Cycle. (Engeström, 2001, p.152).

Source: <https://www.tandfonline.com/doi/pdf/10.1080/13639080020028747?needAccess=true> Copyright © 2021 by Imprint. Reproduced by permission of Taylor & Francis Group.

As depicted in Figure 4-4, Engeström (2001) describe the phases of expansive learning cycle as follows:

- 1) **Questioning**: criticizing or rejecting some aspects of the accepted practice.
- 2) **Analysing**: assessing the situation to expose and define causes of problems.
- 3) **Modelling**: the result of the analysis of contradiction reaches its fruition and a model of the new solution is created.
- 4) **Examining the model**: analysing the new model to understand its dynamics, potentials, and limitations.
- 5) **Implementing the model**: practical applications of the new model, improvements and conceptual extensions.
- 6) **Reflecting**: checking and evaluating the process.
- 7) **Consolidating**: its outcomes into a new, stable form of practice.

The concept of expansive learning is based on four questions: (1) Who are the subjects of learning? (2) Why do they learn? (3) What do they learn? (4) How do they learn? These

questions are guided by five principles as earlier mentioned: (1) Artefact-mediated and object-oriented activity is the unit of analysis; (2) Multi-voicedness of activity system; (3) Historicity; (4) Central role of contradictions as source of change and development; (5) Possibility of expansive transformations. Together, these four questions and five principles form a matrix as depicted in

Table 4-2, that will be used to analyse expansive learning in the teacher education college being studied, in order to identify the potentials of mobile technology as a new learning tool to enhance teaching practices, learning methods and inculcating the “teaching with mobile technology” in teacher education curriculum.

**Table 4-2: Matrix of analysis of Expansive Learning (Engestrom, 2001 p.138)**

	<i>Activity system as unit of analysis</i>	<i>Multi- voicedness</i>	<i>Historicity</i>	<i>Contradictions</i>	<i>Expansive learning</i>
<i>Who are learning?</i>					
<i>Why do they learn?</i>					
<i>What do they learn?</i>					
<i>How do they learn?</i>					

Adapted from Engestrom, 2001 by permission of Taylor & Francis Group Copyright © 2021 by Imprint.

Source: <https://www.tandfonline.com/doi/pdf/10.1080/13639080020028747?needAccess=true>

## 4.5 Summary

Knowledge is the bedrock of change in any system, hence the role of research in the society. The systematic way in which that knowledge is attained is determined by the researcher's ontological view of the world, and their epistemological position. The knowledge obtained depends on the knowledge sought, and the method of understanding how things work, which is usually guided by theories developed to unravel the context being studied and obtain knowledge on the dynamics of relationships within such context. Having explored the philosophical paradigms of researchers in TEL and mobile learning integration research, this study made explicit the epistemological position and the theoretical framework, drawing on pragmatism and the CHAT to guide the entire study from inception to completion.

As reported in the previous chapter, change to promote the use of technology in teacher education in Nigeria is slow and daunting for educators and learners. Indicating that, while potentials of a technology in enhancing learning is understood by lawmakers and management of the institutions, as seen in previous chapters, several factors still linger, and are yet to be addressed. These factors are often identified as isolated factors such as power supply and lack of infrastructure. The lack of detailed understanding of the relationship between the cultural and historical aspects of the environment, the isolated factors and the human perception and attitude that influences the institutional culture of the institution, will continually frustrate the implementation of technology in teaching and learning in Nigerian institutions.

The CHAT framework affords the researcher a tool to obtain detailed understanding of the structure and institutional culture of teacher education institution, which includes its objective, its tools, rules, community, and the roles and responsibilities of members of the community. It also reveals the influence of the management and government's objectives and policies on the activities within the classroom. Therefore, scrutinising the management and the government's activity systems can reveal contradictions that may affect the implementation of ICT policies within teacher education.

The following chapter presents a detailed account of how the study was conducted. It introduces the research design and methodology, the ethical considerations and issues within the study, as well as the data collection procedures and analysis.

## **CHAPTER 5: METHODOLOGY**

### **5.1 Introduction**

The purpose of this research study was to identify the potentials of mobile technology in enhancing teaching and learning in order to propose change in teacher education to promote the use of mobile technology in teaching and learning. A careful study of literatures revealed little or no ICT integration in the classroom and learning process in Nigerian colleges of education, stating factors such as lack of infrastructure and digital literacy and competence of educators.

As earlier stated, there is a paucity of research on ICT implementation and the potentials of mobile technology in teacher education institutions in Nigeria. Therefore, this study examines the social, cultural and historical challenges that have affected proper implementation of these technologies in this context, which is critical to investigate in order to identify the potentials of mobile technology in enhancing teaching and learning practices, whilst closing that technological gap in the learning environment. Through this investigation, we can perhaps identify lapses and challenges within this institution's institutional culture that could potentially be generalized across other teacher education institutions in the country.

In this study the aim was to answer the following research questions to understand this phenomenon:

1. What are the current pedagogical approaches used in Nigerian college of education?
2. Are ICT currently being used to support these pedagogical approaches?
3. How has/can ICT support the current pedagogic approach used in the college?
4. What are the factors affecting the effective integration of ICT in pedagogy in the college, and how has it been addressed??

## 5. In what ways can mobile technology enhance teaching and learning in colleges of education in Nigeria?

The previous chapter gave an overview of the philosophical paradigm, and theoretical framework of the research, based on the expansive learning cycle (ELC) and the principles of contradictions. This chapter draws on this concept to present the research design, the methodology, the data collection and data analysis procedures, as well as the ethical considerations and methods to ensure that the integrity of the research is maintained.

### **5.2 Research Design**

The nature of this research required an in-depth study of the institutional structure and culture of the college of education, to understand and interpret the phenomenon. It also required gaining the actors' perception of mobile technologies for teaching or learning in order to identify its potential. This situates the research as a qualitative study.

Qualitative research as defined by Hennink et al., (2011) enables a researcher “identify issues from the perspective of the study participants and understand the meaning and interpretations that they give to behaviour, events or objects”. Additionally, it enables the researcher “study people in their natural setting to identify how their experiences and behaviour are shaped by social, economic, cultural or physical context in which they live” (Hennink, et al., 2011, p.10).

This provides the justification for adopting qualitative research method for this study.

While quantitative studies can be used to quantify opinions (Sukamolson, 2007) by collecting data from a wider population, it fails to provide deeper underlying meanings and explanation of concepts (Rahman, 2017). In a study which requires the observation and elicitation of human experiences and perceptions, it is difficult to accurately do so through quantitative study. Thus, the understanding of the research design was crucial in defining the research methodology and the type of data collection method suitable for the study.

As a pragmatist researcher, action and experience shapes the knowledge that is obtained. This required studying the actions of educators within teacher education institutions as well as eliciting and describing their experiences with technology in order to fully understand the phenomenon. Therefore, it was critical for me to undertake this study from an insider's perspective. Hence, one out of the several federal colleges of education in Nigeria was selected as the case to be studied. The need to collect rich and meaningful data, detailing educators' experiences regarding the use of ICT in teaching within this college, revealed the need for a phenomenological case study, which is the infusion of two qualitative research methodologies often used in social science research (Crawford, 2016).

### **5.2.1 Research Methodology- Phenomenological Case Study**

Phenomenological case study has been used in many educational research to study the experiences of educators an/or learners within a single case (Nielsen, 2006; Sumsion, 2002, Hickman and Kiss, 2010; Carwford, 2016). Phenomenological case study, as described by Hickman and Kiss (2010), is dependent on the analysis of spoken words and non verbal indicators of the participants. Nielsen (2006) adopted phenomenological case study to observe the features of social interactions and the lived experiences of imaginative teaching in classrooms. In a similar study, Crawford's (2016) research sought to document the emotional experiences of student teachers in one teacher education by adopting phenomenological case study approach to documents the verbal expressions of participants. These studies encapsulates the use of phenomenological case study as an effective tool in researching educators' and learners' interactions and experiences with objects.

Phenomenologists such as Husserl and Heidegger believed that human experience of the everyday world is a valid way to interpret the world (Eddles-Hirsch, 2015). Thus, Phenomenology as a methodology, seeks to understand, describe and interpret social phenomena from the perspective of the people involved within their context (Finlay, 1999;

Eddles-Hirsch, 2015). This places the focus of the research on the meaning or essence of the interrelationship between the participants and their context. As Eddles-Hirsch (2015) rightly noted, the role of the researcher is to understand participants experience of the phenomenon within their world as well as identify the cruxes of those experiences. This process requires specific methodological techniques known as description, reduction, imaginative variation and essences, which are the 4 major concepts of phenomenological research (Eddles-Hirsch, 2015). Case study as described by Zainal, (2007) explores and investigate contemporary real-life phenomenon through detailed contextual analysis of a limited number of events or conditions, and their relationships. In case study as Iacono, et al., (2009) explained, attention is paid to contextual conditions that are highly relevant to the phenomenon being investigated, as opposed to experiments, which separates the phenomenon from its context to be studied and focuses on several variables. It allows a researcher to observe and analyze data intimately, to fully understand the case (Stake, 1995).

Although phenomenological studies enable rich, detailed description of the phenomenon being studied from the participants' perspective, which ideally present how the participants experienced the phenomenon being investigated (Eddles-Hirsch, 2015), the role of case study in this research pushes beyond participant's experience to study the contextual structures of the institution and the institutional culture in order to identify the essence of participants experiences.

Case study has been criticised for its lack of rigour and reliability, its inability to provide generalization (Flyvbjerg, 2006), as well as its subjectivity and the tendency for a researcher to have a biased interpretation of the data as opposed to quantitative methods (Zainal, 2007). As Stake (1995, p.8) iterated, the primary focus of case study is particularization not generalization, as a case is studied for what it is and what it does. Phenomenological studies have also been criticized for its inability to provide generalization, just as case studies, they articulate individual's unique experience (Finlay, 1999). However, the strength of



phenomenological case study is the tendency for readers to relate to and compare their individual experiences and understanding with that described in the study (Bullough et al., 1991, cited in Sumsion 2002).

Researchers' biases can significantly impact how the phenomenon is studied. It can determine the line of questioning, as well as the interpretation of data, thereby forcing the study to lose its integrity. Nevertheless, quality of this phenomenological case study depends more on the conception, construction, conduct of this study and thoroughness in the description of the context (Thomas, 2011). Additionally, Flyvbjerg, (2006) argues that the issue of subjectivism and biasness toward verification applies to all methods, not just to the case study and other qualitative methods including phenomenology. Therefore, to eliminate such biases, phenomenologist developed a phenomenological reduction process known as bracketing (Groenewald, 2004). Husserl (cited by Eddles-Hirsch, 2015) described bracketing as a process whereby a researcher could purposefully set aside prejudices and beliefs to gain a clear view of the phenomenon (Eddles-Hirsch, 2015).

Despite the criticism, phenomenological case study is espoused in this study because of its versatility as it focuses on a single phenomenon through various lenses to uncover the social, cultural and personal experiences, using different data collection tools such as direct observation, participant-observation, interviews, review of documents such as policy and curriculum review etc. (Zainal, 2007).

### **5.2.2 Research's Role**

As an educator who has taught in this teacher education institution, my role as a researcher was to explore how to improve the quality of learning for all, hence my keen interest in this study. Particularly within this study, my role as a researcher was to observe, conduct interviews, collect, transcribe and analyse data. According to Xu and Storr, (2012) the researcher is the instrument in collecting and interpreting data in qualitative research. Being

the primary instrument, an understanding of the setting and content; based on my experience and skills as well as strong conceptual interest, further validates this research.

### **5.2.3 Setting and Participants**

The participants of this qualitative study were educators and students in the Federal College of Education (Technical) Asaba, Delta State Nigeria. The selection criteria for participants were determined by their roles in the college and their ability to elicit concerns and give accurate account of actions and operations in the learning environment. These participants were divided into two main categories, (1) the College management and administration; (2) the educators, faculty and department administration.

Following the phenomenological tactic, the participants chosen for this study were individuals who have experienced the phenomenon being explored and could articulate their experiences Creswell, (1998). Using stratified purposeful sampling (Creswell, 1998), participants who represent people from various sectors, faculties and departments, with knowledge of the learning system within the college, were identified. This sampling method was used to recruit participants for interviews and observation based on the following criteria participants must and did meet:

1. Must be either a lecturer, a head of department or in the IT department.
2. Must be able to communicate freely in English.
3. Must understand the academic structure of the institution.

For this study, the sample size was subject to the level of theoretical saturation attained (Saunders, et al., 2015). Nevertheless, the anticipated sample size for interviews and observation included 15 academic staff from different schools (faculties) including the ICT director in the college, and the College management or provost. This was divided into 8 educators, 1 director of ICT centre, 5 deans or heads of departments and 1 management personnel or the provost.

Some of the management and staff who were approached declined to participate in the study, which was attributed to the powershift going in the college at the time of the study. The new provost had not settled into office properly so she could not grant us an interview, as she needed time to get accustomed to the college structure. Due to the low participation of educators, only 7 educators, 1 ICT centre director were observed and interviewed.

The selected college as earlier mentioned, is one of the 22 federal colleges of education in Nigeria and is categorised as a “Technical” teacher education college. They were established to meet the challenges of national resourcefulness in the local production of technology teachers to teach technical, vocational, science, and business subjects/courses in vocational training centres, secondary, and technical colleges (FCET-Omoku, 2021). Since this is a technical college, there are expectations for technology dominated classrooms within the college which are not being met, which further justified the selection of this college as the case to be studied.

### **5.3 Data Collection Procedure**

The CHAT expansive learning cycle provided a systematic process for conducting the study, as it begins with the questioning phase. As seen in phenomenological study, questioning is the most important aspect of the study as it prompts native description of participants’ experiences, as well as their actions. As Rubinshtein (1946 cited by Kaptelinin and Nardi, 2012) stated, “experience is both a result and a prerequisite of action. Mutually interpenetrating and supporting one another they constitute a true unity, an interrelated side of the coherent whole”. Thus, to understand the experiences of educators and to learn the actions within the learning environment, different sources of data were required. The primary data sources for this qualitative study as suggested by Hennink, et al., (2011) were interviews, observations and document analysis such as the National Commission for Colleges of Education (NCCE)

teacher education curriculum and minimum standard document and the ICT policy in education documents.

Before the study commenced, an approval was sought and received from the Provost of the participating institution to conduct the study. Furthermore, an application to the Faculty research ethics committee (FREC-UWE) for an ethical approval to conduct the research, was made and obtained.

Upon approval from the FREC, the study commenced by approaching the College director of ICT, educators and heads of departments in every faculty, to hand out information sheets introducing myself and informing them about the research as well as asking them to participate in the observation and interview. Once qualified participants who meet the criteria stated above were reviewed, 15 potential participants were selected and contacted verbally. Thereafter, selected participants were informed in writing and were asked to sign the consent form. Upon receiving their informed consent, each participant was notified of their observation time which lasted for about 30 minutes of their lecture session and afterwards, a follow up Interview which lasted up to 20 minutes was arranged. To maintain confidentiality and anonymity of study participants, the identity of participants was not disclosed to other participants or mentioned in the study.

The data collection commenced with an observation of the learning environment including the classrooms and lecture halls, to provide a better understanding of the current learning environment and the pedagogic strategies used by educators. Thereafter, an interview was conducted to understand the phenomenon from their perspective and give meaning to the observations made.

### **5.3.1 Participant Observation**

The use of observation in this study, based on Driscoll's, (2011, p. 154) description, was to understand the teaching and learning approaches used in the teacher education college being

studied; investigate the effective use of ICT to support these approaches; investigate the social, cultural or environmental issues that may be affecting its implementation and assess how mobile devices/technologies can be used to address these issues and improve the quality of education in this college and in Nigeria's tertiary education.

According to Thomas (2011), observation can be structured and unstructured. An unstructured observation technique which Thomas (2011) describes as a way of immersing yourself into the social situation to take part, watch, and record, was espoused in this study as I observed both educators and their students in their natural setting, recording various activities within the learning environments to understand, 1. How lectures are planned and delivered; 2. Where and how students obtain learning resources; 3. How accessible online learning materials and resources are to educators and students; 4. How students learn and communicate with their educators and classmates; 5. What learning technologies and ICT infrastructures are available to students and educators to support learning; 6. The state of the ICT technologies, facilities and its usability; 7. What mobile devices do educators and learners use and how it can enhance learning. These observations were documented on the notecard (232) and used as a guide to generate further questions that were asked during the interviews.

Based on the findings from this observation, an understanding of how activities were mediated (between the participants, rules, community etc.), the technological challenges in the learning environments, as well as the areas where mobile technology can make an impact were identified.

### **5.3.2 Educators Interview**

Using a transcendental phenomenological tradition, interviews were conducted following the observation as suggested by Gill, et al., (2008), to explore the views, experiences, beliefs and/or motivations of educators in the College. Participants were interviewed individually using a set of semi structured interview questions (234). During the interview, notes were

taken, audio recordings were made which was later transcribed and saved on a hard drive as well as on a folder in my personal computer.

The purpose of the interview was to elicit information from educators about their experiences with ICT technologies in their current learning environment and to get their perception on the concept of mobile technologies as a device to enhance learning. Husserl believed that by using the transcendental reduction process one could delve deeply into consciousness and uncover the underlying structures of a phenomenon using the concept of intentionality and essence (Eddles-Hirsch, 2015).

The development of the interview questions was recreated from the pilot study as earlier described, the observational data and structured based on CHAT framework. The theory structure enabled the creation of intentional questions that cuts across the various aspects of the participants' activities, whilst delving deep into participants consciousness to elicit fundamental essence of the study's phenomenon. As described in the Cheung and Doug Vogel, (2012) questioning structure, questions asked depended on the combination of the data generated from what was observed and the context where data collection is happening.

It was also designed to encourage participants to be honest and communicate their thought freely, whilst understanding their own learning environment, hence the semi-structured yet flexible nature of the questions. The interview questions sought to give meaning or description to the observations recorded in the participants own words. Thus, to accurately describe participants experience, the researcher had to consciously remove biases and records what the participants say about their experiences without judgment and accept that the truth is in what the participants say it is (Finlay, 1999).

### **5.3.3 Document Analysis**

One of the sources of data used in this study included an analysis of the following documents: (1) the NCCE curriculum implementation framework (CIFW), (2) NCCE minimum standards for teachers, (3) National Teacher Education Policy (NTEP), (4) National Policy on ICT in

Education. Since the case being studied is a government institution, regulated by policies and standards, it became imperative to analyse documents that set the standards for teacher education to identify the extent in which the current curriculum, standards and policy support technology enhanced learning. These documents are examined to complement the data gained through interviews and observations to minimise bias (Bowen, 2009).

The purpose of data collection for this study, was to find answers to research questions. Through observation made, and the response gathered from the interview questions, this goal was achieved. For clarity, Table 5-1 gives a clear representation of how the research questions were designed and answered and its relation to understanding a construct of the activity system. The original questions were semi-structured, which was designed to prompt further questions from the researcher, based on the participant's response. Hence, the questions in the table below were extracted from the transcript of the interviews with the educators.

**Table 5-1: Research questions and expected outcome**

S/N	Research question	Activity Construct	Observation	Interview Question	Document Analysis	Expected Outcome
<b>RQ1</b>	What are the current pedagogic approaches used in Nigerian college of education?	Rules Subject Object Division of labour Community Tools	How lectures are planned and delivered, as well as the setting of the classrooms, and the interactions that takes place between the student and the educator. (1)	Can you describe the pedagogic approach used in this college compared to the higher institution where you studied? (q3)  What is different in terms of teaching and learning method? is there any improvement from where you attended to this place over the years (q4)	Study the policy document, curriculum, and minimum standards for educators.  Curriculum implementation framework.	An Understanding of the institutional learning structure.  Captures educators' experiences and the internal contradictions within the activity system.  Identifies tools used to mediate the subject's actions towards the object.



				Do you interact with your students outside the classroom? And how and what method? (q5 and q6 and q7)		<p>Outlines the rules governing current teaching and learning practices in the college.</p> <p>Identifies the roles of the community in respect of the rules that govern the pedagogic practices.</p>
<b>RQ2</b>	Is ICT currently being used to support these pedagogic approaches?	<p>Tools</p> <p>Rules</p> <p>Community</p>	How lectures are planned and delivered, as well as the setting of the classrooms, and the interactions that	Can you describe how learning materials are designed and presented in the classroom? (q8)  I observed that there are no technologies in the	Study the ICT in Education policy document. Review the NCCE standards to identify students teaching practice	An understanding of how and what tools are particularly used to enable subject to meet its object.

	<p>Subject</p> <p>Object</p>	<p>takes place between the student and the educator and if ICT is used during this process (1a)</p> <p>Where students obtain learning resources from (2)</p>	<p>classroom, is it challenging preparing and getting lesson materials to students? (q9)</p> <p>What about the students? How do they get learning, material and resources to prepare for lessons? (q10)</p> <p>Do you believe that ICT technologies such as projectors and computers and internet that enable presentation in classrooms, can address some (if not all) of these challenges? (q11)</p>	<p>requirements and expectations, and educators' roles.</p>	<p>Identifying contradictions in the use of ICT. (educators' contradiction or contradiction between the subject -tool-object.</p> <p>Identifying contradiction in between the community and object or community-division of labour-object.</p>
--	------------------------------	--	--	---	--

				Are any of these technologies available in this college and how accessible are they? (q12)		
<b>RQ3</b>	How has ICT supported the current pedagogic approach used in the college?	Tool Object Community`	How accessible online learning materials are to students (3)  How students learn and communicate with their educators and classmates (4).	Considering the technologies listed earlier, can you describe some of the learning technologies that are currently used to aid teaching and learning in this institution? (q13)		Identify how ICT in use affect the way the community achieve the object

<b>RQ4</b>	What are the factors affecting the effective integration of ICT in pedagogy in the college and how has it been addressed?	Rule  Object  Tools  Community  Division of labour	How accessible online learning materials and resources are to educators and students (3)  The state of the ICT technologies and facilities and its usability (6).	Can you identify some of the factors affecting the use of these technologies in your institution? (q14)  What is the College doing about this? (q15)		Identifying how the rules, social constructs or other activity systems affect the way the community meets its object.  Quaternary contradiction may or may not be identified.  Leading to resolution of contradictions and the need for expansive learning.
<b>RQ5</b>	In what ways can mobile technology	Tool  Subject	What mobile devices do educators and learners use? (7)	What sort of mobile device do you use (q16)?		Possibility for transformation.

<p>enhance teaching and learning in colleges of education in Nigeria?</p>	<p>Community Object</p>		<p>What do you use it for mostly? (q17)</p> <p>What are your thoughts on the use of mobile technologies/devices to support teaching/ learning? (q18)</p> <p>Do you think that mobile devices can act as a tool to provide access to learning technologies which can overall enhance teaching and learning? (q19)</p>		<p>Modelling the new activity system remediated by new tool.</p>
---	-------------------------	--	--	--	--

## **5.4 Data Analysis Procedure**

The data analysis procedure adopted in this study is based on the methodology used and the type of study conducted (Creswell 1998, p.140). The goal of analysis is to uncover patterns, determine meanings and develop theories (Patton and Appelbaum, 2003, cited in Kohlbacher 2006). However, while the goal of this phenomenological case study is not to develop theories, it does seek to uncover themes, patterns and meaning that emerge from the data. Being a qualitative study, qualitative analysis was used as an exploratory process of searching through transcribed data to identify and articulate themes, codes and meaning.

The need to elicit and analyse the experiences of educators as well as the actions within the context in relation to the phenomena, has led to a dual analysis of data using phenomenological analysis to describe educators' experiences, and the CHAT to analyse the actions within the activity systems. Although activity theory and phenomenology do have their distinctive perspective, they do point towards the same direction. As Kaptelinin and Nardi (2012) described, activity theory begins with an analysis of the structure and dynamics of social, mediated, purposeful activity, to reveal the richness of human experience, while phenomenology begins with the richness of human experience. Nevertheless, both phenomenology and CHAT are interested in understanding the individual subject. In a study which focuses on the understanding of human interactions with technology, Kaptelinin and Nardi (2012) opined that the analysis of interactive technologies such as mobile devices and ICTs, should be based on the understanding of human beings as entities that have physical and social attributes and are engaged in interactions with other entities in their physical and social environments. Therefore, they suggest that in analysis of human uses of technology has no choice but to address the fundamental issues of meaning, value, identity, and justice, and activity theory and phenomenology can be coordinated within a larger scale theoretical inquiry (Kaptelinin and Nardi, 2012).

The research questions and the CHAT framework provided pre-specified themes that is expected to be found in the data as shown in Table 5-1 prompted the use of thematic analysis as a deductive approach. This study used the framework as an analytical tool to analyse the qualitative data collected for this study, by purposefully, identifying themes directly linked to the constructs of the activity theory. Then, the phenomenological imaginative variation process is used to uncover the structural themes within the textural description during the phenomenological reduction process (Eddles-Hirsch, 2015), in addition to themes identified from observational data. The following section describes the procedures taken to identify and articulate findings. This study followed O'Connor and Gibson (2003) guide to data analysis. They outlined various steps to guide researchers through the data analysis stage, which was very beneficial in this study.

The presentation of findings in the analysis, was influenced by the work of (Hawkins-Walter, 2013). Her work developed a structure for interpreting and identifying research data, and a model of presenting findings of contradiction and analysis. However, the concept of developing knowledge reflected an extensive process of knowledge generation which was not the focus of this study.

#### **5.4.1 Organising Data**

The first step to analysing qualitative data collected in this study is organisation of data and familiarization with research documentation. This is understood as a process of structuring data in a manner that enables easy identification of concepts and themes (O'Connor and Gibson, 2003). Familiarizing with data makes this process more effective as it enabled the researcher to identify what research questions the data would answer and what concepts were captured in the data, as seen in Table 5-1 above.

Documents were studied in great depth to identify areas of interest and correlating page numbers were recorded and relevant excerpts extracted and documented. Audio recordings were transcribed manually without the use of software to give the researcher time to listen, read through and familiarise herself with the data to gain deep understanding of participants perception, attitude and feelings in order to gain a sense of how they all come together. After transcribing and documenting the data, they were organised into retrievable sections according to type (e.g., Interviews, observations, review notes), date and version conversions (e.g., interview anonymised, audio recordings, transcribed interview, interview notes etc.). Names and identifiable information of participants were replaced with pseudonyms and narrative data were numbered for traceability. Word file was converted to text format to allow lines from the transcripts to be numbered for traceability.

#### **5.4.2 Coding**

Researchers emphasise the need for coding in data analysis because, it is a means of reducing data without losing its meaning (Adu, 2013). A process also defined by phenomenologist as delineating units of meaning through a rigorous process of dividing transcripts into phrases to enable focus on contents (Finlay, 1999).

This method was used in this study to allow text retrieved from data to be organised into meaningful categories of similarities and differences for analysis (Lacey and Luff, 2007). Based on the research questions, this study utilized open, axial and selective coding methods to identify answers to the research questions from participants' responses, observations recorded, and documents reviewed.

Open coding is a process of segmenting chunks of data to describe what the reader sees; basically, making sense of raw data by short word description known as open codes. Axial coding tries to identify the relationship among the open code and selective coding enables bringing together codes with one overarching category (Galicano, 2013). Firstly, open coding



was used to break down the data collected from the interviews and observations to identify first level concept and categories (Priest, et al., 2002). This coding method assisted in identifying codes that were related to the objectives of the study, and further reading into the data, linked related categories, hence patterns and themes were identified (Thomas, 2006). Open coding portrayed the basis on which participants formed their viewpoints. It identified similar views from other participants, and then linked these responses to concepts that were very similar. For example, one of the study's objective was to identify the factors affecting ICT implementation in the classroom. Lingered on a data excerpt from a participant's interview, revealed its significance to the objective, which was either a feeling or identification of an issue, for instance, "*it is exhausting because I have to walk all the way to use the computer lab, that's why I do not use it*" and "*there are no computers in the classroom*". This was then coded using colour stripes as "access", "insufficiency", and "stressful". Excerpts from other participants with similar response or relative responses were coded under the initial codes which then became sub-categories. Identification of sub-category was based on phenomenological concept of turning towards the meaning of the experience of the participant, by using "imaginative variation" to capture what each activity, situation and feeling derived from an experience means to them (Finlay, 1999).

Within this coding, the activity theory constructs, and the contradictions identified within a data excerpt were defined. For instance, the CHAT construct identified in "there are no computers in the classroom" in "insufficiency" was "tool" and the contradiction was between "subject-tool-object". To identify the CHAT constructs such as *object subjects, rules, tools, community* and *division of labour*; and the contradictions within the data, the annotation feature was used to describe the activity theory constructs and contradictions, identified in codes. This made the identification of contradictions within the activity system less cumbersome.

The axial coding method was used in the next phase of analysis to create categories from the open codes or subcategories earlier identified and recognising the connection between the

subcategories and categories. Through this coding method, occurrences were identified, the cause of the phenomenon, contradictions, the context, the intervening conditions as well as the actions and consequences were also identified (Priest *et al*, 2002). Using the example earlier mentioned, the sub-categories were coded as “infrastructure” and “underutilization”.

Selective coding was then used to enable the researcher select and integrate categories of these organized data from axial coding in organised and meaning-filled expressions (Williams and Moser, 2019). These expressions were designed to find the essence in relation to the context being studied. The CHAT constructs were used in the selecting coding process as the overarching category. As in the example, “infrastructure” and “underutilization” were coded as “Tools”. Having defined the overarching categories, they were reviewed to identify connections between the overarching category and the rest of the codes in the data, and codes which data were not considered useful were removed.

A data analysis software Nvivo12 was used for the coding and analysis of data. This software provided different coding techniques which enabled the researcher import data form multiple data sources whilst coding them into themes and patterns (Nvivo, 2018). Data collected from the interviews, observations, transcribed audio recordings, documentations etc., were imported into this application for analysis. Colour stripes were assigned to codes for easy identification of codes in the data. Cross referencing and themes were developed from these different data sources. Using the query-based coding feature which allows a user run word frequency queries to see how often words appear or run a text search query on a particular word, enabled all occurrences of the word or phrases not previously coded, to be added according to the themes where the code applies. The themes and subthemes that emerged from the data are represented in a flow diagram in Appendix E: Themes, and Sub-themes Flow Diagram

The final stage of the analysis was bringing to life the findings of the phenomenological experience. According to Finlay (1999), the role the researcher at this stage is that of an author

and is challenged to construct a phenomenological text that maintains concreteness, with the ability to portray intensity, character, and understanding of the study.

## **5.5 Research Integrity**

Research is a knowledge building process which provides insight into a problem or phenomenon and presents opportunity for change and transformation. Therefore, ensuring research integrity is crucial. It allows readers to have confidence in the way the study was conducted whilst meeting the professional and ethical standard set by the University's research committee. To ensure integrity of this research, the researcher has taken the following steps to ensure that this study was conducted honestly.

### **5.5.1 Trustworthiness**

Researchers such as Shenton, (2004) and Hadi and José Closs, (2016) have highlighted the importance of ensuring trustworthiness in research. This is to establish rigour and ensure the study is conducted honestly without bias and it gives the research an intrinsic value (Hadi and José Closs, 2016). To ensure credibility, reliability and dependability of this study, I employed, triangulation members check, audit trail and reflexivity (Shenton, 2004).

### **5.5.2 Triangulation**

Shenton (2004) suggested the use of triangulation in research study, which involves the use of different methods as a strategy for data collection as well as gaining different perspectives to produce very comprehensive findings (Noble and Smith, 2018). Although this study was conducted in one site, using three sources of data (observation, interviews and document analysis) gives an in-depth understanding of the learning system and the potential of mobile technology in the system. Another type of triangulation used in this study to ensure credibility was methodological triangulation as Anney, (2014) suggested. This study adopted both phenomenology and case study methodology. The results from the case study compliments and clarifies the phenomenological findings which gives the study credibility.

### **5.5.3 Members Check**

Member's check allows participants check the accuracy of data collected (Shenton, 2004). During the data collection process, participants were asked to review their interview transcript for accuracy and to ensure that the words matched what they intended to say and if there are any discrepancies, additional data will be collected. Few participants who reviewed their transcripts, rephrased some of their responses. This prompted follow up questions, and as Shenton (2004) suggested, participants were asked to give reasons for any pattern observed in order to give meaning to the data. This was an essential process in ensuring credibility of the data, as it eliminated researcher's bias during analysis and interpretation of results (Anney, 2014).

### **5.5.4 Audit Trail**

To establish dependability of this study, audit trail was used to examine the data collection process for validation of data. (Anney, 2014). All the raw data, interview transcripts, observation notecards were cross checked. The importance of this process was to elucidate how the data that led to the information and findings were gathered, processed and used (Shenton, 2004).

### **5.5.5 Reflexivity**

According to Roller and Lavrakas, (2015) reflexivity is important as it addresses the issue of researcher's bias which impedes the accuracy of the research outcome. For this study, I was fully aware of my own bias and assumptions and the use of reflexivity helped me assess how my perception and experience may have influenced my research outcome.

Already, some of the participants were fully aware that I was a co-worker, and having taught and studied partly in the country, I was not oblivious to the fact that some of the issues being investigated and discussed may seem to be coming from a personal point of view. However, this did not affect the participant selection process, as this was solely driven by the CHAT

framework and nature of the research question, as well as the extensive exploration of literature in this area.

## **5.6 Ethical Considerations**

Ethics are set of regulations, moral and legal codes intrinsic to good quality research and integrity and ensures that research studies are conducted honestly and ethically. This research was conducted in line with the UWE's code of good research, and the British Educational Research Association (BERA, 2018) ethical guideline for educational research. To ensure research is conducted ethically, UWE Faculty Research Ethics committee scrutinizes the types of ethical issues that are raised when a research involves human participants. The objective is to ensure that research is conducted in a way that serves interests of individuals, groups and/or society, as well as examine research activities and projects for their ethical soundness.

According to BERA (2018) guidelines, a researcher has several responsibilities which includes responsibility to study participants, to sponsors, clients, and stakeholders, to community of educational researchers, and for publication and dissemination. This research has taken the ethical issues relating to this study and the responsibilities of the researcher as outlined by BERA into consideration and has devised means of addressing them.

Research studies should be conducted with the "ethics of respect for the people involved or impacted by the research study, including themselves" (BERA, 2018). This means that participants should be treated with dignity, without discrimination, and their rights must be respected.

### **5.6.1 Informed Consent**

According to Wiles, et al., (2007) gaining informed consent from people being researched is fundamental to ethical research practice. A participant must retain its right to autonomy and can make informed decisions to participate in any research voluntarily only if they have information on the possible risks and benefits of the research (Fouka and Mantzorou, 2011).

Therefore, Participant's information sheets giving details about the research, what it means for participants to engage in the study, why their participation is important and how the data will be used, were handed out to participants alongside the consent forms to obtain their consent to participate in the study. Full consent was given by every participant who was observed, interviewed or took part in the pre-study survey.

In the information sheet, participants were advised that they could withdraw from the study at any point without an explanation, and they were not forced to complete the study if they felt uncomfortable to continue. However, bearing in mind that such withdrawal could potentially prejudice my ability to complete the research, a fixed final withdrawal date was set to 60 days after giving consent. If participants withdrew from a study after data collection, they would be asked to complete a withdrawal form and indicate if they wanted the data collected thus far to be retained and included in the study, or to be destroyed and not included in the study.

However, participants were advised that once the research is complete, and the data analysed, it will no longer be possible for data to be withdrawn from the study.

In this research, there were also passively involved participants during the observations who were implicated in the context such as students and colleagues of the educators being studied. As stated in the BERA (2018) guidelines, researchers should consider whether it is necessary to provide information or obtain informed consent from such participants. Information sheets were given to the students in the classroom, and colleagues who shared office space with the participants, whereas the date and time of the observation was communicated via the participants. Although signed informed consents were not obtained, students/colleagues were given the choice to be excused and those who decided to remain in the classroom or office during observation were allowed.

As identified by Fouka and Mantzorou, (2011) vulnerable groups include captive populations (prisoners, institutionalised, young students or pupil etc.), mentally ill persons, aged people, children, critically ill or dying, poor, with learning disabilities, sedated or unconscious who

are unable to protect their own rights and welfare. This research did not recruit participants from any of these categories mentioned above. Moreover, one of the criteria for participating in the study was that participants must be 18 years old and above and can give informed consent before participating in the study, which was the case here.

### **5.6.2 Confidentiality, Anonymity and Privacy**

According to the BERA (2018) guidelines, researchers “should recognise the entitlement of both institutions and individual participants to privacy and should accord them their rights to confidentiality and anonymity”. Crow and Wiles, (2008) emphasized that it is important for researchers to assure participants that every effort will be made to ensure that the data they provide cannot be traced back to them in reports, presentations and other forms of dissemination.

Every participant has a right to privacy and to ensure confidentiality and anonymity of participants in this study, interview questions were designed in a way that did not require the disclosure of any identifiable information about themselves, that can easily be deduced from published work. Where a participant’s identifiable information was required (such as interview with the head of ICT, Head of department, Provost or Vice chancellor of an institution, or the institution being studied), they were requested to explicitly give consent for this information to be used in this study, and where participants willingly decided to wave their rights to privacy, their rights were respected by the researcher. Otherwise, the researcher had a duty to ensure confidentiality was maintained, and data securely stored and disposed accordingly. Every participant who took part in this research, did so anonymously and the subjects being observed were not individually discussed or identified. The BERA guidelines also noted that it may be possible for some readers to infer the identity of participants and the institution even from a fully anonymised account of that research, which was the case in this study for some participants. Details about interview participants’ age and professional backgrounds could

have revealed a new line of analysis instrumental for this study, but some readers from this institution could have easily identified these participants. In order not to put them at reputational risk, the researcher had to employ ethical judgement to exclude the compilation of such details from the study. Thus, maintaining confidentiality and anonymity was upheld to protect the privacy of participants to build trust and rapport between the researcher and the participant.

A Researcher's responsibility to the stakeholder as stated in the BERA guidelines, requires consent to be obtained before the study commences. Therefore, consent was sought and obtained from the Provost of the college and the Director of ICT, to allow access to the institution, staff and students as well as resources for data. Study participants were approached only after their head of department was consulted and approval to commence was granted. A copy of the information sheet and consent form can be found in Appendix A and B.

Research studies should be conducted in “the highest standards to protect the integrity and reputation of educational research” (British Educational Research Association BERA, 2018). As a responsibility to educational research, studies were reviewed and criticised in an appropriate professional manner. All sources used in the study were adequately disclosed, and proper attributions were made. The researcher ensured to check the reuse and attributing conditions of all digital contents, and permissions were also sought and obtained for works of others subject to copyright.

Finally, as stated in the BERA guidelines, “researchers have a responsibility to make the results of their research public for the benefit of educational professionals, policymakers and the wider public”. Hence this study was conducted with integrity and accurately disseminated findings without falsifying, distorting, suppressing, selectively reporting or sensationalising the research evidence or findings. Although no sensitive or outstanding findings that could impact on institutional reputation were identified in the data, the research findings were not



compromised to promote any work or reputation of the context (British Educational Research Association BERA, 2018).

## **5.7 Summary**

It is important to outline the steps taken to conduct a study as it allows the researcher to review his/her own research approach, compare and justify methods against many others developed by educational researchers in the field. This chapter has explicitly outlined the approach adopted to conduct this study.

Time and effort were dedicated to investigating the various methodologies for this study. Phenomenology was considered a suitable approach for this study because of its systematic method of studying, analysing and describing participants experience, however it lacked potency in studying human actions within an environment. While the use of imaginative variation technique to study the data, envisages a scenario to capture the essence of the phenomenon, some scenarios are better understood if a researcher immerses his or herself in the context to study the actions and get a sense of what participants experience in their daily teaching or learning process, hence its fusion with case study. Case study was used as an ethnographic approach to the study to understand the actions, culture, and structures of this teacher education institution that influences educators' teaching practices with regards to ICT adoption.

Expressly, the infusion of the two methodologies enabled me "walk in the educators' shoes" while experiencing with, and eliciting what the experience means to them, in order to properly describe the phenomenon. The following chapter will present the findings from the phenomenological analysis of the educators' experience with ICT integration in their teaching practices and the entire learning process.

## **CHAPTER 6: FINDINGS**

### **6.1 Introduction**

The overall aim of this study was to identify the potentials of mobile technologies in teacher education colleges in Nigeria. However, the absence of ICT to enhance learning in these colleges prompted the need to analyse factors that affects its adoption using this selected college as a case study. I strived to investigate how the user and the environmental factors (discussed in chapter 2) affects technology adoption, and the ways it has or has not been addressed within this teacher education college. This was crucial to investigate in order to identify the potentials of mobile technologies to enhance learning and teaching practices of educators and students training to become teachers.

To contribute to existing research in TEL and the impact of mobile technologies in teacher education, this research sought to answer the following questions:

1. What are the current pedagogical approaches used in Nigerian college of education?
2. Are ICT currently being used to support these pedagogical approaches?
3. How has/can ICT support the current pedagogic approach used in the college?
4. What are the factors affecting the effective integration of ICT in pedagogy in the college, and how has it been addressed??
5. In what ways can mobile technology enhance teaching and learning in colleges of education in Nigeria?

As discussed in the previous chapter, data were collected using multiple data sources, and thoroughly analysed to reveal themes and patterns relevant in answering these research questions. This chapter presents the findings from document analysis and the interview, alongside brief discussions to describe the findings. Firstly, a summary of the data generation process is introduced, followed by presentation of findings from the document analysis and

interviews, alongside discussions to describe the accounts of educators for better understanding of the data. Finally, a summary of the findings is presented, providing a link to the next chapter.

## 6.2 Data Generation

The data collection was conducted in two phases. During the first phase, observations were made and recorded and some interviews were conducted. There were some interesting findings from the observation data which revealed the need for further questioning and a consideration of another method of data collection. Furthermore, some of the participants had to reschedule their interview for a later date, hence the 2<sup>nd</sup> phase of the data collection. This created more time to study the previous data and find ways to restructure the interview questions to elicit richer data from these participants during the second phase of data collection. The phases of data collection are presented in Table 6-1

**Table 6-1: Data generation phases**

	Phase 1	Phase 2
<b>Participants</b>	Educators and students	Director of ICT/HOD
<b>Observation</b>	7	1
<b>Interview</b>	7	1
<b>Dates</b>	March 2019	August 2019
<b>Location</b>	Study site (permanent)	Study site (permanent)
<b>Duration</b>	3 weeks	2 weeks

The option of using focus group as another method of data collection presented itself, but the process of getting an ethical approval, considering the short duration of time left to complete the data collection process, impaired the need to go further. Thus, the existing data collection method was utilized to elicit as much relevant data as possible. Overall, a total of 8

observations were made followed by interviews. The number of participants and their roles are presented in Table 6-2

**Table 6-2: Qualitative Study Participants**

Data collection method	Number of participants	Roles of participants
<b>Participant observation and Interviews</b>	Male: 6  Female: 2	Participants held various years of experience as educators and senior lecturers from different schools and departments within the college.  One of the participants was the director of ICT who was also the HOD of computer science department.

Although the observations were conducted with pre-defined set of topics and themes designed to generate answers to the research questions (see Appendix C Sample Observation Notecard). However, as the study progressed new topics and subsequent themes emerged. Participants were approached at the start of the day and observed at different settings such as their offices and classrooms. After the observation a formal semi-structured interview followed. Observations of other areas of the college relevant to the learning process such as the library, the departments, the ICT business centres, as well as the college ICT facilities, were also carried out. Non-formal conversations relevant to the observation activities outside the formal interviews, were recorded.

### **6.2.1 Data Labels**

To enable traceability of data excerpts from the analysis to the data source, data IDs were generated. The data ID was generated using a combination of the participants' ID, type of data and lines from the data. The participants' ID was generated to keep the identity of the participant anonymous. In the data excerpts example as shown in Table 6-3, FM1 relates to

the female participant 1, INT1 relates to interview 1, while the L15-25 means the lines from the interview transcript.

**Table 6-3: Data ID**

Components of Data ID	Meaning	Example
MLx or FMx	ML = Male FM = Female x = 1,2,3	ML1 = Male 1 FM2 =Female 2
OBSx or INTx	OBS = Observations INT = Interview x = 1,2,3...	OBS1 = Observation 1 INT2 = Interview 2
Lxx-xx	L = Line number	L15-25 = Line 15-25
Example	ML1OBS1L15-25 = Male1, Observation 1, Lines 15-25	

### 6.3 Technology Enhanced Teaching and Learning - Documents

The mandates of the Federal Ministry of Education (FME) include: to formulate and coordinate the national policy on education, develop curricula and syllabuses at the national level as well as prescribe and maintain uniform standard of education throughout the country (FME, 2021). The Tertiary Education department (TED) under the FME is charged with the responsibility of designing, coordinating, implementing, and monitoring education policies, promoting ICT penetration and utilization– data collection, bandwidths etc. for tertiary institutions including teacher education colleges. Government parastatals/agencies were setup for every tertiary education institution under the supervision of TED, to execute the education policies tailored to their learning institution.

The implementation of the National Teacher Education Policy (NTEP) is regulated by the National Commission for Colleges of Education (NCCE), whose mandate includes laying

down minimum standards for all programmes of teacher education in Nigeria, outlining the curriculum implementation framework (CIFW), as well as designing the component of the curriculum (Israel and Israel, 2020). The components of the curriculum determine what the students are exposed to that are adequate to enable them to enter or re-enter the teaching profession with confidence in their ability to perform creditably as expected (Israel and Israel, 2020). The documents reviewed in this study included standards and expectations set for the delivery of quality education for teacher education institution.

A study of the 2014 NTEP document revealed that the FME acknowledged the need to address some of the challenges in teacher education including the “...low level of IT penetration and utilization in an IT-dominated area” (p.9) such as computer centres or departments. However, to understand how the NTEP accommodates the adoption of ICT in teaching and learning, the analysis focused on the curriculum and instruction guidelines, one of which states that:

“PRINCIPLE FOUR: For teachers to be able to teach well, at their level, they must have sufficient mastery of content and subject-specific methods of teaching...

12. As part of the Education courses, either in the NCE or undergraduate programs, all student teachers must take courses in IT and relevant audio-visual their applications in teaching and learning”.

Although not highly emphasized, it indicated the inclusion of a course on technology application in teaching and learning as a criterion for all student-teachers. However, it does leaves much to ponder on, are student-teachers expected to only learn the relevance of ICT in their teaching and learning? Or are they trained on the practical application of ICT in their own teaching? This led to the review of the 2012 NCCE minimum standards document (MSD) to examine the contents of the curriculum.

A careful study of the MSD for the various schools revealed that students are not only overcrowded with many courses to learn, but the vital course such as “training to use ICT in

teaching practices” and “developing digital learning contents for online platforms” are excluded from the curriculum. The inclusions of ICT/IT courses in the Science curriculum are mainly as core subjects for computer science student. Although the “Introduction to ICT/IT” and “Educational Technologies” are sparingly included in other subject area curriculum such as Adult and Non-formal Education, Special Needs Education and General Education, they are listed as 1-2 credit compulsory courses for all NCE programs, with emphasis on multimedia and educational media. Where mentioned as instructional tools, they are considered supplementary tools where necessary and not an essential instructional tool. Furthermore, one of the objectives of teacher education is to produce teachers who can:

Professionally combine use of conventional and ICT or other innovation instructional/learning strategies in generating, and imparting knowledge, attitudes, and skills at Basic Education level.

This can only be achieved if the student-teachers are explicitly trained to do so, and the teaching method used in their classroom is facilitated by technology. As stated in the NCCE CIFW, teacher standards such as professional knowledge also requires teachers to “use diverse methods (i.e., role plays, games, discussion, etc.) teaching aids and use of ICT, etc.” (p.18) to deliver contents of the curriculum to their learners. This means that educators are expected to integrate ICT in the classrooms, which requires a level of educator-specific digital competence to do so. Again, the teaching method used by educators will generally depend on the subject taught, the structure and design of the learning content, and access to technology as instructional tools to facilitate chosen methods. These three factors combined will determine how/if ICT will be used in the lesson

A study of the teaching methods listed on the NCCE minimum standards differs even within the same school. For example, as stated in the school of science minimum standards document:

Mode of Teaching Computer Studies at the NCE level shall be taught by an appropriate selection or Combination of the followings teaching strategies:

Discussion (ii) Lecture (iii) Practical Demonstration (iv) Tutorials (v) Supervised projects (vi) Student's Guided Practice (vii) Problem Solving/Inquiry Method (viii) Excursion to computer firms (ix) Seminar (x) Computer Assisted Instruction (CAI).

A teacher of Chemistry should be aware and familiar with various teaching methods available to him as a teacher. This will enable him/her to use any method or a combination of methods he/she finds appropriate in his special circumstance and setting. A combination of the following methods is recommended.

Discussion (ii) Activity (iii) Demonstration (iv) Lecture (v) Project (vi) Tutorial (vii) Field trips (viii) Games and simulation (ix) Concept mapping (x) Computer Assisted Instruction.

Although Computer assisted instruction is listed as an optional teaching method to be combined with other methods, the focus should be on using computer technologies in facilitating lecture, demonstration, tutorial etc. Nevertheless, irrespective of the chosen teaching method, availability and access to computer and technical resources remains paramount for an ICT mediated lesson.

The NTEP document also identified the lack of adequate infrastructure as one of the challenges that needed to be addressed in teacher education, stating that:

A good number of institutions for teacher education operate with dilapidated infrastructure and furniture; overcrowded lecture halls and insufficient equipment and materials (e.g.) library and laboratory materials, computer).

Of the eight objectives set in the document to tackle the infrastructural issues, the third was "to ensure that teacher education institutions are well equipped both in human, financial and material resources" (p. 13). According to the NTEP document, the principle set to meet this objective are stated:



PRINCIPLE THREE: For student teachers to be able to learn well, teacher education institutions must be equipped to prepare them adequately.

1. Teacher education institutions are required to comply with the NCCE or NUC requirements for Principal Officers and the minimum number and quality of administrative and other non-academic staff relative to academic staff required for approval as an institution for teacher education.
2. NCCE and NUC shall prescribe the minimum number of lecturers i.e., lecturer/student ratio and support staff for each course in the NCE or bachelor's programme.
3. NCCE and NUC shall involve TRCN in monitoring the quality of teaching staff in the teacher education institutions.
4. Teacher education institutions shall always comply with extant conditions of service for staff

The directives for NCCE in the policy document do not include the provision of ICT or computer technologies in the classroom to support the computer assisted teaching as expected. Although the current NCCE MSDs pre-dates the NTEP, the establishment of Centre for Educational Technologies (CET) can be perceived as an attempt to tackle this issue, as historically, it has been a challenge in teacher education. It is also stated in the General Education MSD as an essential facility:

#### Laboratory and Equipment

- There should be a well-equipped Centre for Educational Technology (CET) and Information Communication Technology (ICT) Centre” (p. 11).

The Centre for Educational Technology (CET) should be a service unit in the School of Education which acquires, produces, and houses instructional resources to facilitate effective teaching and learning in all the Schools of the College (p. 21)

The CET are required to be equipped with hardware and software such as photocopying machines, voltage stabilizers, power extension box, white board, computer equipment with printers, magnetic chalkboards and cable satellite facilities etc. there seem to be no emphasis on the use of computers with internet facility to enhance access to comprehensive academic resources or online social platforms for effective learning collaboration.

As part of their teacher training, students are required to earn six credits for teaching practice, designed to demonstrate the practical knowledge gained from their entire program. However, the assessment criteria which, assesses students' competence in the use of instructional materials (relevance, appropriate timing, adequacy, variety); and competence in enhancing class participation; does not emphasize the need to utilize technology in classroom presentations.

The 2019 National Policy on ICT in Education (NPICTE) is dedicated to promoting an ICT enhanced education in Nigeria, which is a seeming step towards the right direction as it recognises the need for Human Capital Development and Infrastructure. Some of the NPICTE objectives are “to facilitate the teaching and learning process, and enhance various teaching and learning strategies required to meet the needs of the population” (p.11), by government restructuring the teaching and learning environment as well as education administration to be ICT enhanced (p.14); ensure appropriate continuing ICT training including content development and delivery for all staff (p.14); ensuring adequate supply of ICT systems for access to software applications, local and international contents and online learning resources at ALL educational institutions and establishment (p.16); and ensure provision of cost effective and alternative power supply (p.17). The implementation of this policy will require a review of the current 2014 NTEP and 2012 NCCE minimum standards and curriculum to include the new ICT policies in education, which will be a massive change in the institutional culture of teacher education in Nigeria.

Overall, having analysed all the documents in this study, it appears that while the ICT policy in education emphasizes the importance of providing technology enhanced educational system, the implementation is slow and the existing NTEP policy does not lay much emphasis on ICT enhanced teaching, learning, or teaching practice of students-teachers. The concepts of ICT in the minimum standards and its role in teaching and learning, are taught as part of the educational courses that ALL learners must complete, and not stated as requirement for learners to essentially utilise it in their teaching practice.

### **6.3.1 Roles and Responsibilities of Educators**

Educators' roles are pivotal in developing and fostering innovative teaching and learning methods in teacher education. The NCCE CIFW set clear teacher standards, specifying their roles and responsibilities as educators of student-teachers. The standards are designed to ensure:

- Teachers exhibit professional knowledge and competency regarding how learners learn and how to teach effectively.
- Teachers have professional skills to plan for and assess effective learning.
- Teachers provide and maintain conducive learning environments.

While the documents do not specifically highlight the role of teachers in fostering innovative technologies in their teaching, as well as promoting learners' competence in their own teaching practice, it does expect teachers to possess "professional knowledge and skills" to plan, deliver and assess effective learning. This means that educators are expected to be creative and innovative in their teaching methods; including the use of ICT, to meet the needs of their learners. Educators are expected to know their learners, their cultural backgrounds, strengths, and weaknesses and should be able to identify learning techniques and resources to engage them including adopting collaborative learning methods and activity-based learning. The learning methods determine students' engagement in their own learning and as the NTEP

document identified, “the predominance of the lecture method of teaching has resulted in the prevalence of memorization-regurgitation” in students (p.9). Hence, educators need to be creative in adopting modern digital technologies and social learning platforms to create an engaging and interactive classroom for learners.

These innovative learning methods can be supported and enhanced with mobile technologies, but it requires educators-specific digital competence to do so. Since this is not a pre-requisite for educators in the CIFW teacher standards, the use of technology in teaching then becomes an option and educators who lack digital competences are apathetic to develop or learn the digital skills required to become digitally competent educators.

### **6.3.2 Roles and Responsibilities of the Institutions**

The learning institution can be considered the centre for the change required in teacher education as it dictate the teaching and learning processes, practices, cultures and how best to implement educational policies within its setting. The institutions are responsible for developing their own institutional policies to align with the mandate and standards set by the FME. Thus, they define the skills, characteristics and qualities required in the educators hired, they identify the need for CPD of the educators and they define the vision of the college and set regulations for educators and learners to follow. As stated in the NTEP document, another challenge of teacher education was that:

Lecturer selection for colleges of education (COEs) was generally considered as not being sufficiently rigorous. Lecturers were found to be inadequately prepared to teach in the areas to which they are assigned; especially Primary Education Studies (PES).

Therefore, in trying to tackle this issue the policy states amongst others that:

2. The minimum requirement for teaching in a College of Education shall be a master’s degree in a teaching subject.

6. All teacher educators shall receive a minimum of 12 hours of Continuing Professional Development (content and methodology) at least once every two years.

7. All Teacher Educators shall be IT compliant.

The need to employ qualified educators with at least a master's degree is irrefutable, however the need for "IT compliant" educators is rather ambiguous. The document fails to explicitly define what IT skills educators must acquire to be effective in the teaching. Additionally, CPD should also include training on content development and methodology for digital technology. If "educators must constantly upgrade their knowledge and skills to remain relevant in the rapidly changing world" (p.22) then they must upgrade their digital skills to enable them to teach the digital generation learners in today's digital world. There is need for increased technical capital amongst educators and learners if technology enhanced teaching and learning is to become top priority in teacher education. Therefore, it is the responsibility of the institution to not only seek IT compliant educators but recognise the need for improved digital skills and competences of educators and encourage CPD to further the acquisition and application of these skills in the teaching and learning process.

Once the institution has a vision to enhance teaching and learning with ICT, IT or digital technologies to improve the quality of teacher education, they can then seek funding from appropriate funding sources such as Tertiary Education Trust Fund (TEFUND) as listed in the NTEP document.

In summary, all the documents reviewed outlined a range of teaching and learning methods for teacher education, however, the predominant method appeared to be lecture method which is an instructivist learning approach. Thus, students are conditioned to be passive in their learning and not engage in the process of acquiring knowledge themselves, due to the apparent lack of adequate ICT infrastructure in the classroom to provide access to wider comprehensive resources. The educators and institutions are charged with the responsibility of being creative

to promote student engagement and participation in the learning. The outdated nature of the documents reflects the backwardness of our teacher education system and does not in any way represent the expected standards for teachers in this digital education era. The following section will try to capture how this college of education institution and its educators are implementing these policies and standards to meet the learning needs of their students.

#### **6.4 Technology Enhanced Teaching and Learning – Educators**

The extensive study of policy documents, teacher education standards and curriculum revealed little emphasis on ICT enhanced instruction and learning. Nevertheless, the college and educators understand the importance of engaging with modern digital technology in today's learning environment but are struggling to fully integrate such technologies in the classrooms. It is evident through the observations and interviews with educators in this institution, that the method of teaching does determine if ICT can be used to enhance teaching and learning, and the pedagogic approach can differ from one educator to another, which is ultimately influenced by their subjects, topic, their own learning methods based on their experiences as learners themselves. One of the educators when interviewed disclosed that:

The approach depends on the way's lecturers teach. It depends on personal teaching approach and manner you use in teaching your students, which is what matters..... we are different in teaching. My approach may be different from other lecturers, so if I want to generalise, it will be based on my own pattern of teaching.... *ML3INT4L26-35*

Some educators believed in the prevailing teaching and learning culture of the institutions they studied in, which has formed their belief that lecture method for instance, is the general teaching method but educators can decide to adopt other methods to deliver their lessons. For this educator as he quoted:

Generally higher institutions in Nigeria always use what is called lecture method but sometimes some lecturers do adopt some other pedagogical method such as demonstration method.... *ML2INT3L28-30*

Other educators' pedagogic approach as observed, is guided by the subject area, which can require a combination of teaching approach as another educator stated:

we are using practical. We use classroom lecture, which is more of theory and later come to the lab to show the practical because they too will go and train some people so they must know both the theory and the practical....

*ML4INT5L27-32*

This reveals the level of influence that students' learning experience can have on their own teaching practice. The Educators' role in the teaching and learning process in this institution is tailored towards training learners by using appropriate teaching techniques worthy of emulation and these educators understand their roles in training and developing competent teachers. According to one of the directors,

our primary duty here is to produce teachers that will go to primary and secondary schools to teach. So, our pedagogy is tailored towards teaching the teachers /training of some sort.... Our courses are double measure courses; because you must do the professional aspect of computer science for example and the teaching aspect to be able to function in the classroom, the students are taught how to use both the experimental and practical teaching methods....

*DICTINT8L38-48*

The courses taught also determined the pedagogic approach that these educators adopted. For instance, during the observation of a Chemistry lesson which was conducted in a laboratory, the educators explained concepts and later students were given tasks to demonstrate. This is because chemistry is a participatory subject and cannot be taught without practical

demonstration. Conversely, in the Educational Philosophy lesson, it was strictly lecture method, with little or no activity for the students to complete. When asked why student did not actively participate in the learning, the educator's response was:

as you noticed in the classroom, some of the students did not participate in the learning because they had no materials. if there was an easier way to prepare the lesson, and send it to them, then the classroom lesson will be more about explaining than dictating notes... *FMIINT1L46-49*

This suggests that if students are to engage in the lesson and complete learning tasks as part of classroom activity, then they require the needed facility and resources to do so. The classroom was overcrowded with very little sitting spaces to accommodate the number of learners and specifically, there were no computers or internet facility to encourage participation. Students just listened to their teacher, answered questions when asked, and wrote down important explanations either written on the chalkboard or as dictated by their educator. As documented in the observation notes:

Delivery method is the same as others. Concepts are explained and written on the board for students to copy, and most of their notes are dictated as the educator explains the concepts that are not in their handouts...  
*ML5OBS6L137-139*

Some educators expressed that their choice of lecture method is because of the infrastructural issues. This educator lamented that... "we often use lecture method as a result of poor electricity in Nigeria" (*ML1INT3L30-31*). He went further to express that... "this college lack a lot of facility" (*ML1INT3L33*). This was the same for almost every lesson observed except in a Computer Science lesson which was conducted in the computer lab. Although the computer lab had a reasonable number of computers to accommodate the number of students in the lesson and was equipped with a projector and monitors, they were not used by the students during the lesson, but rather for presentation of the lesson. As observed, ICT



integration in lessons to engage learners appears to be a concept that these learners and educators are not accustomed to as learning resources are hardly in digital formats. Lesson materials are prepared ahead of time and distributed to students as course handout or manuals. Students are then required to buy these handouts as a commitment to their studies, alongside textbooks written and published by other educators which can also be purchased from the bookshop or available for loan at the library. In this educator's words, "We use chalkboards, at times I print handout for them and at times ask them to go the bookshop and buy textbooks too" (*FM2INT7L150-151*).

These course materials require extensive study, and access to range of online resources and books to be produced, and these educators go through great length to source for these resources and often have to pay for internet services and data to access them. One of the educators when interviewed expressed that: "sometimes we make use of textbook. We go to the library to source for textbook for a lecture and sometimes you know we make use of the internet" (*MLIINT2L61-62*). When asked if he found it challenging to prepare these lesson materials, he responded saying:

it is highly challenging because not everything, not every updated information that we see is in the textbook. Do you know as at the time textbook was designed? You see like today, new technologies come out, so we need to get ourselves updated with the new technology. Right now, we are faced with so many challenges because we cannot restrict ourselves only to textbooks, it is highly challenging using only textbook and other manual materials to deliver our lectures... *MLIINT2L68-77*

He further expressed that "I have to now depend on my own network data to research some information for my students due to lack of Wi-Fi in the school" (*MLIINT2L78-80*). This indicates that the entire process of developing learning materials, delivering the lesson and deciding on a teaching method is rigid and educators find these very challenging. From this

educators' response, it is obvious she recognises the value of using ICT in the entire process, but the institution is flawed with infrastructural issues. Another educator who seemed really displeased with the entire situation expressed that:

Normally, we do not use internet, but we use projectors, all those computers and some devices that is ICT based, but there's no internet. It's not that we do not have it available, but it is not functioning, it's not effective and it's not being used for teaching and learning per se it's just you go to the lab, you do the practical and you go back to your classroom... *ML4INT5L104-*

*108*

His response reveals the lack of proper management and maintenance of the existing ICT infrastructure leading to underutilization, and ultimately the dilapidation of the facility. Educators who were interviewed on what they thought was affecting the little or no utilization of ICT for teaching, blamed the poor allocation of funding for teacher education, as a major factor, others blamed, the management, the lack of electricity and even students and educators' digital literacy and competency. As one educator expressed:

we are lacking a lot of facilities and government of today is not attaching any importance to education. Looking at the budget they drew, even last 2018/19 budget education budget, money allocated is very low....

*ML2INT3L66-69*

While this educator hopes the funding can be reviewed to enable the college to dedicate more funds to technology, another believes that addressing the country's electricity issues will increase the availability of ICT in the classroom as he stated:

equipment may or may not be there, but no electricity but I believe if there are constant electric supply, those teaching gadgets that will aid in student lecturer interaction in learning will be available... *MIL2INT3L40-42*

Digital literacy and competence of educators and students as another expressed, played a major role in the utilization of technology for teaching and learning as he affirmed that... “most of the students are not computer literate, you must go as low as digging them up from the beginning” (*ML3INT4L60-61*). Another educator also articulated that .... “If the staff are not trained or know how to use the technology, likewise the students, the challenges will still be there”. “So, it will only address the challenge when everybody both students and staff are trained” (*ML5INT6L60-62*).

The need for digital skills training for its application in teaching and learning, creates an opportunity for CPD for educators who can in turn create training sessions for their learners. It is the responsibility of the institutional management to identify the needs of their educators and learners and where necessary. They need to source for and provide the much-needed resources to enhance the entire learning process. One of the directors in the institution expressed that it might be an issue to get the management to see things from this point of view as according to him ... “The attitude of management towards technology is also a challenge, we have analogue managers functioning in digital age” (*DICTINT8L63-64*).

This director believes that “the journey to an ICT enhanced classroom begin with the management’s interest in it” (*DICTINT8L139-140*). The gadgets needed to enable this concept to come to fulfilment must be available, the technical capital must be accessible and thereafter, staff and student will be trained on how to use it effectively. However, in this case these resources are either not enough, not functioning properly or simply not available. Educators expressed their frustrations with the poor management of the existing technology, as a few iterated their struggles:

no good management for the technology being used. They are not managed properly and at times some of them do not function the way they are supposed to function, and it affects the teaching to some extent.... *FM2INT7L77-79*

they are not being maintained so they depreciate over time and that's the end of it.... *ML4INT5L119-121*

The depreciation, according to the centre director, was due to underutilization. He expressed concern for the staff and students' attitude towards the existing technology, stating that:

some of these technologies are in place, but they are hardly used by students and staff.... we already created a federal college email platform where the staff and student are supposed to have their email and they are supposed to have on the website a forum for interactions, I can bet you as I am talking to you, no lecturer has utilized that platform. So, if we utilize it, it can make teaching and learning very exciting.... *DICTINT8L117-122*

even the e-library facility is underutilised. So, technologically enabled learning is not taking place in this institution. It is sad but it is true. We do not hide away from it.... *DICTINT8L129-130*

Wondering why these technologies could not be made accessible to learners and educators in their classrooms in order to address the underutilization of the ICT centre, the observation revealed the lack of secure classrooms and power supply to power these equipment's. During the interview, an educator responded to this concern, stating that the reason for the underutilization was connection problem and electricity problem. He further iterated that:

Sometimes if you want to connect it will be very slow or there will be no light to power it. Also, the classrooms are not designed for these technologies. The classrooms are not secured, this means that if you have it in the classroom, it needs to be taken away after use if not you will not see it the next day. It will be stolen or vandalized... *ML5INT678-*

83

Another educator disclosed that the process involved in accessing available technology such as projector and monitor for a lesson, which includes booking to rent them from the ICT centre,

makes it frustrating. In her words, “you must rent the projector if you want to use it and book halls where these technologies can be used, as you can see, we cannot use them in these classrooms. Even if you can, it’s simply not available” (*FM2INT7L71-74*). This reiterated the earlier mentioned issue of classroom safety. Moreover, the structure to effectively use it is usually not the classrooms as they are only equipped with chalkboard and marker-boards, but large lecture halls as they are designed to accommodate these technologies, which must be booked in advance depending on availability. Others also disclosed their need for technology, but poor network frustrates their efforts.... “sometimes we need technology, and we discover that network and other things becomes a problem” (*ML1INT2L73-74*).

In a quest to understand what actions the management have taken to address these issues, some educators in their response believe the management of the institution do not care about their struggles, as some disclosed the reluctance of management to initiate the changes needed. One disclosed that she doesn’t believe they (management) understand their struggles as she expressed... “I am not really sure they know there is a problem” (*FMIINT1L67*). Another educator seemed to be oblivious of what the college was doing about the challenges they are facing, however he assumed that “Maybe they are waiting for the government, I do not know” (*ML3INT4L105*). Some educators do believe that the college management is doing the best they can.... “they are working towards making things better, providing more technologies and making the environment more conducive for learning” (*FM2INT7L81-83*). Contrariwise, two other senior lecturers were quite clear that addressing the technological challenges was not the responsibility of the college but of the government. One carefully explained the ways the issues can be addressed, stating that:

College cannot do anything, it’s the government! It is if government provide something for them that they’ll be able to do that. But the student on their own maybe using their association. They tried to do something, but it cannot be enough because it’s the

government that owns the school that should maintain and make sure that their facilities are working.... *ML4INT5L123-128*

Another educator buttressed on this point, stating that he has not been privileged to talk to the management, but “the union has been trying their best to see what can be done about this and I believe that the union will convey the message after the so called COASU finish their discussion” (*ML5INT6L86-90*). COASU in this case is the College of Education Academic Staff Union.

As observed, there are other processes involved in teaching and learning which includes communication, classwork, assignment, and lesson note distribution, teacher’s feedback as well as small group discussions and projects, depending on teaching methods, that still requires ICT to facilitate. Educators expressed that these were some of the unsaid challenges that they encountered in getting information across to learners. An educator expressed that although preparing the lessons were frustrating, the challenge was getting the electronic format to the students as he stated:

The challenge is not in the preparation as much, although sometimes it’s frustrating because you must pay for the internet to do the research and prepare the materials, but at least we can afford it because we are earning. For the students they can hardly access the materials because they do not have access to computers or internet.... *ML5INT8L49-53*

This means that if students do not have access to computers and internet to receive learning resources, they will not know how to use it to do same with their learners. Communication was surprisingly both analogue and digital through mobile phones as this educator disclosed “I communicate with my students through their class representative and mobile phones” (*ML5INT8L42-43*). Another educator also disclosed that:

you know we have a course rep who is the head in the classroom, sometimes I send emails to pass any information to the course rep while the course rep

now passes any information to the students, and sometimes also they come to my office one-one.... *MLIINT2L52-57*

This suggests that the university email is either not utilised by the educators and learners, doesn't work or they lack the resources to access it, hence this mode of communication. Sadly, student who are not in the classroom when the course representative passes this information will not receive it and will miss out on important announcements.

## **6.5 Potentials of Mobile Technology**

Educators have come to believe that the much-needed improvements in their learning environment seems impossible as management appear obstinate, therefore, they have devised other means of utilizing digital technologies to make the process of sourcing, designing, and disseminating learning resources and information less cumbersome. Mobile technologies have become the last resort for educators. As stated in this educator's response: I now make use of my phone, laptop, iPad, and other android devices to google the net and obtain information from the net (*MLIINT2L108-109*).

The use of mobile technology, although not predominantly used in the actual teaching process, it appears to enhance some of the learning process such as communication, smaller group discussions, distribution of classwork, assignments, and feedbacks. A surprising number of educators who participated in this study, used social platforms, accessible from smartphones and android devices, to make communication easier and to boost the dissemination of information and resources. These educators, amongst others, conveyed that:

.... we chat through social media, we have Facebook even some of the courses I taught, I asked them to create a Facebook page so that they will make it interactive. Even, someone will put up a topic, you teach it using your lesson note. You put it in detail so that somebody can access it, read it, ask a question and you reply the person through that page. Even the students have a social

media group WhatsApp that they normally do their chatting and sharing of what they do not understand.... *ML4INT5L60-67*

.....the students normally have WhatsApp group. so, if there are questions, they do not understand, they approach me, I solve it for them, I give to the admin of their WhatsApp and he'll upload it for them. So even after that some of the students come to me personally you know, and I attend to them.... *ML3INT4L43-47*

.....because I created a WhatsApp chat in each of the level of students I always teach. I am among their WhatsApp chat for outside class interaction in case if there are any students that need a guide based on the courses being taught, he or she can ask questions or if there is impromptu assignment, I do give through their various e-mails.... *ML2INT3L49-54*

Nevertheless, there were few educators who did not, and were less innovative in their processes. The distinctive variables between these two groups of educators as observed, were primarily their course background, their enthusiasm towards technology, their learning experience, and their perception. Age was certainly not a factor, although they did not disclose, however some of the non-users of mobile technology appeared younger than the users. Educators with a background in science and technology seemed to embrace mobile technology as part of their learning curve, while other users were the technology enthusiasts who were quite excited to share their opinions about the potentials of mobile technology to enhance teaching and learning. Some educators who shared their opinions and experiences said:

I think mobile device will aid teaching and learning because through your mobile devices you can get information very fast and easily. Secondly, it is handy. It's something you can carry along and anytime you feel like you can just use it to get any information you want..... *FM2INT7L93-97*



.....most of the knowledge I have today is as a deep root of national open university the guidance they gave to us because they always employ mobile learning in their school. so, it will help the individual if the individual is willing to learn..... *ML2INT3L102-105*

.....mobile devices support teaching and learning in a very efficient and reliable way. First of all, if there is information you want to get across this country, the fastest way of you getting it is through the internet. So, my happiness is when you get a very fast device that can get you this information, it is also a plus to our teaching and learning activities.... *MLIINT2L115-120*  
mobile devices can increase, rather, improve teaching in learning in this school... *MLIINT2L124-125*

For this director whose background and experience are in Computing and Information Technology, the concept of mobile technology in his practice comes as no new concept to him as he considers himself to be a digitally competent educator. He owns several mobile gadgets and prides himself as, “100% a technologically inclined person, who’s online 24hrs a day” (*DICTINT8L184-185*). When asked what he uses these gadgets for his response was:

Mostly I use it for interaction, conducting research, I have so many research platforms and I have so many international journals. I answer all my emails through these phones, yet my laptop is in the bag and I do not have time for it because I know I have an android device that has 1TB of storage so I could do anything on the go. You could even send class assignments, tests from your mobile devices to a school-based device and allow students, even when you’re not physically available, to do test. I believe, if properly utilized, it would deliver teaching and learning easily.....*DICTINT8L186-197*

Undoubtedly, his perception about the impacts of technology in education is unwavering and using his position as the Director of ICT, he was committed to bringing innovation to this

teacher education college. However, his concerns have always been the negative attitude and perception towards technology amongst faculty members, students, and management. In his interview he lamented that:

At a point I was trying to attract a foreign innovation hub in this college, where they produce iPads and tablets for lecturers and students to make us imbibe this new technology so that all of us can benefit from it, at the last trial we find that the college management was not so interested in delivering that type of learning to this institution, so I had to pull out....*DICTINT8L130-135*

While there were some positive opinions about mobile technologies in education, other educators had quite an opposite and somewhat lukewarm reaction to the concept. While one educator thought learning technology could enhance learning, she opined that it would not be the case in a developing country like Nigeria, due to the cost of owning a smartphone or tablet. Another educator believed the learners will struggle to use or afford it as he stated:

sometimes when you drop a message to students on email or in the chat, students will complain that they did not see it because of lack of funds. Most often, to communicate assignments to students, I notify them at the beginning, say first or second week of every month and their assignment will be done. once it enters 3rd or 4th week their allowances or pocket money might have gone down for them to recharge or buy data to view the message and it will require the lecturer to visit the school to give out the assignment or call upon the course rep to notify him or her of the assignment on WhatsApp or email for its circulation. ...*ML2INT3L89-98*

This is an indication that although mobile technologies can certainly enhance the entire learning process, educators were still concerned about the students being able to afford the technology, especially for student who struggle financially to get themselves through school.

Thus, the concept of bring your own device BYOD in this teacher education would create digital ownership divide amongst learners. Another educator also expressed concerns for mobile technology in the classroom as:

the only problem I can see is that if students are addicted to use of phone, they kind of divert from what they are supposed to learn from the use of the technology, they interfere it with something else by chatting with their friends instead of sitting down to read their modules that they have on their phone.... *ML3INT4L112-115*

This educator's response reveals his perception of mobile technology being a distraction and creating negative social influence amongst learners. These educators are indeed concerned about their learners' performance and welfare as they recognise that while technology can automate some processes, it is expensive and comes with a lot of uncertainties. This could be a representation of their fears or the lack of knowledge of how it can be controlled and regulated for it to be effectively utilized for learning purposes.

## **6.6 Summary**

The purpose of this chapter was to present the findings in the data collected and studied during this research. Having carefully studied documents, interview transcripts and observations, the overall findings were:

1. There is a seeming lack of coherence between what the national policy on ICT in education states, what the teacher standards presents and what is implemented in the college, which can be attributed to the different years these documents were created.
2. There are no standards or clear guidelines in the current minimum standards that outlines the process of integrating ICT in the teaching and learning process, and student are not specifically trained and assessed on how they integrate ICT in their teaching practice.

3. Educators do not have adequate access to computers, and the lack of Wi-Fi in the college, makes using their own laptops to access learning resources challenging. This has prompted educators to utilize their personal funds to buy network data while on campus, to access resources that will enable them prepare learning materials for learners. This seems to be an institutional culture.
4. The teaching methods are predominantly teacher focused, not by choice but because the state of the learning facility restricts them to this approach. To respond to, and manage their challenges, some educators devised ways to use mobile technology to enhance some of their teaching and learning processes.

From the responses of these educators, the challenges of ICT in the teaching and learning process is alarming and affects the entire learning process from educators to students. The problem appears to be improper documentation and outdated teacher education standards and curriculum, which does not represent the quality of a good teacher education curriculum for this digital age. Hence, the implementation of ICT policy in this teacher education at the time of this study, was haphazardly done.

It is evident through this study that Mobile technology has the potential to enhance several, if not all, of the learning process in this college. However, there are several contradictions that the educators themselves struggled to categorically identify. The differing views of educators on the factors affecting ICT implementation only revealed an institutional culture of “doing what works as long as you get the work done”. The educators do not seem very happy about the situation but cannot help it either. For the much-needed change to happen, the several factors currently affecting ICT implementation, if not properly identified, could potentially affect the adoption of mobile technology or any other innovation within this learning environment. Hence, based on the CHAT framework, the following chapter will describe the different elements of the activity system as identified in the data, thereafter, the subsequent

chapter will present contradictions identified as triggers within the activity systems studied, that has led to the ineffective implementation of ICT in this teacher education institution.

## CHAPTER 7: CHAT ANALYSIS

### 7.1 Introduction

The previous chapter analysed and presented the challenges of ICT integration in pedagogic practices and learning process in this teacher education institution, by using a phenomenological process to describe the experiences of educators as well as findings from the documents analysed. The aim of this chapter is to present the findings from the contextual analysis based on the cultural historical activity theory (CHAT) and the expansive learning cycle. It presents and describes the individual CHAT elements within the college to identify specific areas where contradictions causing the failures in the teaching and learning process emerge, and how these contradictions might lead to the transformation of the activity system. The goal of identifying contradictions within this learning environment is to reveal the opportunities for mobile technology, which will be discussed in the next chapter.

This chapter reports on the observational data gathered over a period of 5 weeks in this teacher education college and the interactions that occurred. As earlier stated, the observations included an observation of the classroom activity to study the pedagogical practices to evaluate the level of ICT integration in lessons, and the observation of the learning environment to understand the learning process and the ICT integration challenges to identify the potentials of mobile technology. I adopted Hardman's (2015) evaluative episodes as a selection mechanism to select episodes (actions and events) from the observation of classroom activities, facility observation and interactions, and analysed them in more depth to get clarity on the object of each episode, a process I likened to the questioning phase of the ELC. Understanding the object of these episodes led to the identification of institutional culture that is acceptable to the educators but do not represent the acceptable standards of teacher education for the digital age. The goal is to present a coherent view of the entire learning process of the college from the

subject, the tools required, the objects, the rules that guides the process, the community, the roles of the members of the community (division of labour) to the outcome (Hardman, 2015).

## 7.2 Data Generation and Analysis

The first step to analysing the activity system, usually begins by identifying the unit of analysis (Engeström, 2001). The unit of analysis, as defined in chapter 4, is the teaching and learning activity system within the college. It is a collective system of educators, learners and their immediate community, object oriented and mediated by artefacts such as tools, rules, division of labour and community, towards an outcome.

The questioning phase of the ELC, through observations and interviews, captured the actions, experiences and perception of educators, which led to the identification of the needs of educators in this college. During the questioning phase, as earlier mentioned, evaluative episodes were selected which led to the formation of topics that guided the data generation process. Table 7-1 presents some of the topics that were identified during the data collection stage and the data sources.

**Table 7-1: Topics identified and data source**

Topics	Observations	Interviews
Current teaching, learning and communication methods.	X	X
Planning and organization of lessons and resources.	X	X
Students' access to learning resources	X	
Pedagogic challenges and state of infrastructure.	X	X
Current state of ICT in the College.	X	
Current impact of ICT on access to resources, teaching and learning methods and communication and interaction.	X	X
Different factors impeding the implementation of ICT.	X	X

The attitude of educators towards ICT driven teaching and learning.	x	x
Actions of college management towards ICT enhanced teaching and learning	x	x
The role of digital literacy and competence in ICT integration.		x
The role of social influence and technical capital on technology acceptance, usage, and integration in the college.	x	x
Perception of educators towards change.		x
Potentials of mobile technology in pedagogic methods.	x	x
Perception and acceptance level of educators towards mobile learning.		x
Limitations of mobile learning in the learning environment.	x	x

As stated in the previous chapter, during the analysis process, data ID was generated to enable traceability of data excerpts from the analysis to the data source. The data ID was generated using a combination of the participants' ID, type of data and lines from the data. The participants' ID was generated to keep the identity of the participant anonymous. In the data excerpts example as shown in Table 7-2 FM1 relates to the female participant 1, INT1 relates to interview 1, while the L15-25 means the lines from the interview transcript.

**Table 7-2: Data ID Generation**

Components of Data ID	Meaning	Example
MLx or FMx	ML = Male FM = Female x = 1,2,3	ML1 = Male 1 FM2 =Female 2
OBSx or INTx	OBS = Observations	OBS1 = Observation 1



	INT = Interview x = 1,2,3...	INT2 = Interview 2
Lxx-xx	L = Line number	L15-25 = Line 15-25
Example	ML1OBS1L15-25 = Male1, Observation 1, Lines 15-25	

Data generated from the participant observations and interactions with educators were jointly analysed using thematic analysis. Using the data ID, excerpts from the data was analysed to describe some of the concepts, identify the CHAT constructs and contradictions that emerged. The results will be presented using Engestrom's (2001) matrix of analysis of expansive learning.

The analysis phase focused on exposing and defining causes of problems within the activity system, through the identification of internal contradictions that exists between the elements of the activity, and the external between the activity and a neighbouring activity. The first step towards identifying contradictions, is the identification of the activity theory construct present in the data. While the line of questioning was not exactly designed to elicit this from the participants, however, based on their response it was captured and described below.

To identify contradictions within the activity system, it is imperative to first identify the activity theory constructs within the activity system, from the data. This process involved going through the data, to recognize the constructs and coding them accordingly. An example of the activity theory constructs within the data, is presented in Table 7-3. Column 1 shows the data ID; column 2 presents the topic where excerpts were generated from; column 3 presents the data excerpts with the activity theory construct emphasised in bold italics font. For this activity system, all constructs were identified in the data.

**Table 7-3: Examples of CHAT constructs identified from data excerpts based on topic**

Data ID	Topic	Excerpts with CHAT construct and contradictions identified
ML4INT5L104-108	ICT integration into teaching and learning.	<p><i>We (<b>subject</b>) do not normally use internet (<b>tools</b>), but we use projectors (<b>tools</b>), all those computers and some devices that is ICT based (<b>tools</b>), but there's no internet (<b>tools</b>). It's not that we do not have it available, but it is not functioning it's not effective and it's not being used for teaching and learning per se it's just you go to the lab, you do the practical and you go back to your classroom (<b>rule</b>).</i></p>
FM1INT1L46-49	Students' access to resources	<p><i>as you noticed in the classroom (<b>activity system</b>), some of the students (<b>subjects</b>) did not participate in the learning (<b>object</b>) because they had no materials (<b>tools</b>), if there was an easier way to prepare the lesson and send it to them, then the classroom lesson will be more about explaining than dictating notes (<b>tools</b>)</i></p>

### 7.3 Defining the Activity System

The overall aim of this study is to identify the potentials of mobile technology in enhancing learning in the Nigerian college of education, by conducting an in-depth study of the pedagogic approach with respect to ICT and the entire learning structure of this college. Potential, as defined by the oxford dictionary is “*the possibility of something happening, or being developed or used*” (Oxford dictionaries, 2020). Potentials of mobile technology can only be identified when the full dynamics of the institutional structure, the learning method, the cultural and historical factors, challenges, behaviours and perception of stakeholders within the learning environment, has been understood. In other words, a full contextual understanding is essential, and CHAT has facilitated the realization of such potentials. The following sections describes in detail, the relationship between the subject, object, tools, rules, community and division of labour of the activity systems within this college. Figure 7-1, Figure 7-2, Figure 7-3 and Figure 7-4 provides a graphic representation of the teaching activity system, learning activity system, tools activity systems, and the activity system of the college studied.

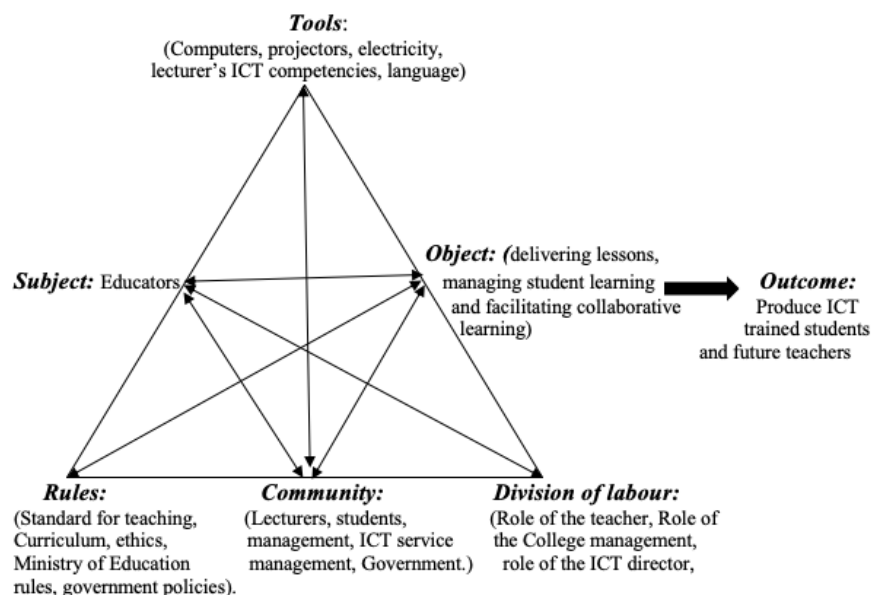


Figure 7-1: Teaching Activity System within the College Activity System. Adapted from Engestrom, 2001 by permission of Taylor & Francis Group Copyright © 2021 by Imprint.

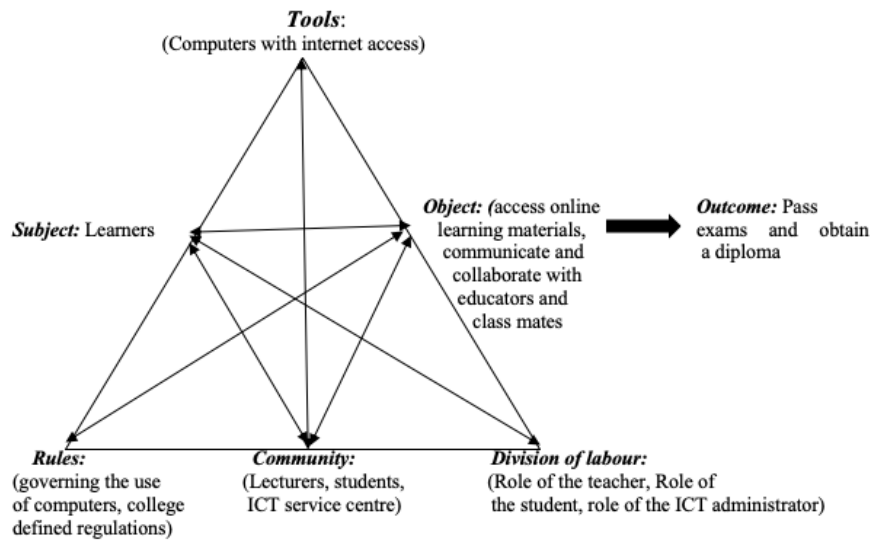


Figure 7-2: Learning Activity System within College Activity System. Adapted from Engestrom, 2001 by permission of Taylor & Francis Group Copyright © 2021 by Imprint.

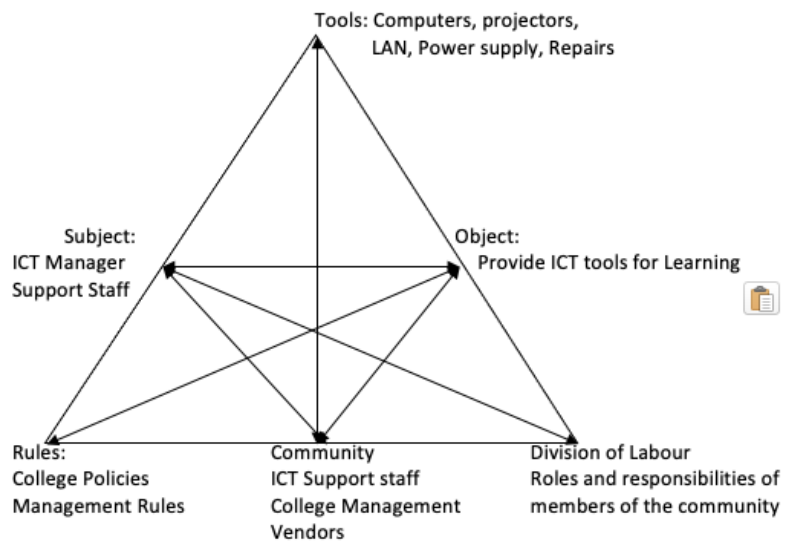


Figure 7-3: Tool Activity System within College Activity System. Adapted from Engestrom, 2001 by permission of Taylor & Francis Group Copyright © 2021 by Imprint.

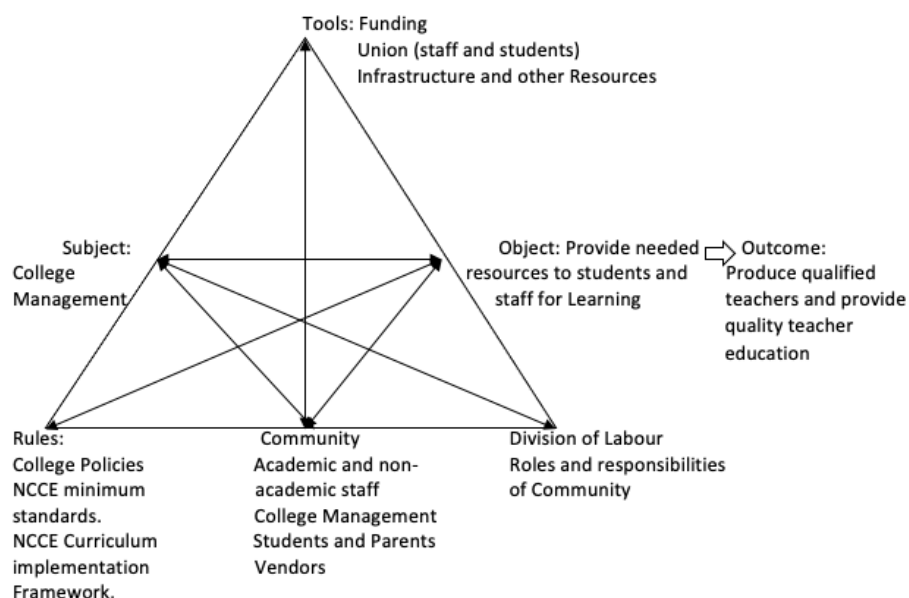


Figure 7-4: College Activity System. Adapted from Engestrom, 2001 by permission of Taylor & Francis Group Copyright © 2021 by Imprint.

### 7.3.1 Subject

Using a CHAT-based expansive learning cycle, through thorough examination of the college learning environment, the findings revealed the need state of the educators and students who are the subjects of the teaching and learning activity systems. The need state formed the object of each of these activity systems. For instance, in this case, the need to become a qualified teacher drives the students (subjects) towards learning/training to become one, this then becomes the object. Thus, subject must carry out activities in order to meet the object, which in this case is the learning. However, these activities are influenced by the attributes and skills of the student (subject) and the nature of the object. If the object is to become a qualified digitally competent educator, then the activity will depend on their cognitive abilities, digital skills and as well as the complexity of the process involved in becoming a qualified digitally competent educator. It becomes obvious that a person's digital skills are attributed to experience with technology, and the application of those skills further defines their digital skills and competence. Therefore, it is through the learning activities, whether formal, informal, or social interactions that the subjects are shaped. Hence, a comprehensive account

of the learning activity, motivation, developments and social cultural context is necessary for understanding the subjects and their experiences (Kaptelinin and Nardi, 2012).

Educators' (subjects) account of their teaching methods, preparation of learning materials and communicating with students can be understood as the actions within the activity system (teaching and learning) towards the object (producing qualified teachers). The process involved in each of these actions (e.g., teaching methods) can be understood as operations undertaken to achieve the goals of each action. For instance, the process of choosing an appropriate pedagogic approach can be understood as operations to foster student engagement and manage classroom activity, which is the goal of the teaching methods. In a bid to uncover the operations of the educators, the process of planning and delivering lessons were carefully observed and episodes were evaluated, which informed their pedagogical approach. Two types of pedagogical approach that emerged in the findings were directive and reinforcement pedagogical practice, which was a pattern amongst all educators observed.

As observed during the lesson, the conversational structure in the classroom provided limited opportunities for practice-based and collaborative learning, as interactions were based on introduction/question, response and remark structure, promoting more student verbal interactions than practical engagement. Students' engagement was driven by the reinforcement pedagogical approach which the educators adopted to effectively manage classroom behaviours.

The process of planning and preparing learning materials necessitated functional organs (Kaptelinin and Nardi, 2012), which requires the combination of human capabilities with artefacts to achieve their goals. These artefacts are considered as external resources that enables a person to attain a goal that otherwise cannot be attained (Kaptelinin and Nardi, 2012). Educators struggled with access to resources as textbooks in the library were either outdated or not enough. Additionally, the ability to prepare learning materials with limited access to adequate resources requires high level of subject knowledge and skills to adequately lecture

students on concepts. Nevertheless, these educators were able to design course manuals for students to purchase, as the cost of acquiring resources were expended by the educators. Students were driven to purchase such learning materials not because they understood its value in building and developing their knowledge in the subjects, but because of the positive reinforcements that accompanied the purchase. For instance, students are told that obtaining a lecture manual constitutes 5% of their continuous assessment. Additionally, verbal marks were given to students who read their manuals and referred to it when responding to questions during the lesson. Thus, educators use this pedagogic approach to foster student motivation and engagement in the learning.

The concept of technology enhanced learning can be understood as the concept of functional organs and in addition to pedagogic knowledge and institutionalised cultural capital, educators must possess digital competencies necessary to use technology to achieve their goals in the learning environment. However, in this context, some educators do recognise their lack of digital literacy to do so, while others who seemed confident in technology integration, either had prior experience with technology integration in their own learning or were motivated towards technology (technology enthusiasts) owing to their access to technical capital and adherence to the socio-cultural norms of the digital society which is characterised by their digital identity as natives or immigrants. Although educators did not disclose their age, the younger educators in school of science education seemed more abreast with technology integration and could be classified as the “knowledgeable others” in the faculty with regards to technology. This indicated the availability of technical capital amongst educators in school of science, however I cannot say the same for educators in other faculties observed prior to school of science as no episode was recorded to this concept. The observation also revealed that the underutilization of existing ICT centre by learners, was attributed to their lack motivation towards technology in their learning which is significantly characterised by the lack of digital literacy of students to effectively utilise available technology to support their own

learning. Such motivation should be driven by educators setting goals that entails the utilization of ICT to perform certain learning tasks that students must participate in, just as in the case of obtaining lecture manuals to foster student engagement. However, educators can only set these goals only if they themselves are digitally literate and competent enough to encourage their learners achieve them.

Overall, human actions can be understood by the mediating artefacts that directs the activity towards the object. In understanding what motivates an educator's teaching method, and commitment to their activities which invariably influences the students own learning activity, the object of the activity system needs to be identified and analysed. Thus, the following section will elaborate on the object of the activity systems studied.

### **7.3.2 Object**

The object of an activity system influences the activities of the subject, it defines the rules, the tools, the community and the roles of the members of the community. Thus, analysis of objects is therefore a necessary requirement for understanding human activities, both individual and collective ones (Kaptelinin and Nardi, 2012).

Objects can be the overarching goal that motivates the subject and can also be the sub-goals of actions and sub-sub-goals of the procedures undertaken by the subjects within an activity system. In observing the actions of educators in this college, the overarching goal is to train students to become teachers, and for the students, it is to obtain NCE qualification to become qualified teachers. However, the actions and procedures towards their individual objects, led to the realization of needs. For instance, the action of planning and preparing for lessons, necessitated the need to obtain resources to study and put together lesson notes, presentations or contents for the lessons. Likewise, the different subjects these educators taught, for instance teaching "Educational Philosophies", were directed towards achieving the object of inculcating the knowledge of different pedagogical approached in students. This object then



defined the tools the educator would use to achieve the object. The selection of appropriate tool will then depend on the educator's unique attributes, and the characteristics of the tools as sufficient tools for the educator. Choosing library books can be sufficient tools for educators if they are able to identify useful information relating to the topic of the lesson. Also, using internet to search for resources will depend on educators' digital literacy and competence in identifying relevant and credible sources of information, and effectively planning a lesson will depend on the organizational skills of the educator.

Although the object of the educators differs from the object of the learners, the co-dependency of their actions and procedures is what constitutes the joint activity system. Educators designing learning materials, is to the benefit of the students. Indicating that the ability to instil content knowledge depends on students obtaining the learning resources and the ability to receive the knowledge depends on students' access to the learning resources. The dispensation of learning resources will depend on the attributes of the educators and students. If the educator is technologically inclined, chances are that resources will be dispensed through digital platforms such as emails, virtual learning environments or social platforms as observed in the director of ICT. However, the educator will also have to consider the digital identity, the digital literacy and access to resources or technical capital of the learners when deciding how materials are dispensed. Likewise, digital native learners are more likely to utilize technology and digital platforms to access learning materials than the non-digital ones.

In this case, students solely depended on the printed resources from their educators and hardly used the digital platforms available to them, as the ICT centre equipped with internet facility was greatly underutilizes at every visit which lasted for an hour every day. Although educators desired to use technology to make learning resources accessible to all students, their beliefs of the students' lack of digital literacy to use these technologies, was considered as the main reason for the manual dispensation of learning resources. Conversely, some classroom discourse revealed that students desired more flexible and enhanced access to resources as

most students were unable to purchase the learning materials to participate in the learning. As a result, students created classroom groups on social platforms to enable collaboration, sharing of resources and information.

The co-dependency of their objects led to the transformation of their individual objects, to jointly formed objects such as, the shared need of improving access to learning resources, effective communication, and collaborative learning platforms for students to learn, pass exams and graduate as teachers. The attainment of the new object necessitates the adoption of new tools to mediate the activity either because the existing tools are not efficient enough to mediate the learners and educators towards the new shared object.

In summary, the object of the activity system determines how the subjects mediate towards the object as well as the tools utilized for such mediation. As earlier identified, the tools used are determined by the unique characteristics of the subject and the usability of the tool itself. Having identified the unique attributes of the subjects in this college, in the following section, we dive deeper to identify and understand the characteristics of the current tools used by these subjects and how it supports the actions and procedures of the subjects.

### **7.3.3 Tools**

Tools are necessary artefacts that mediate the subjects towards their objects within an activity system, which within a learning environment can be a combination of different pedagogic approaches and technologies used to teach and learn. In this case, we assessed the availability, usability and effectiveness of technical tools to mediate the activities of educators and learners towards their objects. The major tools identified were pedagogic epistemological approach, technologies such as ICT, and other artefacts such as curriculum, whiteboards and blackboards, mobile devices and digital social platforms, as well as the infrastructure that supports these tools. By understanding these tools, the identification of its unique features then reveals how it effectively facilitate the procedures and actions of educators and learners.

Tool mediation as Kaptelinin and Nardi (2012) describe, enables the appropriation of socially developed forms of acting in the world, which echoes the experiences of people accrued from their interactions with the structural properties of the tool and the knowledge of how it should be used. This implies that using tools is a way of accumulating and disseminating social, cultural and somewhat technical knowledge. Therefore, social and cultural norms influence people's use and choice of tools within their environment. The social norm in today's learning environments includes the mediation of its activities with technical and ICT, yet the adoption of this norm in this setting is mainly influenced by the culture. Nigeria as a country is a culturally driven environment and its people places high value on the cultural and historical aspects of their environment. Accordingly, people tend to be complacent with their ways that change to embrace innovation, which requires giving up on their culture, is habitually slow because people tend to choose what innovation to embrace or reject. The cultural norm is this teacher education college suggests that the tools used to teach and learn has historically not improved at the pace required to align with the current society.

Tools can be viewed as a motivation that propels people to complete tasks and activities. This motivation could be because of the social status attached to the use of specific tools or the satisfaction in effectively using it to achieve a goal. The availability and access to ICT as seen in the literature, is a motivator for learners to acquire digital skills, and the ability to apply those skills to solving problems within their learning environment drives their attitude and social status of digitally competent learners. In this institution, a considerable amount of technology is available, however they are not easily accessible and cannot adequately enhance their teaching and learning practices. Nevertheless, the objectified cultural capital amongst educators and learners, is a prevalent social norm in this society as observed, as educators and learners, places high value on personal technology gadgets such smartphones, iPads, tablet computers, laptops and mobile internet dongles.

In a socially distributed environment such as the institution in this case, an educator who is abreast with technology and understands its value in facilitating his practice, can adopt these tools to mediate an activity such as accessing online platforms for resources. The externalization of this action can then be adopted by other educators, which then become a socially distributed action. Similarly, an educator with ten years of teaching experience over time, becomes conversant with the curriculum implementation framework and minimum standards and other documents as necessary tools which directs how educators teach and informs what skill they should possess. The externalization of his teaching practice is appropriated by his learners who are training to become educators themselves, will in turn internalise these methods, approaches and tools as suitable mediating artefacts in their own teaching practices.

In this study, it was observed that different tools can be used to mediate activities towards the different goals in the activity systems. The CIFW and minimum standards mediates educators towards the object of teaching and training to become teachers and producing qualified educators. Within this document, standards for educators and students were specified, the required tools to carry out these actions as well as the roles and responsibilities of the subjects were clearly stated and provided. Hence, the educators must identify specific tools provided that serves their purpose and enhances their activities, as some tools may be more effective than others, and one tool can also be used for a variety of purposes depending on the complexity of the object. During the classroom observation, the primary tools predominantly used by educators were language and printed learning materials.

Other episodes where the use of participatory tool and demonstration in the classroom were recorded included chemistry, biology and computer lessons. During these lessons, students observed their educators whilst assimilating the description of the actions being demonstrated, then the educators asked questions that required students to make predictions by interacting with other students. Thereafter the educator explained the concept demonstrated and tasked

students to participate in the activity. These lessons were much more interactive and exciting for learners.

When social and cultural norms evolve to embrace new tools in teaching practices, the existing tools become obsolete and can no longer mediate activities in the modern world. When educators and learners struggle with existing tools to mediate activities, the object of the activity or actions changes, leading to the transformation of the object and the remediation with new tools. As observed in this study, the evolution of digital technologies in the society as well as the breed of digitally conversant or digital native and immigrant educators and learners, has exposed the tools in this college as impractical tools, resulting in the transformation of the objects of the joint activity system. This requires new tools to enhance the organisation of individual inputs of educators, learners and their community to collective activities, by outlining their specific roles and responsibilities (Kaptelinin and Nardi, 2012). Since tools are inherently created by skilled individuals to mediate the activities of other members of the society; in this case, the college management, the National Commission for Colleges of Education under the Federal Ministry of Education, it then becomes the responsibility of these government sectors and parastatal to review the current tools and update as appropriate. From the findings, the tools in this college are not up to date with the social and cultural norms of today's digital society. As observed in the learning environment, the current ICT available are not enough meet the needs of these educators and learners. The college for instance has no Wi-Fi, and as such connection to the internet using their own devices such as laptops and tablets to access student emails, view lesson presentations and notes becomes impossible. Educators and students must attend the ICT centre to gain access to the internet, which was quite a distance from the faculties, and as experienced, walking under the scorching sun to and from the centres is exhausting. Therefore, the underutilization of the centre is comprehensible.

Overall, in this learning environment, educators and learners adopt different tools such as minimum standards, ICT and curriculum implementation framework, instructional tools, communication tools etc., to achieve their goals and sub-goals, and mediate their activity towards the object of training students to become teachers in order to produce/become qualified teachers (the outcome). The effectiveness of these tools depends on its usability, which drive motivation to learn how to use them. Thus, the internalization of the knowledge of tools leads to externalization through actions, and since human actions are often replicated by others based on their perceived impact of the action, it becomes apparent that tools have the potency to create social impact.

Since achieving the objects often requires collective input of others (community) such as ICT technicians, curriculum managers, heads of departments, other educators and students, the shared object necessitates interactions between the subject and the community to define the actions, expectations, required tools, skills and attributes etc., to achieve the object. These interactions between the subjects and members of the community are mediated by rules. Thus, it becomes apparent to review the implicit and explicit rules within this institution.

#### **7.3.4 Rules**

Rules are fundamentally what constrains behaviours, maintains social order and defines actions within the learning environment. How students act in the classroom, how assessments are conducted, and how/for what purposes educators should use ICT and other tools are defined by rules. The evaluative episodes recorded during the observation revealed the instructional rules, and institutional rules that mediates subject – community interactions with shared objects. For instance, during the classroom observation, the object of that activity was to inculcate content knowledge of the course being taught, e.g., Curriculum Studies. Thus, only members of the institution, e.g., assistant/associate lecturers with immediate shared interest in “Curriculum Studies” can be identified as the community. Therefore, the interactions on how

to plan and organise contents of the learning materials and who teaches what, and on what days, are mediated by rules. Similarly, how students relate with their classmates to complete assignments and tasks, or group presentations are mediated by rules.

Institutional rules are made up of formal rules which are explicitly and intentionally written rules and laws, while informal rules such as social norms and culture, are implicit. They primarily define the structure of teacher education and how activities are mediated. Within this college there is a rule hierarchy enforced using a top-to-bottom approach. As detected, the Federal Ministry of Education determines the rules in the National Teacher Education Policy (NTEP), which then determines the rules and standards set by the National Commission of College of Education (NCCE), and the standards determine the rules set by the College. From a functionalist perspective, the college is responsive to the interest and needs of the government, even when the rules selected might not be efficient (Greif and Kingston, 2011). Looking at the college structure, it is apparent that the rules enforced is a representation of the explicit rules stated in the NTEP and the NCCE documents, presented in chapter six. While some of the rules met the standards of teacher education, the actions of educators and students as observed, indicated that some of the rules regarding interactions with their community were impossible and ineffective. For instance, the number of subjects the students are required to take, includes a combination of their core subjects, general education, language courses, etc. Students' curriculum is overwhelming, because these compulsory subjects are essential preparatory subjects for the teaching profession, yet the tools to enhance the learning, especially for this current generation of learners, are not efficient. Moreover, students are not receiving the essential training on the utilization of appropriate tools to teach the digital generation of learners. The implicit rules were more of the social norm within the college. Some of the episodes recorded when evaluated by educators through informal interactions used the phrase "it's a normal thing here" or "that's how it is done here" to infer implicit rules within the college. For instance, educators inferred that lecture method was a normal teaching method.

This is because lecture method has become the habitus of educators in learning institutions in the country, and irrespective of the subject, the assumption is that it is the acceptable teaching method. Citing another episode recorded, there is this belief that printing lesson material or to making photocopies requires a trip to the business centre, since walking five minutes to the ICT centre will be a waste of time because power supply cannot be guaranteed. While the ICT centre is free for all educators and students, they would rather attend the business centre and pay to print resources or use the computer because its closer to the faculties and more reliable. Due to this implicit rule, the subjects have formed a perception indicating lack of trust for the infrastructure provided by the institution and the government.

Another implicit rule observed was the influence of educators on student behaviour. Students usually scampered into the classrooms when their educator approached, and students who came late for lessons would either turn back or beg to be allowed in. This indicated that students saw their educators as authority figures and by internalizing the instructional rule set by their educators such as not coming to class late, or no wandering the hallway during lessons, students unconsciously reacted to this whenever their educators approached, making it a social norm for students.

Finally, an episode displaying the influence of senior faculty members on the roles and actions of associate members were also observed. When a senior lecturer is assigned a course to teach (course leader), the head of department alongside the course leader, decides who supports the course leader and they are usually referred to as assistant lecturers. There are rules that govern how these assistant lectures conduct their lesson, what resources to use and the stages where new topics are introduced, and these are defined, although not explicitly, by the course leader. For some, they are required to only use the textbooks and manuals designed by the course leader, and for others, the course leader sets the topic, and the assistant educators are to source for resources to prepare lesson notes for the specified topic.



Instructional rules are specific rules often drafted by management, educators and other members of the community, to manage classroom behaviours and the teaching and learning activities. In this college, the instructional rules guide how educators teach and what courses students should learn, which are clearly stated in the NCCE CIFW as teacher standards and the minimum standards for students. For educators, these rules are designed to ensure that:

- Teachers exhibit professional knowledge and competency regarding how learners learn and how to teach effectively.
- Teachers have professional skills to plan for and assess effective learning.
- Teachers provide and maintain conducive learning environments.

The need to shift from teacher-focused to learning-focused method, resulted in a change in educational approach in teacher education, to improve learners' engagement in the learning process. Since the goal of teacher education is to produce professional teachers, the CIFW includes rules that can enhance this learning-focused approach to ensure that the professional knowledge that learners assimilate, can be applicable in a way that leads to the development of professional skills and engagement.

The rules governing professional knowledge of educators requires them to know their learners by recognising their unique strengths and weaknesses and understand and respect learners as individuals. They are also required to know how students learn, and how to facilitate the learning. This includes recognising students' prior knowledge and knowing how to engage them in active learning by identifying and applying adequate teaching methods. Additionally, educators are required to understand the content of the curriculum and know how to apply effective pedagogic approach and effective tools to ensure learning. These as earlier discussed, were observed in the classroom as educators knew their students by name and their unique characteristics. Students were moved around from their normal sitting position and paired with

groups of other students to support their lessons, and some were moved to reduce classroom disruption as some students were more disruptive than others. Some students preferred to take notes during the lesson while others assimilated contents as the teacher described, while others were focused on the lesson manuals to answer questions.

In respect of the professional practice, the rules ensures that educators plan and assess effective learning by using the knowledge of learners and curriculum content to set clear and achievable learning goals and use a range of activities and resources to monitor learners' engagement, progress and provide feedback. Educators are to create and maintain safe and challenging learning environments by encouraging learners to ask questions, bring suggestions, ideas and other sources of information. However, with poor access to resources as observed and absolute dependency on educators for resources, learners are not challenged to explore concepts or bring ideas. Additionally, educators are expected to use a range of techniques and resources to engage learners effectively, yet the technical resources to foster the techniques suggested such as groupwork, and field trips are not easily accessible. The physical structure of the classroom leaves little or no sitting space as learners squeeze into bench-desks, thus not a conducive environment to conduct group activities.

Finally, professional engagement are rules that govern the educators' reflective practice. Educators are expected to reflect on and evaluate their own professional knowledge and effectiveness of their facilitating, work with other members of the profession to engage in research to improve professional practice, identify their own learning needs and engage in professional development, and develop skills to manage their non-teaching duties. This indicates that educators should keep reflective journals to document their evaluation. This document was however inaccessible at the time of this study and could not be reviewed.

In summary, the rules and the standards create opportunities for educators to plan, organise and decide the effective tool and techniques to support learners participation and engagement. This gave clarity on the perception of "doing what works to pass the knowledge". Sadly, what

works for these educators is a combination of manual techniques, and where educators adopt technology to support their process, they do so at their own expense, which educators found challenging and somewhat frustrating. Some educators sighed and gave up and utilize only teaching methods that the institution affords them, hence the prevalence of the lecture method in the classroom.

In reviewing this document and from the observation, it became evident that the enforcement of the rules were the responsibilities of the different institutions, and the perception of doing what works should be a collective effort and not the sole responsibility of an educator. Therefore, the following section identifies the members of the community in this institution.

### **7.3.5 Community**

The community as earlier described, are people within the activity system with shared object as the subjects. In the overall object of training students to become teachers, the community would typically include students, educators, non-academic staff such as administrators, management and parents. The identification of the community in the CHAT construct is a depiction of a famous African parable that says, "*it takes a village to raise a child*". Consequently, to produce a qualified teacher requires input from others who have shared interest in this goal. However, the materialization of the qualified teacher is not in who the members of the community are, but in what they do and their individual contribution to ensure that the learner attains their object of becoming a qualified teacher. Therefore, the following section will outline the roles and responsibilities of the members of the community.

### **7.3.6 Division-of-labour**

Division of labour mediates the community towards the object. The object of the activity system can either serve as a guide or a motivator for the community, which often determines their actions. According to Kaptelinin and Nardi (2012), the actions of the community are typically motivated by one object but directed to another one. For example, the college librarian is

motivated by the object of producing qualified teachers, but their actions are directed towards the goal of providing books and resources to support students' learning. Similarly, educators are motivated towards the same object as librarians, but their actions are directed towards the individual subjects they teach. The individual actions of the members of the community can often be internalized to an extent that the members lose sight of the importance of their goal towards the overall object of the institution, which invariably affects their commitment. It is the collective contributions of the actions of members of the community that impacts the overall outcome. Thus, Kaptelinin and Nardi (2012) opined that collective activities can be carried out much more successfully if contributing individuals understand the relationship between the intermediate goals and the ultimate outcomes.

What determines the contributions of each member of the community, is their roles and responsibilities. These roles and responsibilities of the community, although not explicitly stated in the documents reviewed, were partly identified in the rules. Nevertheless, from the observations, roles were identified. The role of the educator amongst other is to teach, facilitate learning, and monitor students' progress through assessments. However, these responsibilities require tools utilization. The utilization of tools introduces other members of the community whose responsibilities are to ensure the tools are effective. Since educators utilize various tools, the community broadens. For instance, to determine what course students learn and when, is represented through a timetable designed by the head of department, the provision of textbooks and resources to prepare the lesson is the responsibility of the librarian, and for access to internet to obtain digital resources, it's the ICT centre and so on. The responsibility of the college management to oversee community's commitment to achieving their individual and collective goals and identify problem areas as well as challenges that affects the efficiency of the community. Where such problems impact on activities within the activity system and affects the attainment of the object, the management must take actions to address them. When members of the community perceive that other members of the community do not attach

importance or show dedication towards their responsibilities, it influences their attitude towards commitment to their actions which then impacts the quality of the collective contribution of the community towards the object and ultimately the outcome. The lackadaisical attitude of management towards the technology integration in enhancing the actions of the educators and members of the community, has led to the poor-quality teaching and learning in this teacher education institution.

## **7.4 Summary**

Understanding the dynamics of this college revealed how the various elements of the activity interrelate in their very nature as mediating artefacts, to facilitate the attainment of outcomes in this teacher education institution. Once a need has been identified, the unique attributes of educators and learners determines how they effectively utilize technology to meet their needs which is now the object. The object however determines what technology to be used, the rules that guides their actions towards the object, the contributions of the community and their individual roles and responsibilities (division of labour). The adoption of technology is influenced by the unique characteristics of the specific device, the skill level of the educators and learners to effectively use the selected device, and if the institutional rules identify such technology as a necessary instructional tool. The adoption of technology to facilitate learning, often requires the input of others such as IT support and defines their roles and responsibilities. The analysis of this systems using this CHAT framework revealed several contradictions within the college and the opportunities for transformation. The following chapter will present these contradictions as identified.

## CHAPTER 8: DISCUSSION OF CONTRADICTIONS

### 8.1 Introduction

Having analysed the documents, described educators' experiences and studied the aspects of the learning institution and how they mediate activities within the college, we move further to identify contradictions that present opportunities for possible transformation. In this study, contradictions are considered as disturbances that are necessary to drive further development within the activity system. The teacher education college is flawed as any other learning institution, but these flaws are identified as drivers of change in the learning environment which is the goal of this study. The change is centred on tool-mediated activity; thus, the investigation analysed the three levels of activities, the activity (teaching and learning), the actions (planning for lessons) and the operations (accessing resources and producing learning materials) of the educators.

The analysis of the activities was undertaken to identify contradictions according to the activity theory constructs. The analysis revealed a total of 14 contradictions within the 6 AT constructs as presented in Table 8-1. Column 1 shows the construct where contradiction exists, column 2-4 indicates the level of contradiction against each construct. The full description of contradictions identified according to the constructs that emerged, is presented in Appendix F: Topics and Description of Contradictions Identified.

**Table 8-1 - Contradictions**

Contradictions Number of Activity Theory Element contradictions		
<b>Primary</b>	3	Subject, Tools and Rules
<b>Secondary</b>	6	Subject-tool-object; Subject-rule-object; Subject-division of labour-object; Community-tool-object;

		Community-rule-object; Community-division of labour-object.
<b>Tertiary</b>	1	Community, subject towards new object
<b>Quaternary</b>	4	tools and the new object; rules and the new object; subjects and the new object; the new object and the object producing activity that identifies the community and their roles and responsibilities.

Some examples of primary, secondary, tertiary, and quaternary contradictions that emerged from data are presented in Table 8-2. The columns from L-R indicate contradiction, data excerpts where contradictions were identified, and the description.

The first row presents an example of primary contradictions within the subject, where educators' response to the question on the use of ICT, describes how the ICT literacy of the subjects affects their inability to meet their objectives. The second row presents secondary contradictions, as primary contradiction within tools affects the subjects' ability to meet objectives. This can lead to transformation of the object.

The secondary contradiction created the need to change the object and remediate the activity with a new tool, but this resulted in the tertiary contradiction as presented in the third row. The attitude of the community towards the use of advanced mode of communication, is as a result of tertiary contradiction. Quaternary contradiction emerged between the classroom and the college as described in the fourth row. This is because, the actions of the classroom activity are influenced by the object of the college activity system.

**Table 8-2: Examples of Contradictions**

Level of Contradictions	Data Excerpts	Description of Contradiction
Primary	<p><b>ML3:</b> the challenge is that most of the students (<i>subject</i>) are not computer literate, you must go as low as digging them up from the beginning.</p>	<p>The <b><i>primary contradiction</i></b> is within the Subject, where the students lack the ICT skills that can enable them to use the ICT for learning (Object). This can be described as: the contradiction within the subject has affected their ability to achieve its objective.</p>
Secondary	<p><b>ML4:</b> We (<i>subject</i>) do not normally use internet (<i>tools</i>), but we use projectors (<i>tools</i>), all those computers and some devices that is ICT based (<i>tools</i>), but there's no internet (<i>tools</i>). It's not that we do not have it available, but it is not functioning (<b>secondary contradiction</b>), it's not effective and it's not being used for teaching and learning per se it's just you go to the lab, you do the practical and you go back to your classroom (<i>rule</i>).</p>	<p>The <b><i>secondary contradiction</i></b> is between Tool-Subject-Object. The primary contradictions within the tool technology not functioning, affects the subject's ability to mediate towards its object effectively.</p>
Tertiary	<p><b>DICT:</b> we already created a federal college email platform (<i>tool</i>) where the staff and student (<i>community</i>) are supposed to have their email and they are</p>	<p><b><i>The tertiary contradiction</i></b> that occurred here is the culturally more advanced object of changing the method</p>



	<p>supposed to have on the website a forum for interactions (<i>object</i>), I can bet you as I am talking to you, no lecturer has utilized that platform.</p>	<p>of communication by creating new college assigned email for all staff and student (subject). This precipitated contradictions between the existing mode of communication and the new one. Resulting in the underutilization of the technology by the community.</p>
<p>Quaternary</p>	<p><b>DICT:</b> At a point I (<i>subject</i>) was trying to attract a foreign innovation hub (<i>external activity system</i>) in this college (<i>neighbouring activity system</i>), where they produce iPads and tablets (<i>tools</i>) for lecturers and students (<i>subject</i>) to make us imbibe this new technology so that all of us can benefit from it (<b><i>transformed Object</i></b>), at the last trial we found that the college management (<i>community</i>) was not so interested in delivering that type of learning (<b><i>tertiary contradiction</i></b>) to this institution (<i>neighbouring activity system</i>) so I had to pull out.</p>	<p><b><i>The quaternary contradiction</i></b> can be described as external contradiction between the classroom (activity system) and the college (neighbouring activity system), when the new object of the classroom, contradicts the object of the college, leading to the breakdown of the transformation process of the classroom.</p>

## 8.2 Primary Contradictions

As defined earlier, primary contradictions often occur within each elements of the activity system, which causes its inability to mediate activities within that system. Sometimes, these primary contradictions are caused by the external activity producing system of each construct within the central activity system as presented in figure **Error! Reference source not found.**(Hasan and Banna, 2010). From the data analysis, these primary contradictions were identified and are presented as follows:

### 8.2.1 Subject

The pedagogical approach adopted, and the tools used within the classrooms were dependent on the educators' skills and competence. As the findings revealed, there were some similarities in approach which revealed a pattern of teaching amongst educators, indicating the dominance of instructivist pedagogy (Crosslin, 2016) in the college. This was attributed to the fact that many educators do not recognise the importance of technology in education and cannot comprehend the need to utilise digital tools to enhance their activities. This was influenced by their digital identity, literacy, competence and experience. Although some educators who recognised the importance of technology in enhancing their activities, actions and procedures, and desired to utilize more technology based instructional tools to conduct their lessons, engage their learners, and enhance the planning and preparation of lessons, they were conflicted because they recognised their lack of digital skills and competency to do so efficiently. Additionally, the absence of the technology itself alongside their lack of digital skills and competency made educators complacent with their current approach. This presents opportunity for development by providing technology-focused professional development training to equip educators with the necessary skills and competencies to effectively utilize technology in their activity, actions and procedures.

### **8.2.2 Tools**

Tools as seen in the study is a motivator for educators as the usability and effectiveness of the tool determines how it mediates the activity and its social impact. The primary contradictions within the tool are in relation to the contents of the curriculum for learners, and the ineffectiveness of the pedagogic approach, as well as the unavailability instructional technology to enhance participation. The available tools cannot facilitate collaboration and participation in classroom activities, enhance planning of lessons and provide easy access to resources. Additionally, it does not enhance communication, feedback and dissemination of learning materials to students, neither does it encourage students to take responsibility for their own learning by challenging themselves to bring in other sources of information to contribute to classroom discourse. This provides opportunity for development through considerations to invest in tools that can facilitate the activities, actions and procedures of educators and learners to improve the quality of teaching and learning in the college.

### **8.2.3 Rules**

As observed in the study, the rules govern how educators interact with the immediate community within their activities, their actions and their procedures towards individual goals which were represented in the institutional and instructional rules. The contradiction identified was in the outdated nature of the CIFW and the lack of coherence between the CIFW, NTEP, NCCE minimum standards and the policy on the implementation of ICT in education. This suggests that the NTEP document, the CIFW and the minimum standards should be updated to reflect the new ICT policies in education. Additionally, the rules fail to recognise the need to specifically train students on how to utilize technology in their practice and the need to assess how technology is utilized during students' teaching practice.

### **8.3 Secondary Contradictions**

Secondary contradictions can be understood as impact of the primary contradictions in mediating activities between other elements of the activity system. Based on the primary contradictions earlier identified, the secondary contradictions are outline below.

#### **8.3.1 Subject-Tools-Object**

The contradictions within the subject and the tools affected the effective attainments of objects within the activities, actions and procedures. Some educators struggled with access to resources and preparing learning materials because of the lack of internet to facilitate the process, and the available resources reduces instead of improving, the efficiency of the process. Learners are unable to actively engage in learning or carry out tasks and additional studies because the classroom infrastructures are not designed to incorporate technology or encourage group collaboration. Although the lack of adequate tools negates the educators and learners from achieving level specific goals, their skills and competences do not match the existing tools. For instance, digitally literate educators and learners will struggle to complete procedures using analogue tools. This contradiction can lead to the transformation of the objects of the collective activity systems which necessitates the adoption of new tools. It presents opportunities to improve the classroom infrastructure, provide adequate technology or utilize existing digital technologies such as mobile devices, to enhance the activities, actions and procedures of learners and educators.

#### **8.3.2 Subject-Rule-Object**

The lack of specificity in the explicit rules on what technology/resources to use, and the access to such resources, created the implicit assumption that educators have to devise techniques that fits their purpose to carry out their tasks.

Although the explicit rules require the encouragement of mutual respect and involvement of learners in learning, the implicit rules that influence the actions and behaviours of students

such as, purchasing teacher handout indicates contribution to learning and attracts marks towards assessments, does not build confidence in the students to challenge themselves and intellectually contribute to classroom discourse. These contradictions have led to a breakdown of trust in the rules and in the system, and the implicit assumptions has created an institutional culture that do not meet the expectations of teacher education and the attainment of the object of producing qualified subject-competent educators to function in the education system. Nevertheless, the contradictions created an opportunity for development as the consideration of the social norms of the digital society, have influenced how educator and learners meet their object. For instance, the incorporation of social media platforms to encourage participation in learning and classroom discussion is fast becoming an acceptable practice for educators and students.

### **8.3.3 Subject-Division of labour-Object**

The co-dependent relationship between educators and learners reveals their roles and responsibilities, particularly, it specifies what they are required to do to achieve their object. The role of the educator is to teach and promote knowledge acquisition, while the responsibility of the student is to attend lectures, participate in the learning and study to acquire the knowledge. However, the level of responsibility assigned to an educator and the workload of the learner can impact their ability to achieve their goal. For instance, when students struggle with excessive coursework, tasks and assignments, it takes a toll on their emotional and psychological wellbeing and students can often drop-out or fail. Similarly, when educators are bombarded with many subjects to teach, they struggle to complete tasks, which affects the completion of curriculum content delivery, and ultimately affects the quality of teaching they deliver. The contradictions identified relates to the efficiency of educators and learners to properly manage workload and tasks. This contradiction presents opportunity for

developments by proposing effective techniques for the organization and management of task and activities.

#### **8.3.4 Community-Tool-Object**

The contradiction within the tools affects the individual contributions of members of the community to the collective activity. For educators to adopt a different teaching approach when one approach cannot satisfy their object, such as using presentation as opposed to printed materials, educators have to hire projector and monitor from the ICT centre, however where projectors are unavailable or not yet returned or simply faulty, the technical support team cannot allocate one and where one has been allocated, educators have to book a hall to use it. If the lack of power supply or faults in the power generating units affects the utilization of the hall, the resource allocation team cannot rent the hall, therefore, the educators cannot use the hall to setup the projection tool for the presentation of the lesson. The shared goal of the community is to facilitate the use of presentation for lesson; therefore, the attainment of the object can be considered a failure. The contradiction creates opportunities for a reassessment of the available tools and possibilities of change. The change can lead to the transformation of the object.

#### **8.3.5 Community-Rule-Object**

The general rule that poses as a contradiction in how the community achieve their collective goal is more of an implicit assumption that affects the underutilization of existing tools to support their activities, actions and procedures. This has created a distrust in the system and fostered lack of motivation to develop skills. This also applies to the course leader – assistant lecturer rule. When assistant lecturers do only what they are told, teach contents as written in the notes and use pedagogic approach stated by the course leader, the motivation to initiate interest in the learners' progress fades and soon lose sight of the importance of their role in the object. Where these educators are unsatisfied with the rule, it coerces change in the rules to

encourage them to develop interest in the course, bring their own knowledge and skills, which will lead to the development of keen interest in the learner's progress and a sense of satisfaction. However, such change will result in tertiary contradictions as other assistant lecturers who are comfortable with the current rule will reject the change.

Also, the roles and responsibilities of the ICT director is to ensure the availability, the usability and access to technical resources to support educators and students. Where contradictions emerge within his tool producing activity, the rules forbid him to effect changes or acquire new gadgets without the approval of management and allocation of funds to do so.

### **8.3.6 Community-Division of labour-Object**

The major secondary contradiction was identified in the attitude of management towards their roles and responsibilities in achieving the shared goal of the providing quality teaching and learning. Management not acting on the challenges of ICT integration, need of new infrastructure, unavailability of teaching resources inherently affects how educators teach, how students learn, the level of support faculty member receives from the administrative team etc. In this collective system, the inefficiency of one member of the community can impact the efficiency of others. Similarly, the ICT director's inability to effect changes in his tools producing activity is because the object of the activity is a shared object between the ICT director and the management. The lack of autonomy to effect changes causes a dependant relationship between the ICT director and the management.

Overall, the characteristics of the subject and members of the community, the tools and rules that govern actions are the indispensable assets that creates synchrony or contradictions within an institution. Where secondary contradictions result in the transformation of an object of the activity system, tertiary contradictions will arise.

## **8.4 Tertiary Contradictions**

Tertiary contradictions can be understood as resistance to the change in the object or the new form of activity from a more culturally advanced activity system. This can be understood in this context that when a new technology is introduced in an activity system forces the dynamics of the system to re-align with a new object. Rules will change, new members of the community will be introduced, thus roles and responsibilities will be reassigned and restructured, requiring the acquisition of new skills and attributes to carry out actions and procedures towards the object.

The only tertiary contradictions recorded was as a result of the changes caused by the secondary contradictions between Community-Tool-Object. The challenges encountered by members of the institution in completing teaching and learning tasks, led to the transformation of the object of the activity by the management and the ICT director, through the introduction of emails, online registration, and e-library to mediate their activity. However, this was met with some resistance such as the underutilization of emails and e-library observed in the classroom. While some educators embraced the new object, others rejected the new process and still relied on analogue communication and interactions between educators and learners. The predominance of smartphones functioning on either IOS or Android platform, tablets and iPads amongst faculty members, led to the prevalence of social media channels such as WhatsApp and Facebook in the classroom. This can be considered as resistance by some of the educators and learners, as the new object of communicating and interacting through the online platform provided by the institution is rejected, hence the attitude of choosing what works to mediate their own activity.

## **8.5 Quaternary Contradictions**

In order to describe quaternary contradictions identified in this study, I employed Engeström's (1987) contradictions in activity systems depicted in figure 8-1. A central activity system is



made up of a network of activity systems with a common goal of producing a joint outcome. The introduction of the new object requires the realignment of the other elements of the activity system. Therefore, the new object of the central activity system, to use emails and e-library to access resources and communicate with members of the community, jointly formed by the tool producing activity system and the college management activity system which are external activity systems, redefines the objects of the constructs within the central activity system.

This entire change is why tertiary contradictions occur. For instance, tool producing activity now has a new object of ensuring adequate bandwidth, server, constant power supply to power the servers, assign email addresses etc. This introduces new members the community, new tools, new rules, new roles and responsibilities, and requires new skills attributes from the subject.

Since the tool producing activity system is responsible for the availability of tools, when tertiary contradictions within the tool producing activity causes contradictions in the tool element which impacts mediation of the central activity system, it is considered that quaternary contradictions have occurred.

In an attempt to address this tertiary contradiction within the tool producing activity, the ICT director envisaged the need for mobile gadgets to ensure availability of technology tools to students and educators in their teaching and learning process. This resulted in quaternary contradiction between the newly formed object of the tool producing activity and the object of the college management, the external activity system. This is was attributed to the resistance in their own activity system due to power play, funding and definition of responsibilities and rules. When management failed to recognise the importance of the innovative intervention (new object) of the tool producing activity, it resulted in the breakdown of consolidating the new practice. Hence the presence of quaternary contradictions was identified between tools and the new object, rules and the new object, the subjects and the new object, the new object

and the object producing activity that identifies the community and their roles and responsibilities.

The quaternary contradiction presents an opportunity for the college management to reflect on the current ICT implementation challenges within the technology tool development system and the new object of the system and also re-examine the relationship between the college and the ministry of education system, to explore how the higher authority can influence the consolidation of these new object of utilizing mobile technologies, and digital platforms, to enhance learning in this college. The findings also present a model for studying and designing mobile based learning platforms for other colleges of education and higher education system.

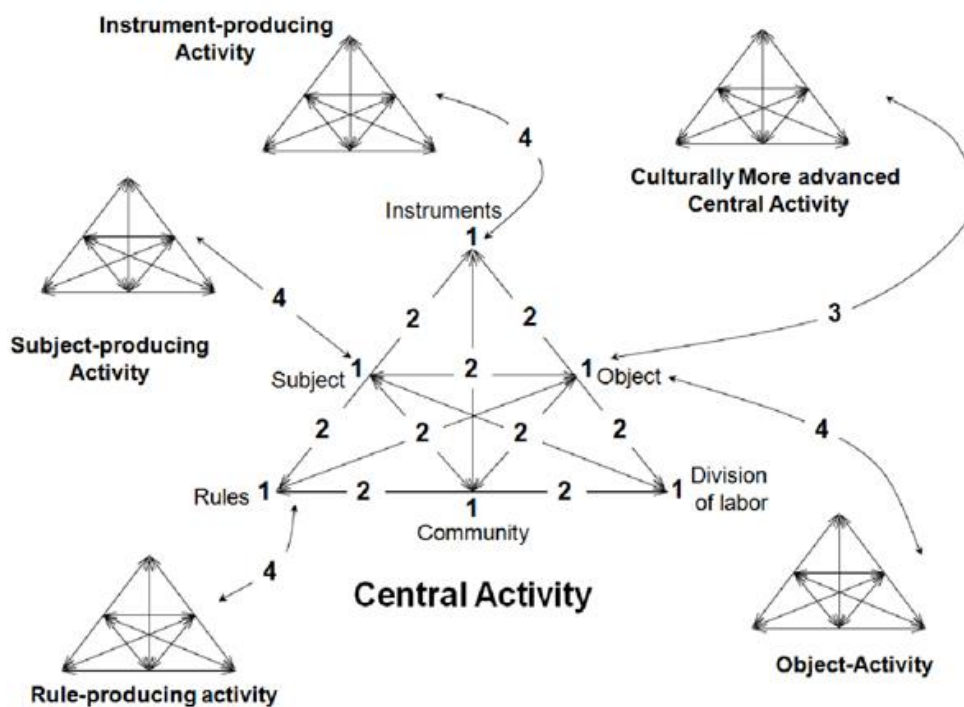


Figure 8-1: Interactions of surrounding activities and potential contradictions within and between them. (Engeström 1987, cited in Madyarov, 2012, p.6).

Source: [https://itdl.org/Journal/Jun\\_12/Jun\\_12.pdf](https://itdl.org/Journal/Jun_12/Jun_12.pdf). licensed under [CC BY 4.0/](https://creativecommons.org/licenses/by/4.0/)

## 8.6 Matrix of Analysis for Expansive Learning

The concept of expansive learning, according to Engestrom (2001), uses a matrix for analysing and presenting expansive learning in a study, based on four questions and five principles as

discussed in chapter 4. The findings from the study of expansive learning in this context, is summarised in the matrix in Table 8-3.

**Table 8-3: Presentation of Study of Expansive Learning**

	<i>Activity system as unit of analysis</i>	<i>Multi-voicedness</i>	<i>Historicity</i>	<i>Contradictions</i>	<i>Expansive learning</i>
<b>Who are Learning</b>	Educators Students ICT director  Classroom interaction, roles and responsibilities of educators.	Educators teaching, Students learning and engaging in the classroom discourse, director of ICT and management collaborating to ensure tool availability and effective use of technology.	The poor quality of teacher education resulting in the production of inadequate teachers.  The lack of value for teacher education colleges in the country.  The negative perception of the society towards teacher education colleges.	Students' digital identity vs their digital literacy.  Educators' experience and skills vs their current roles and responsibilities.  Expectations vs actions of educators and learners.	Educators recognising their own weaknesses and working within their own abilities.  Educators identifying the needs of their learners and finding suitable approach to support their learning needs.
<b>Why do they learn</b>	Understanding how student study towards becoming qualified teachers.  Educators, training students, by delivering the contents of	Understanding the roles of students, educators, and management in developing the teacher.  The role of ICT director in facilitating the actions of the	Understanding the challenge with pedagogic practices. Challenges with integration of technology.  Challenges within the ICT	Unavailability and insufficiency of tools.  Underutilization of tools.	The identification of new object of teaching and learning with ICT.  Introduction of e-library, email and online platforms.

	<p>curriculum based on the teacher standards set by the CIFW, NTEP and NCCE-MS.</p> <p>ICT director's activities towards providing ICT to mediate activities of educators and learners.</p>	<p>learners and educators.</p>	<p>centre in providing technology and services.</p>		
<b><i>What do they learn?</i></b>	<p>A new mode of activity jointly created by educators and learners.</p> <p>New modes of activity jointly formed by ICT director and college management.</p> <p>New ICT implementation policy in education.</p> <p>Social influence of mobile technology on teaching, learning, classroom collaborations and discussions.</p>	<p>Government's input by the formulation of new policies to encourage technology integration.</p> <p>The influence of learners' background on participation and level of engagement.</p> <p>The impact of educators' experience and skills on teaching approach.</p> <p>The impact of division of labour on the ability to effect change to embrace</p>	<p>Lack of facilities to support effective use of current ICT in the learning environment.</p> <p>Environmental factors affecting the effective use of technology in teaching and learning.</p> <p>The need to improve teaching and learning process and practices with new technology.</p>	<p>The new joint object of the educators' and learners' activity system, as well as that of the management and ICT centre vs consolidation of practice.</p> <p>Educators' digital literacy and competence's impact on teaching practice.</p> <p>Implicit rules of senior educators vs other educators' creativity and contribution to achieving common goals.</p>	<p>Allowing new social norms as implicit rules to influence the adoption of alternative tools to mediate activity.</p>

		<p>mobile technology.</p> <p>The impact of effecting change in technology tool on the college budget.</p> <p>Monitoring and regulating issues associated with new technologies.</p>	<p>Outdated rules and incoherent standards, policy and curriculum.</p>	<p>Available tools vs the usability, availability and efficiency of the tools.</p>	
<b><i>How do they learn?</i></b>	<p>Questioning existing practice, studying documents.</p> <p>Observing classroom interactions, educators' actions and interactions with other educators and students.</p> <p>Observing the ICT centre and the actions of the director, the available tools.</p>	<p>Interactions between educators and students on ways of bypassing challenges with learning and communication tool.</p> <p>Observations of related service providers such as the IT business centre.</p> <p>Informal interactions with the ICT centre attendant, and resource and faculty administrators</p>	<p>The institutional culture of teacher education and the college.</p> <p>Account of peoples experience in the college and how it shaped their identity as educators.</p> <p>Understanding how the lack of trust in the system influenced their views and attitude towards technology.</p>	<p>Contradictions from the need to state, to modelling of the new activity, to resistance.</p>	<p>Provide basis for management evaluation and examination of current ICT integration process and realignment of goals with the ICT centre.</p>

## 8.7 Summary

The major contradictions identified in the CHAT analysis that was instrumental to this study were tool-based contradictions, rule-based contradictions, subject-based contradictions and role-based contradictions. This is because of the interconnectivity of activities, actions and procedures between the different CHAT constructs. The tool-based contradictions identified the disturbances in the tools and how it impacted the educators and students' integration of ICT in teaching and learning. It also revealed the need for skill-based competencies in educators and learners. The subject-based contradictions revealed how the digital skills and competencies of educators influenced their adoption and utilization of ICT in their practices as well as how their own prejudice on technology integration can be informed by their own experiences as educators and learners, the social norms and lack of technical capital within their immediate community. Rule-based contradictions also impacted on the attitude of learners and educators. Since people in the society are often motivated by implicit rules but bounded by explicit rules, it becomes a determinant factor in the behaviours of the community. Where the explicit rules contrast with the social norms, it causes confliction between what people choose to do and what they should do. This then leads to contrasting views of what is right or wrong, which inherently impacts how the community chooses to act towards their responsibilities.

The use of the expansive learning cycle has proven to be an instrumental tool in the design of the study, from the data generation phase, through to the analysis and presentation stage of the study. It enabled integral parts of the learning system to be studied in great depth, in order to identify disturbances in the relationship between them. The output from the study has presented answers to the research questions and has enabled the study to meet its objectives. The next chapter will present the implications of the findings and make recommendations where necessary.

# **CHAPTER 9: DISCUSSION, CONCLUSION AND RECOMMENDATIONS**

## **9.1 Introduction**

The use of mobile technology to enhance learning have often been considered an advancement from existing technology enhanced learning such as e-learning or a mobile device to support e-learning termed m-learning. While these definitions are accurate for some studies, this study considered mobile technology as a useful mobile device that facilitates access to learning resources, enhances current pedagogical approaches, and promotes mobile learning for students in learning institutions with little or no access to technology. Thus, the aim of this study was to identify the potentials of mobile technology in enhancing teaching and learning in Nigerian teacher education institution by utilizing various data sources to find answers to these research questions:

- 1) What are the current pedagogic approaches used in Nigerian college of education?
- 2) Are ICT currently being used to support these pedagogic approaches?
- 3) How has/can ICT support the current pedagogic approach used in the college?
- 4) What are the factors affecting the effective integration of ICT in pedagogy in the college, and how has it been addressed??
- 5) In what ways can mobile technology enhance teaching and learning in colleges of education in Nigeria?

The previous chapter discussed the findings generated from the data, outlining the cultural, historical activity theory constructs in the data as well as the contradictions that emerged from the phenomenological case study of the Federal College of Education Asaba, Delta State Nigeria. The findings were summarised using the matrix of analysing expansive learning. This chapter presents of the discussion and implications of findings as well as recommendation in response to

the research questions and for teacher education. A full reflection of the research progress, the contributions of this research to knowledge, as well as the limitations of the study is also reported. Finally, recommendations for further study based on the discussion is alluded.

## **9.2 Discussion**

The study of the potentials of mobile technology in this teacher education college revealed its possibilities in providing access to a range of learning resources anywhere, anytime. This is because mobile devices are not limited to time or space due to its portability, ubiquity and mobility, and therefore has the potency to become one of the most powerful learning tools for learners. However, for mobile technology to have any impact on the teaching and learning practices, the characteristics of the user and their environment must be understood. This informs the digital literacy of the educators and learners, their attitude towards technology and the level of technology acceptance and integration in their current practice, which ultimately determines their perception on the use of mobile technologies to facilitate learning.

A careful study of the learning environment, the activities, actions and operations of educators captured their individual characteristics as well as the facilitating conditions and pedagogic approach within the college. The following section will present answers to the research questions posed at the beginning of this study, based on the findings from the study.

### **9.2.1 The current pedagogic approach**

Assessing the pedagogical approach of the educators in the college was irrefutably relevant to recognise the effectiveness of the current approach and if it can be enhanced with mobile technologies. As discovered, the teaching method used by educators generally depended on the subject taught, the structure and design of the learning content, and access to technology as instructional tools to facilitate chosen methods. These three factors combined determined how/if ICT will be used in the lesson.



Therefore, the prevalent pedagogic approach in the college can be understood as an instructivist pedagogic approach often described as teacher-centred-learning, as educators adopted directive and reinforcement teaching methods, focusing on the delivery of content, which gives them control over what is learned and how it is learned. Although the expected method defined in the teacher standards demands an educator to foster competent-based learning, which requires learners' active engagement in their learning process, the challenge is that the learning facility such as unequipped classrooms, do not provide a conducive atmosphere for such learning to occur. Additionally, the institutional culture which demand that students show respect for their educators, places the educator as an authority figure within and outside the classroom. Hence, students' attitude portrays submission to the directives of the educator, specifically, dependency on the educator. Such dependency inhibits learners' ability to challenge themselves to learn more, initiate intellectual conversations, or even probe educators' technique. An attempt for the educator to engage learners by asking questions, is often perceived as punishment and as a result, students tend to withdraw from classroom participation. This learning approach is predominant in the college because it is what the facility accommodates and from educators' perspective, it is an effective teaching and classroom management technique.

Teaching methods that do not support student engagement and autonomous learning such as this, is ineffective and should not be a common practice in teacher education institutions. Mobile and digital technologies present platforms where such learning can occur, however it is the characteristic of the educator that can influence its adoption.

Two user characteristics listed by Koole (2009) that influences technology adoption in teaching practices is the cognitive abilities of educators, and motivation. The cognitive abilities of an educator centres around professional, pedagogic and content knowledge and competence (Samuel and Adekunle, 2019). As Samuel and Adekunle (2019) rightly stated, effective pedagogic approach reveals the professional competence of the educators, which invariably contributes to these student-teachers' professional competence. Therefore, it is fundamental for educators in

teacher education to develop educator specific digital competence as describe in the the 2017 European Framework for the Digital Competence of Educators which encompasses professional competence, pedagogic competence and the knowledge to foster learners' competence. However, developing educator-specific digital competence is motivated by the knowledge of its relevance and value in promoting good quality education, as well as its impact on the learners, which will enable the selection of effective pedagogic methods that can contribute to the student-teachers' educator-specific competence.

### **9.2.2 Identification of ICT to support teaching and learning**

The introduction of ICT was to provide a platform where students can obtain online resources to encourage their engagement in their learning as active learners rather than passive learners. While the vision was ideal, the lack of constant electricity to power the ICT infrastructure affects the usability of available technologies, rendering them ineffective. ICT in the college was also implemented as a tool to support the preparation of learning materials and research for professional engagement. Yet educators find doing so frustrating, owing to the lack of constant internet connection at the centre due to the unavailable or fluctuating power supply. Despite the alternative power source provided by solar energy to power the technology infrastructures, access to internet cannot be guaranteed. Hence, while ICT are available, they do not adequately support teaching and learning process.

Based on the findings, these barriers within the learning environment hinders the effectiveness of ICT in enhancing learning, which represents a poor state of the facilitating condition in the college. Access to technology as identified in Bennett's (2014) study discussed in chapter two, is one of the motivators that drives learners' interest in the use of technology, as well as promoting digital literacy and competence to use technology to support teaching or learning. Therefore, the unavailability of usable technologies to support these practices frustrates the learning process,

demotivates educators, impedes the attainment of digital skills and affects the quality of education.

Desktop PCs, internet servers, and databases were designed to be powered by electricity and in the absence of such, they become unusable. However, mobile devices were designed to be powered by built-in batteries as most mobile devices such as notebooks, iPads, tablets and android phones once charged, have sufficient power to enable the completion of tasks. According to Fagas et al., (2017) a contemporary smartphone has more computer power than a ten-year-old desktop PC and consumes significantly less energy. Thus, mobile technology can be considered as an alternative to conventional desktop PCs to address the challenges of insufficient power supply within the college.

### **9.2.3 The application of ICT in teaching practices**

The application of ICT in teaching practices was assessed to understand how it is used to support current practices. ICT implementation aimed to facilitate teaching by utilizing available technology as instructional tool and to support learning. While ICT encompasses a range of technology and not limited to computers, it can be argued that ICT is being utilized in the college as instructional tool. However, for this study, the emphasis on ICT was on the utilization of computers, peripherals, software, digital platforms and internet access, and as the findings revealed, none of these tools were identified as part of classroom infrastructure to enhance teaching or learning. Where available, they were managed by the ICT centre and required due process to hire them for teaching purposes. Evidently, the inadequacy of existing technology impedes its application in the learning environment.

Furthermore, the current teaching methods used by educators does not encourage the application of ICT in the classroom. Moreover, little or no impact is felt from its application as students rely on lesson manuals from educators, and not from online learning space, hence the process of obtaining ICT equipment for a lesson seems fruitless.

#### **9.2.4 Challenges of ICT Implementation**

Having identified the ineffective application of ICT in teaching practice, in supporting learning and in enhancing the learning process, it becomes apparent that there are factors affecting its implementation. The rules clearly demand the implementation of ICT in the college, although not explicitly for teaching practices, it does recognise the role for modern technology in improving productivity and efficiency in the college. Technology integration in teaching practice as stated in the teacher standards, is at the discretion of the teacher and the disposal of the technology. This, therefore, requires educator-specific digital competence and robust technology to facilitate their process. In this case, many educators who are considered to be digitally literate and competent in technology usage, lack educator-specific digital literacy and competence to adequately use ICT to enhance their teaching and promote learners' digital literacy to do so in their own practice.

For learners, while they are considered as digital natives as they represent the younger generation born in the digital era, they appear to be less conversant with technology, owing to the lack of technical capital to encourage and influence the use of ICT to support learning. Learners are motivated by access, and their inquisitive nature as digital natives propels them to explore available technology, which can create interest in developing digital skills and eventually competences in practical application of skills developed. The lack of accessible, functional and effective ICT and infrastructure to support the technology, is one of the challenges affecting its practical application in teaching and learning.

Another challenge affecting ICT implementation is the characteristics of the institution. Based on Burke and Foulger's (2014) findings as reviewed in chapter two, institutional vision and attitude towards innovative technologies to support learning can greatly determine its uptake and impact on institutional practices. ICT cannot be effective if preserved as an institutional asset. It should be integrated in core areas of the institution to enhance teaching and learning, communication and work process. Having an ICT facility in the college, yet using analogue methods for

professional engagements, communication and accessing resources, shows the college do not understand the value and effectiveness of ICT. The attitude of management towards enforcing institutional rules that can enforce the effective utilization of technology, is the rationale behind the underutilization of the current ICT centre, college e-mails and e-library. This lackadaisical attitude is a demotivator and cannot encourage the development of digital skills in learners and educator-specific digital competences.

Finally, the rules governing the teaching of ICT to students, is designed to provide theoretical knowledge of the fundamentals of ICT and its impact in teaching and learning. Students are not taught the practical application of ICT in teaching and learning, and their teaching practice assessment do not specifically assess students' competency in the application of ICT in teaching. Therefore, it is not considered as a pre-requisite for the NCE qualification which is the lowest qualification for entry into teaching profession in Nigerian schools.

### **9.2.5 The potentials of mobile technology to enhance teaching and learning**

This study revealed that technology is a motivator and has the potency to create social impact, much so that its use becomes an acceptable norm. Based on Odukoya et al.,' (2017) study, mobile technology has created both positive and negative social impact in the country's society as mobile phone ownership is on the rise. This has turned ICT business centres to printing hubs in the society as the era of attending these centres to surf the web is fast becoming history, although it still a norm for people who cannot afford a mobile device such as smartphones or tablets.

Examining at the challenges of ICT implementation in teacher education colleges, mobile technologies have the potency to address most of these challenges and improve the quality of teacher education in this college and other colleges of education.

#### ***9.2.5.1 Mobile technology as motivator to improve digital literacy and competence***

The motivation to become digitally literate and competent, as realised in the literature review, depends on access to the technology for students, and the recognition of the use value. Use value

in this context is the realization of the useful purpose of mobile technologies in the learning environment and the value attached to the skills acquired (exchange value). This implies that a person can be motivated to develop digital skills and competence in using mobile technology, if they understand how it can enhance their teaching, their learning, support engagement, improve access to resources etc. Similarly, a person can be motivated to develop same skills if the value for possessing the skills is in high demand. Both can be true in this context as the demand for digitally competent educator is high, yet very few possess the skills required. In training these learners to utilize mobile technologies to facilitate their entire learning process, they develop the digital skills alongside competences to teach others, especially the “iPad generation” of pupil and students in primary and secondary schools which they are trained to teach.

When a learner or an educator realises the use value and the potential exchange value of digital literacy as educator-specific digital competence, they are driven to gain access to technology or access to knowledgeable others which is determined by the level of technical capital within their immediate community. Mobile technology offers a platform as a device with access to internet, to facilitate the process of obtaining the necessary resources to learn digital skills. As the findings suggests, many educators in this context understand the use value of mobile technologies and the possession of these devices, is considered access to technology and therefore a motivator to effectively use it to support teaching, encourage learning and facilitate collaboration in the classroom. Hence, students who lacked the digital knowledge to use these devices, now have access to technical capital, and can learn to use it to support their learning.

#### ***9.2.5.2 Mobile technology to improve access to resources and pedagogic practices***

The prevalence of different form of media accessible on mobile devices, provides instants access to learning resources. Students can research lesson topics and initiate conversations about the topic in the classroom, ask questions and actively engage in classroom activity. Based on the findings, educators use social media applications easily accessible on mobile devices, to foster collaborative learning, provide students with learning resources, create an interactive forum to

engage students in conversations on lesson topics and provide information on assignments as well as instant feedback. Such platforms and applications are provided by mobile learning vendors such as the new “Google Classroom” platform, to provide mobile classrooms with access to interactive learning contents and enable collaboration, real-time completion of task and assignment, instant feedback, and multimedia contents to meet the different learning needs of learners. With these mobile learning platforms, an educator can act as a facilitator of learning to guide students towards competent based learning as opposed to current approach in the college. Students’ engagement in their learning can impact their learning experience, build their confidence through what they learn, and positively impact their professional practice as educators themselves.

The ubiquitous nature of mobile devices provides anywhere access to learning. Within an institution plagued with technology integration challenges such as this, learners can still receive quality education within their classroom without the need for institutions to build new classroom to support the devices. The current infrastructure provides situated learning, but mobile devices provide mobile learning. The challenges of the absence of Wi-Fi can be manoeuvred as mobile technology is designed to operate on affordable mobile network with 3G, 4G and 5G access to the internet. Mobile technologies are affordable and easily accessible as evidence through the high rate of smartphone ownership in the country. Although, mobile devices are mostly used for social interactions as Odukoya et al.,’ (2017) study revealed, its potential should be a motivator to propel the Federal Ministry of Education and the management of College of Education to develop institutional rules that support the adoption of mobile technology in teacher education. Both the rule and the possibilities of mobile technology should drive educators and learners’ interest in the development of digital skills and competences to harness its potential.

### **9.2.6 Challenges of mobile technologies in enhancing learning**

Although the findings of this study revealed positive potentials of mobile technology, it also revealed the challenges of adopting mobile technology in the college. One of the outstanding challenges identified was the cost of mobile technologies and its impact on participation and engagement. Educators expressed the difficulties many students will face if required to purchase a mobile device to support their learning. Some expressed the financial difficulties of their learners and how it currently affects their learning as their families are unable to provide their basic needs such as food, books and academic materials. Therefore, demanding that students must acquire or own a mobile device or smartphone to facilitates access to learning, will not only affect the student's ability to do so but can also negatively impact their self-esteem and social status amongst their peers, which can be discouraging. Despite being unable to afford a mobile device, the current infrastructure of the college lacks the availability of Wi-Fi to grant free access to users, therefore users must also obtain network data from their mobile network service providers to enable access to the internet, which comes at a high cost, making mobile learning an expensive alternative. Nevertheless, as Ali and Arshad (2016) suggested, institutions can solicit support from parents and the government to provide financial assistance to students with financial difficulties.

Another challenge of mobile technology as the findings suggest, are the security issues within the learning environment such as risk of theft and vandalism. However, with adequate security measures, thefts and vandalism can be controlled.

Finally, the findings also revealed concerns on how to ensure the use of mobile technologies for learning purposes in the classroom, which is congruent with Odukoya et al., (2017) findings who revealed the lack of control and self-discipline of learners to deviate from learning to social media and games. Therefore, considerations on how to control access to social media in order to curb the abuse of mobile technologies in the classroom should be explored.



### **9.3 Implication of Findings**

The Nigerian college of education is an integral part of the education sector. It is an institution whose purpose is clearly defined, as a teacher training institution. Meaning that the role of the teacher in the classroom, especially in today's digital environments, is clearly defined. The ever-changing advancements in technology and its implementation in schools and institutions, requires teachers to also advance in technological knowledge as it evolves. Thus, educators in the colleges of education, require ardent use of technology to train these student-teachers, because of their future roles in technologically inclined classrooms. However, this can only be achieved if the educators possess educator-specific digital competences.

The students in this context, study diverse technically inclined subjects for area-specific knowledge, and general education subjects for pedagogic knowledge to teach subjects they are assigned in primary, secondary, vocational training centres etc., therefore their learning needs are double bind. If they are to teach the eminent younger generation of digital natives, they must be equipped to do so through the inclusion of subjects designed to teach the integration and utilization of digital technologies in their curriculum and be assessed on effective application during teaching practice.

Despite the cultural and historical challenges identified in the college, the study shows that mobile technology has the potential to transform and enhance teaching and learning practices in this learning environment. However, the issues within the learning environment such as the institutional culture and infrastructural challenges which has trampled the implementation of ICT, must be addressed. From the findings presented in chapter 6, 7 and 8, most environmental factors such as power and infrastructure, are not essential factors to hinder the adoption of mobile technologies in the learning environments, especially where mobile technologies are already utilised for other social interactions, including classroom discourse. Rather the attitude of

educators, management, and students, towards mobile technology in the learning environment, will determine its adoption and utilization.

The attitude of educators towards technology is because of their experience with existing technology in the college, due to the infrastructural challenges. This has led to the distrust in the ICT facility observed in the college. The professional knowledge and skills to effectively harness its potential, and the funding to acquire satisfactory technology that will serve the needs of the student within their classrooms or departments is a major hurdle that when crossed, can positively impact the quality of education in the college, and generate revenue that can boost the economy of the country through the education. Thus, with effective planning, development, deployment, strategic implementation and management of mobile technologies, and the acquisition and/or liaison with learning applications vendors to develop applications that can enhance the learning process, can overturn the negative attitude of educators and learners. Although these actions can address the attitude of users of the technology, the decision to embrace innovative technologies as the data revealed, is determined by the commitment of the management of this institution to innovation, and availability of funding to support this innovation.

Overall, the findings from this study revealed that the rules governing teacher education ultimately determines: (1) the dedication of resources to promote digital competences of educators through effective CPD, (2) the provision of adequate technologies to support learning and improve access to technology and resources, (3) the level of awareness on the impacts of technology and the interest of educators and learners in developing digital skills. Regardless of the inclusion of ICT in the teacher education curriculum and minimum standards, the findings of this study are congruent with Samuel and Adekunle's (2019) findings who emphasized that the current teacher preparation curriculum in Federal Colleges of Education in Nigeria is inadequate to meet the demands of education in this digital era, and therefore requires effective changes in order to improve the quality of teacher education in Nigeria.

## 9.4 Conclusion and Recommendation

The process of changing practices is never as easy as one expects it to be. As Salmon (2019) rightly said, major transformations in education are often slow, frustrating and exhausting. The process can be so protracted, that some great people at all levels and in different roles within the learning hierarchy, sigh and give up. We must continue the search for ways to improve our learning environment to in order to provide good quality education in the country, not only for the learners but also to the benefit of our economy, as quality education is no longer a choice, but an essential global sustainable development goal.

Overall, the knowledge gained from this study revealed that the potentials of mobile technology depend on the characteristics of the technology, the skills and attributes of the user, and the social context where the user dwells. The uptake of mobile technologies in any institution depends on the digital literacy and competence of the users or stakeholders. There is no need introducing a new technology; no matter its potentials, in an environment where no one knows how to use it. Such technology will be received as an alien in their environment.

However, digital literacy and competence is influenced by the knowledge of its use value and exchange value. When an educator understands the value of such skills within their environment it therefore becomes a motivator to acquire digital skills and competence.

So how does one acquire such skills? this is dependent on the following:

1. Rules (implicit and explicit)
2. Availability of technology and infrastructure
3. Technical capital

The social, institutional and instructional rules and policies are the major drivers for digital literacy and competence. This is because they define the use and exchange value of the technology and the digital skills and competence to use these technologies within their society. For instance, when educators understand that they have competitive advantage over their colleagues if they

possess or acquire digital skills and competence to meet the demand of today's education, they will be driven to improve or acquire such skills.

The definition and the understanding of the use and exchange value of digital skills and technologies, also determine the level of an institution or government's investment in educational technologies, in order to make available the necessary technologies and infrastructure to promote digital literacy of its educators and learners. Finally, the rules and access to technology to promote digital skills and competence of educators and learners, improves the level of technical capital within the learning environment to enable other educators and learners learn these skills from their peers and colleagues.

Therefore, to harness the potentials of mobile technologies within this college to meet the growing demand for technical expertise in today's digital world, certain rules governing the use of technology to support teaching and learning within teacher education must be changed to promote the attainment of educator-specific digital literacy and competence to effectively use mobile technologies to enhance teaching and learning. Thus, the adoption of mobile technology in teacher education colleges, relies on the actions, input and intervention of the government through the Federal Ministry of Education, which can influence the learning environment and promote training for educators and learners to develop educator-specific digital competences. This is because the colleges are federal government institutions and as such decisions are made at the federal level.

Based on the findings, the recommendations on how the government can effect changes to encourage the digitalization of teacher education through the adoption of mobile technologies, is grounded in UNESCO recommendation discussed in chapter 2 which are as follows: (1) creating or updating policies related to mobile learning. This includes the incorporation of pedagogic practices that enables learner-centred education in the curriculum, (2) training teachers to advance learning through mobile technologies, (3) expanding and improving connectivity options while ensuring equity, (4) developing strategies to provide equal access for all, (5) raising awareness of

mobile learning through advocacy, leadership and dialogue. If the federal government shows commitment to effecting these changes, the potentials of mobile technology will be harnessed in Nigerian teacher education institutions.

## **9.5 Reflection on Research Process**

At the commencement of this research, the confusion on how to approach the study, presented itself. This is because of the researcher's assumption of the ideology that mobile technology can, and should irrefutably, enhance teaching and learning in this learning environment. The CHAT framework provided an alternative way of thinking about the learning environment under study. Firstly, it offered the view of the learning environment as collective units of the environment, to allow the inner structures of the context to be studied. From learning this structure, the main functional areas of the college were identified, and separated to be studied as individual units that make up the whole. The particular context that would benefit from the adoption of mobile technology was studied in detail. The entire process also revealed the lapses, loopholes and areas that can and should be addressed in order to make the adoption and implementation of mobile technology in these systems less problematic or not problematic at all.

The mixed method approach implemented for the data collection process, particularly, the combination of participant observation followed by interviews, and the document analysis were very effective. Reviewing the data collected after the first phase revealed that some important views of participants were not properly captured. Thus, the second phase was to introduce focus groups to gain the views of students with regards to using mobile learning applications on their mobile devices for learning purposes, however, obtaining and right mobile learning application to support this activity was another challenge that halted this method.

The withdrawal of several educators, especially 1 head of departments and 1 dean of school and 5 other educators, was really disconcerting. However, the findings within the document analysis as well as the interview with the director of ICT, provided very rich data that changed the course

of the research findings. Moreover, the data reached saturation after observing and interviewing 5 educators from different faculties, as no new data or information was obtained from the study.

## **9.6 Limitations**

The major limitation of this research was the inability to study the learners in more details. Data concerning the learners were identified in the data as elicited from the educators. The perspective of the learners would have expanded on knowledge of the learning process through the description of their experiences. Educators' interviews had the tenacity to capture rich data about the actions of the management and the impact of the academic staff union in pushing for developments in the institution. However, most of the educators' gestures indicated the need to be somewhere else, either another lesson to teach or the need to leave, forcing a hurried response and further probing revealed little of no new data. The second visit to the site, offered more prolific data which created an opportunity to profoundly study the ICT centre and their activities in relation to the accessibility and availability of technology.

## **9.7 Contribution to Knowledge**

The application of CHAT and expansive learning cycle in studying the teaching and learning culture of Nigerian College of education to reveal the dynamics of the classroom, and inform a contextual understanding of the learning environment, which can enable effective design, development and deployment of mobile-based learning applications to support this learning environment, is the contribution that this research has made to the body of knowledge. Also, the contextual structure, which reveals how the perception of higher authorities, informs decisions that impact the beneficiaries of the system such as this, can form the basis on which the NTEP policies are reviewed, the minimum standards are updated and the CIFW; particularly on the inclusion of digital technologies as an instructional/learning tool for both educators and learners, can be reviewed to accommodate mobile technology.

## **9.8 Recommendations for Further Research**

The findings of my research generated more questions, therefore further research is required to build on the findings of this study. The recommendations for further research are as follows: My first recommendation is to conduct an in-depth study of the experiences of students experience in learning in today's teacher education colleges and their perception on the role of technology in their own teaching practices. The study should reveal their unique attributes and if their digital identity influences their interest in technology. Secondly, I recommend that a study of other colleges of education should be conducted to determine if the challenges of ICT implementation identified in this institution is synonymous with others. Thirdly, my recommendation is to conduct a study the of primary, secondary and vocational education centres to identify the demand for digitally literate and competent educators and if the qualities of new teachers meet these demands. My fourth recommendation is a study of other colleges of education who have successfully implemented ICT, using technology acceptance model, to assess how educators and learners accept changes to include technology in their learning environment. Finally, Mobile technology has the potential to positively change how students learn and how educators teach. The only challenge is the lack of knowledge on how to prepare learning contents for mobile devices. This reveals the need for further studies on how to design and plan effective learning contents.

## References

- Acilar, A. (2011) Exploring the Aspects of Digital Divide in a Developing Country. *Issues in Informing Science and Information Technology* [online]. Vol. 8 [Accessed 22 July 2016].
- Adedjoja, G. (2016) The Influence of Age and Educational Qualification on Stakeholders Perception of Integrating Mobile Technology into Basic Education in Nigeria.. *An International Multi-disciplinary Journal, Ethiopia* [online]. 10 (3), pp. 96-110. [Accessed 23 September 2018].
- Adegbija, M. V. and Bola, O. O. (2015) Perception of undergraduates on the adoption of mobile technologies for learning in selected universities in Kwara state, Nigeria.. *Procedia - Social and Behavioral Sciences* [online]. (176), pp. 352 – 356. [Accessed 12 October 2017].
- Adegboye, Y. (2016) *Mobile Technology in Nigeria: Statistics, History, Setting*. [Online] Available from: <http://mobilityarena.com/quick-facts-mobile-nigeria/> [Accessed 28 April 2017].
- Adeyemo, O. S. and Babatunde, S. M. (2018) Perception of Tertiary Institution Students Towards Mobile Assisted e- Cheating and Nigerian Examination Quality: Focus on Lagos State Tertiary Institutions. *Participatory Educational Research (PER)* [online]. 5 (1), pp. 74-85. [Accessed 12 March 2019].
- Adomi, E. E. and Kpangban, E. (2010) Application of ICTs in Nigerian Secondary Schools. *Library Philosophy and Practice (e-journal)* [online]. 345. [Accessed 12 October 2017].
- Adu, P. (2013) *Qualitative Analysis: Coding and Categorizing*. [Online] Available from: <https://www.slideshare.net/kontorphilip/qualitative-analysis-coding-and-categorizing> [Accessed 22 March 2018].
- Agbetuyi, P. A. and Oluwatayo, J. A. (2012) Information and Communication Technology (ICT) in Nigerian Educational System. *Mediterranean Journal of Social Sciences* [online]. 3 (3). [Accessed 12 October 2017].
- Agbo, I. S. (2015) Factors Influencing the Use of Information and Communication Technology (ICT) in Teaching and Learning Computer Studies in Ohaukwu Local



Government Area of Ebonyi State-Nigeria. *Journal of Education and Practice* [online]. 6 (7). [Accessed 28 April 2017].

Airoboman, A. E., Amaize, P. A., Ibhaze, A. E. and Ayo, O. O. (2016) Economic Implication of Power Outage in Nigeria: An Industrial Review. *International Journal of Applied Engineering Research* [online]. 11 (7), pp. 4930-4933. [Accessed 27 April 2017].

Al-Hunaiyyan, A., Alhajri, R. A. and Al-Sharhan, S. (2016) Perceptions and challenges of mobile learning in Kuwait. *Journal of King Saud University – Computer and Information Sciences* [online]. [Accessed 23 April 2018].

Ali, R. A. and Arshad, M. R. M. (2016) Perspectives of Students' Behavior Towards Mobile Learning (M-learning) in Egypt: an Extension of the UTAUT Model. *Technology* [online]. 6 (4), pp. 1109-1114. [Accessed 25 May 2017].

Ally, M. (2009) *Mobile Learning Transforming the Delivery of Education and Training*.

[Online] Available from:

<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.475.2163&rep=rep1&type=pdf>

[Accessed 17 August 2020].

Anene, J. N., Imam, H. and Odumuh, T. (2014) Problem and Prospect E-learning in Nigerian Universities. *International Journal of Technology and Inclusive Education (IJTIE)* [online]. 3 (2). [Accessed 23 April 2018].

Anney, V. N. (2014) Ensuring the Quality of the Findings of Qualitative Research: Looking at Trustworthiness Criteria.. *Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS)* [online]. 5 (2), pp. 272-281. [Accessed 13 July 2018].

Asiimwe, E. N., Grönlund, A. and Hatakka, M. (2017) Practices and challenges in an emerging m-learning environment. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)* [online]. 13 (1), pp. 103-122. [Accessed 13 April 2018].

Asiyai, I. (2013) Challenges of Quality in Higher Education in Nigeria in the 21st Century. *International Journal of Educational Planning and Administration* [online]. 3 (2), pp. 159-172. [Accessed 18 April 2018].

Ayoade, O. B. (2015) Factors Influencing Students' Behavioural Intention to Adopt and use Mobile Learning in Higher Educational Institutions in Nigeria: An Example of Ekiti State University, Ado-Ekiti. *International Journal of Emerging Technology and Advanced Engineerin* [online]. 5 (4). [Accessed 18 April 2018].

Baghrmain, M. (2015) *Relativism* [online]. Stanford, USA: Stanford Encyclopedia of Philosophy. Available from: <https://plato.stanford.edu/entries/relativism/> [Accessed 16 March 2020].

Baller, S., Dutta, S. and Lanvin, B. (2016) *The Global Information Technology Report 2016 Innovating in the Digital Economy* [online]. Available from: [http://www3.weforum.org/docs/GITR2016/WEF\\_GITR\\_Full\\_Report.pdf](http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf) [Accessed 16 March 2020].

Bandara, S. (2018) Activity Theory is an Effective Framework on Qualitative Data Analysis in Social Sciences Studies. *International Journal of Research – Granthaalayah* [online]. 6 (7), pp. 85-95. [Accessed 18 January 2020].

Barab, S., Schatz, S. and Scheckler, R. (2004) Using Activity Theory to Conceptualize Online Community and Using Online Community to Conceptualize Activity Theory. *Mind, Culture, and Activity* [online]. 11 (1), pp. 25-47. [Accessed 18 January 2020].

Baran, E. (2014) A Review of Research on Mobile Learning in Teacher Education.. *Educational Technology and Society* [online]. 17 (4), p. 17–32. [Accessed 26 January 2019].

Bellinger, G., Castro, D. and Mills, A. (2003) *Data, Information, Knowledge, and Wisdom..* [Online] Available at: <https://homepages.dcc.ufmg.br/~amendes/SistemasInformacaoTP/TextosBasicos/Data-Information-Knowledge.pdf> [Accessed 20 06 2018].

Bennett, L. (2014) Learning from the early adopters: developing the digital practitioner. *Research in Learning Technology* [online]. Volume 22. [Accessed 18 February 2020].

Bolaji, S. D., Gray, J. R. and Campbell-Evans, G. (2015) Why Do Policies Fail in Nigeria? Vol. 2, No. 5. *Journal of Education and Social Policy* [online]. 2 (5). [Accessed 18 January 2018].

- Bonneau, C. (2013) Contradictions and their concrete manifestations: an activity-theoretical analysis of the intra-organizational co-configuration of open source software, 29th EGOS Colloquium, Montreal, 4-6 July 2013. *Researchgate* [online]. [Accessed 22 January 2020].
- Bowen, G. A. (2009) Document Analysis as a Qualitative Research Methodology. *Qualitative Research Journal* [online]. 9 (2), pp. 27-40. [Accessed 12 February 2021].
- Bradley, C., Haynes, R., Cook, J., Boyle, T. and Smith, C. (2009) Chapter 8: Design and Development of Multimedia Learning Objects for Mobile Phones. In: Ally, M., ed. *Mobile Learning Transforming the Delivery of Education and Training* [online]. Alberta, CA:AU Press., pp. 157-182. [Accessed 8 March 2018].
- British Educational Research Association BERA (2018) *Ethical Guidelines for Educational Research, fourth edition, London*. [Online] Available at: <https://www.bera.ac.uk/researchers-resources/publications/ethical-guidelines-for-educational-research-2018> [Accessed 13 January 2021].
- Brock, A., Kvasny, L. and Hales, K. (2010) Cultural Appropriations of Technical Capital,. *Information, Communication and Society* [online]. 13 (7), pp. 1040-1059. [Accessed 15 January 2021].
- Brooks, D. C. (2016) ECAR Study of Undergraduate Students and Information Technology: Research Report. *EDUCAUSE Centre for Analysis and Research*. Louseville CO: ECAR. [Accessed 18 April 2018].
- Burke, D. M. and Foulger, T. S. (2014) Mobile Learning in Teacher Education: Insight From Four Programs That Embraced Change. *Journal of Digital Learning in Teacher Education* [online]. 30 (4), pp. 112-120. [Accessed 13 January 2021].
- Buzzard, C., Crittenden, V. L., Crittenden, W. F. and McCarty, P. (2011) The Use of Digital Technologies in the Classroom: A Teaching and Learning Perspective. *Journal of Marketing Education* [online]. 1 (9). [Accessed 14 August 2019].
- Casanova, D., António, M. and Costa, N. (2011) Technology Enhanced Learning in Higher Education: results from the design of a quality evaluation framework. *Procedia – Social and Behavioural Sciences* [online]. Vol. 29, pp. 893-902. [Accessed 17 August 2017].

- Caudill, J. G. (2007) The Growth of m-Learning and the Growth of Mobile Computing: Parallel developments.. *International Review of Research in Open and Distance Learning* [online]. 8 (2). [Accessed 14 August 2017].
- Chaka, J. G. and Govender, I. (2017) Students' perceptions and readiness towards mobile learning in colleges of education: a Nigerian perspective. *South African Journal of Education* [online]. 37 (1). [Accessed 14 August 2018].
- Chavoshi, A. and Hamidi, H. (2019) Social, individual, technological and pedagogical factors influencing mobile learning acceptance in higher education: A case from Iran. *Telematics and Informatics* [online]. Issue 38, pp. 133-165. [Accessed 14 August 2020].
- Chen, B., Seilhamer, R., Luke, B. and Bauer, S. (2015) *Students' Mobile Learning Practices in Higher Education: A Multi-Year Study*. [Online] Available at: <https://er.educause.edu/articles/2015/6/students-mobile-learning-practices-in-higher-education-a-multiyear-study> [Accessed 20 June 2017].
- Chen, Y.-S., Kao, T.-C. and Sheu, J.-P. (2003) A mobile learning system for scaffolding bird watching learning. *Journal of Computer Assisted Learning* [online]. Issue 19, pp. 347-359. [Accessed 14 August 2017].
- Cheung, R. and Doug Vogel, (2012) Designing Web 2.0 collaboration tools to support project-based learning: An activity-oriented approach. *International Journal of Systems and Service-Oriented Engineering* [online]. 3 (2), pp. 1-14. [Accessed 14 August 2017].
- Chowdhry, S., Sieler, K. and Alwis, L. (2014) A Study of the Impact of Technology-Enhanced Learning on Student Academic Performance. *Journal of Perspectives in Applied Academic Practice* [online]. 2 (3). [Accessed 11 August 2017].
- Clough, G., Jones, A., McAndrew, P. and Scanlon, E. (2009) Informal learning evidence in online communities of mobile device enthusiasts. In: Ally, M., ed. *Mobile Learning: Transforming the Delivery of Education and Training. Issues in Distance Education* [online]. Athabasca University Press, pp. 99–112. [Accessed 9 September 2017].
- Cobcroft, R. S., Towers, S., Smith, J. and Bruns, A. (2006) Mobile learning in review: Opportunities and challenges for learners, teachers, and institutions.. *Proceedings Online Learning and Teaching (OLT) Conference* [online]. pp. 21-30. [Accessed 4 August 2017].

Crawford, K. M. (2016) *Developing the Whole Teacher: A Phenomenological Case Study of Student Teachers' Emotional Experiences in One Teacher Education Program* [online]. Georgia: Georgia Southern University. [Accessed 14 January 2021].

Creswell, J. W. (1998) *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*. 2<sup>nd</sup> ed. Thousand Oaks: Sage Publication.

Creswell, J. W. and Clark, V. L. P. (2011) *Designing and conducting mixed methods research* [online]. 2<sup>nd</sup> ed. Los Angeles: Sage Publication. [Accessed 14 August 2016].

Crosslin, M. (2016) From Instructivism to Connectivism: Theoretical Underpinnings of MOOCs. *Current Issues in Emerging eLearning* [online]. Vol. 3 1 (6). [Accessed 10 June 2019].

Crow, G. and Wiles, R. (2008) Managing anonymity and confidentiality in social research: the case of visual data in Community research. *ESRC National Centre for Research Methods NCRM Working Paper Series* [online]. [Accessed 14 August 2016].

Cuenca, A. (2010) Self-Study Research: Surfacing the Art of Pedagogy in Teacher Education. *Journal of Inquiry & Action in Education* [online]. 3 (2), pp. 15-29. [Accessed 28 June 2021].

Davidson, C. B. and Lazaros, E. J. (2015) Adopting Mobile Technology in the Higher Education Classroom. *Journal of Technology Study JOTS* [online]. 41 (1). [Accessed 12 April 2017].

Davies, S., Mullan, J. and Feldman, P. (2017) *Rebooting learning for the digital age: What next for Technology- Enhanced Higher Education?* [online]. Oxford.: Higher Education Policy Report. [Accessed 22 September 2018].

Devane, B. and Squire, K. (2012) Activity Theory in the Learning Technologies. In: Jonassen, D. and Land, S., eds. *Theoretical Foundations of Learning Environments* [online]. Second Edition. New York and London:Routledge, pp. 242-267. [Accessed 03 March 2020].

Dike, V. E. (2015) *Why Nations Fail'' to Develop: The Case of Nigeria*. [Online] Available from: <https://doi.org/10.1177%2F2158244015611714> [Accessed 28 May 2016].

Draper, S., (2013) *Social Constructivism- What is it?*. [Online] Available from:

<http://www.psy.gla.ac.uk/~steve/courses/archive/CERE12-13-safari-archive/topic3/webarchive-index.html> [Accessed 07 May 2017].

Driscoll, D. L. (2011) Introduction to Primary Research: Observations, Surveys, and Interviews.. In: Lowe, C. and Zemliansky, P., eds. *Writing Spaces: Readings on Writing* [online]. Vol. 2. South Carolina: Parlor Press. pp. 153-175. [Accessed 14 December 2016].

Dudovskiy, J. (2018) *Research Philosophy*. Business Research Methodology [Online]. Available from: <https://research-methodology.net/research-philosophy/> [Accessed 17 December 2019].

Eddles-Hirsch, K. (2015) Phenomenology and Educational Research. *International Journal of Advanced Research* [online]. 3 (8), pp. 251-260. [Accessed 10 December 2020].

Egoeze, F., Colomo-Palacios, R., Akman, I. and Misra, S. (2014) An Evaluation of ICT Infrastructure and Application in Nigeria Universities. *Acta Polytechnica Hungarica* [online]. 11 (9). [Accessed 23 January 2021].

Engeström, Y. (1987) *Learning by Expanding* [online]. 2nd ed. Cambridge, UK: Cambridge University Press. [Accessed 20 February 2020].

Engeström, Y. (1999) Activity Theory and Individual and Social Transformation. . In: Engeström, Y., Miettinen, R. and Punamaki, R., eds. *Perspectives on Activity Theory* [online]. Cambridge:Cambridge: Cambridge University Press. [Accessed 22 February 2020].

Engeström, Y. (2001) Expansive Learning at Work: Toward an activity theoretical reconceptualization. *Journal of Education at Work* [online]. 14 (1), pp. 133-156. [Accessed 20 February 2020].

Engeström, Y. (2009) The future of activity theory: A rough draft. In: Sanino, A., Daniels, h. and Gutierrez, K. D eds. *Learning and Expanding with Activity Theory* [online]. Cambridge, Uk: Cambridge University Press. pp. 303-328. [Accessed 20 February 2020].

Engestrom, Y. and Sannino, A. (2010) Studies of expansive learning: Foundations, findings and future challenges. *Education research review* [online]. 5 (1), pp. 1-24. [Accessed 22 February 2020].

Eze , S. C., Chinedu-Eze , V. C. and 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* [online]. 15 (34). [Accessed 23 June 2019].

Fagas, G., Gallagher, J. P., Gammaitoni, L. and Paul, D. J. (2016) Energy Challenges for ICT. In Fagas, G. (ed.) (2017) *Energy Concept for Efficiency and Sustainability* [online]. Open Access peer-reviewed Monograph. [Accessed 03 May 2021].

Farley, H., Murphy, A., Johnson, C., Carter, B., Lane, M., Midgley, W., Hafeez-Baig, A., Dekeyser, S. and Koron, A. (2015) How Do Students Use Their Mobile Devices to Support Learning? A Case Study from an Australian Regional University. *Journal of Interactive Media in Education* [online]. 1 (14), pp. 1-13. [Accessed 20 October 2018].

Feldman, P. (2018) The potential of Education 4.0 is huge – the UK must take the lead, now. [Online] Available from: <https://www.timeshighereducation.com/hub/jisc/p/preparing-education-40> [Accessed 7 December 2019].

Feliz, O. (2012) Pedagogical framework of m-learning. *Procedia - Social and Behavioral Sciences* [online]. Issue 31, pp. 927-931. [Accessed 27 June 2018].

Ferreira, J. B., Klein, A. Z., Freitas, A. and Schlemmer, E. (2013) Mobile Learning: Definition, Uses and Challenges. In: Wankel, L. and Blessinger, P., eds. *Increasing Student Engagement and Retention Using Mobile Applications: Smartphones, Skype and Texting Technologies, Cutting-Edge Technologies in Higher Education* [online]. Vol. 6 Part D. Bingley: Emerald Group Publishing Limited. pp. 47-82. [Accessed 23 September 2018].

Finlay, L. (1999) Applying Phenomenology in Research: Problems, Principles and Practice. *British Journal of Occupational Therapy* [online]. 62 (7), pp. 299-306. [Accessed 15 January 2021].

Flyvbjerg, B. (2006) Five Misunderstandings About Case-Study Research. *Qualitative Inquiry* [online]. 12 (2), pp. 219-245. [Accessed 18 February 2017].

Foot, K. (2014) Cultural-Historical Activity Theory: Exploring a Theory to Inform Practice and Research. *Journal of Human Behavior in Social Environments* [online]. 24 (3), pp. 329-347. [Accessed 24 March 2020].

Fouka, G. and Mantzorou, M. (2011) What are the major ethical issues in conducting research? is there a conflict between the research ethics and the nature of nursing? *Health Science Journal* [online]. 5 (1). [Accessed 17 December 2016].

Frické, M. (2009) The knowledge pyramid: a critique of the DIKW hierarchy. *Journal of Information Science* [online]. 35 (2), pp. 131–142. [Accessed 19 August 2018].

Galicano, T. (2013) An example of how to perform open coding, axial coding and selective coding. *The PR Post* [blog]. 22 July. Available from: <https://prpost.wordpress.com/2013/07/22/an-example-of-how-to-perform-open-coding-axial-coding-and-selective-coding/> [Accessed 10 June 2019].

Garba, S. A. and Alademerin, C. A. (2014) Exploring the readiness of Nigerian Colleges of Education toward Preservice Teacher Preparation for Technology Integration. *International Journal of Technology and Inclusive Education (IJTIE)* [online]. 3 (2). [Accessed 5 October 2019].

Garba, S. A., Singh, T. K. R., Yusuf, N. B. M. and Ziden, A. A. (2013) An Overview of Technology Integration in Nigerian Colleges of Education. *Journal of Education and Learning* [online]. 7 (1), pp. 35-42. [Accessed 5 October 2019].

Geidd, J. N. (2012) The Digital Revolution and Adolescent Brain Evolution. *J Adolesc Health* [online]. 51 (2), pp. 101-105. [Accessed 10 January 2017].

Gikas, J. and Grant, M. M. (2013) Mobile computing devices in higher education: Student perspectives on learning with cell phones, smartphones and social media. *Internet and Higher Education* [online]. Volume 19, p. 18–26. [Accessed 10 January 2017].

Gill, P., Stewart, K., Treasure, E. and Chadwick, B. (2008) Methods of data collection in qualitative research: interviews and focus groups. *British Dental Journal* [online]. Volume 204, p. 291 – 295. [Accessed 14 January 2017].



- Gomez, S., Zervasb, P., Sampson, D. G. and Fabregat, R. (2013) Context-aware adaptive and personalized mobile learning delivery supported by UoLmP. *Journal of King Saud University- Computer and Information Sciences* [online]. 21 (1). [Accessed 20 August 2017].
- Greif, A. and Kingston, C. (2011) Institutions: Rules or Equilibria. In Schofield, N. and Caballero, G. eds. (2011), *Political Economy of Institutions, Democracy and Voting* [online]. Verlag Berlin Heidelberg: Springer. [Accessed 20 February 2021].
- Grobler, B. (2013) The school principal as Instructional Leader: A structural equation mode. *Education as Change* [online]. Issue 17, pp. 177-199. [Accessed 11 January 2019].
- Groenewald, T. (2004) A Phenomenological Research Design Illustrated. *International Journal of Qualitative Methods* [online]. 3 (1). [Accessed 23 January 2021].
- Gunhouse, G. and Sinclair, B. (2016) The Promise of Virtual Reality in Higher Education. *EDUCAUSE REVIEW* [blog]. 07 March. Available from; <https://er.educause.edu/articles/2016/3/the-promise-of-virtual-reality-in-higher-education> [Accessed 24 June 2017].
- Hadi, M. and José Closs, S. (2016) Ensuring rigor and trustworthiness of qualitative research in clinical pharmacy. *International Journal of Clinical Pharmacy* [online]. 38 (641). [Accessed 10 December 2018].
- Haji, A. H., Shaame, A. A. and Kombo, O. H. (2013) *The Opportunities and Challenges in using Mobile Phones as learning tools for Higher Learning Students in the Developing Countries: Zanzibar Context* [online]. Africon, Pointe aux Piments Mauritius. Pp. 1-5. [Accessed 24 June 2016].
- Hall, T. and Connolly, C. (2019) Mobile Learning in Teacher Education. *TechTrends* [online], Issue 63, p. 644–646 . [Accessed 25 September 2020].
- Hardman, E. (2015) How Pedagogy 2.0 Can Foster Teacher Preparation and Community Building in Special Education. *Social Inclusion* [online]. 3 (6), pp. 42-55. [Accessed 24 July 2018].
- Hasan, H. and Kazlauskas, A. (2014) Activity Theory: who is doing what, why and how. In: Hasan, H. (ed.) *Being Practical with Theory: A Window into Business Research* [online]. Wollongong, Australia: THEORI: UOW, pp. 9-14. [Accessed 19 February 2020].

Hashim, N. H. and Jones, M., (2007) *Activity Theory: A framework for qualitative analysis* [online]. Wollongong, Australia: University of Wollongong. [Accessed 19 March 2020].

Hawkins-Walter, L. A. (2013) *Drawing on knowledge to plan: activity theory to aid facilitators' knowledge articulation* [online]. Rockhampton, Australia: Central Queensland University. [Accessed 29 March 2020].

Hayes, P., Dietmar, J. and Hall, T. (2006) *On the Role of Mobile Scaffolding in Learning*. [Online] Available at: [http://trap.ncirl.ie/1046/1/On the role of mobile scaffolding in learning.pdf](http://trap.ncirl.ie/1046/1/On_the_role_of_mobile_scaffolding_in_learning.pdf) [Accessed 06 03 2019].

Hayhoe, S. (2015) *Utilising mobile technologies for students with disabilities*. In: Jones-Parry, R. (ed.) Commonwealth Education Partnerships 2015/16 [online]. Commonwealth education partnerships. Nexus Strategic Partnerships, Cambridge, UK. [Accessed 29 January 2021].

Hennink, M., Hutter, I. and Bailey, A. (2011) *Qualitative Research Methods*. 1<sup>st</sup> ed. London: Sage Publication [online]. pp. 8-9. [Accessed 28 May 2017].

Hertz, M. B. (2011) What Does "Technology Integration" Mean?. *Edutopia* [blog]. 16 March. Available from: <https://www.edutopia.org/blog/meaning-tech-integration-elementary-mary-beth-hertz> [Accessed 17 January 2021].

Hickman, R. and Kiss, L. (2010) Cross-Curricular Gallery Learning: A Phenomenological Case Study. *International Journal of Art and Design* [online]. 29 (1), pp. 27-36. [Accessed 29 April 2021].

Higgins, S., Xiao, Z. and Katsipataki, M. (2012) *The Impact of Digital Technology on Learning: A Summary for the Education Endowment Foundation* [online]. Education Endowment Foundation. [Accessed 19 March 2017].

Hussain, I. and Adeeb, M. A. (2009) Role of Mobile Technology in Promoting Campus-Wide Learning Environment. *The Turkish Online Journal of Educational Technology* [online]. 8 ( 3). [Accessed 19 March 2017].

Hussin, A. A. (2018) Education 4.0 Made Simple: Ideas For Teaching. *International Journal of Education and Literacy Studies* [online]. 6 (3), p. 93. [Accessed 27 March 2019].

Iacono, J., Brown, A. and Holtham, C. (2009) Research Methods – a Case Example of Participant Observation. *Electronic Journal of Business Research Methods [online]*. 7 (1), pp. 39 - 46. [Accessed 19 August 2017].

Imtinan, U., Chang, V. and Tomayess, I. (2013) Common Mobile Learning Characteristics- An Analysis of Mobile Learning Models and Frameworks. In: Sanchez A. and Isaias, P. eds. *Mobile Learning [online]*. 14 March 2013. Lisbon, Portugal: IADIS Press, pp. 3-11 [Accessed 27 March 2017].

Israel, P. C. and Israel, H. C. (2020) Assessment of Curriculum Load of the National Commission for colleges of Education’s Minimum standard for Nigeria Certificate in Education. *Journal of Research Opinions [online]*. 7 (1), pp. 2598-2605. [Accessed 19 January 2021].

Janks, H. (2010) *Literacy and Power [online]*. New York: Routledge, Taylor and Francis Group. . [Accessed 19 January 2021].

Jude, W. I. and Dankoro, J. T. (2012) ICT Resource Utilization, Availability and Accessibility by Teacher Educators for Instructional Development in College of Education katsina- Ala. *New media and Mass Communications [online]*. Vol. 3, p. 16. [Accessed 28 June 2019].

Kaiser, K. (2009) Protecting Respondent Confidentiality in Qualitative Research. *Sage Journal Qual Health Res [online]*. 19 (11), pp.1632-1641. [Accessed 23 August 2017].

Kaliisa, R. and Picard, M. (2017) A Systematic Review on Mobile Learning in Higher Education: The African Perspective. *Turkish Online Journal of Educational Technology – TOJET [online]*. 16 (1), pp. 1-18. [Accessed 10 July 2018].

Kaptelinin, K. and Nardi B. (2010) Activity Theory in HCI: Fundamentals and Reflections. In: Carroll, J. M. ed. (2012) *Synthesis Lectures on Human-Centered Informatics [online]*. Morgan & Claypool. [Accessed 14 February 2021].

Kaushik, V. and Walsh, C. A. (2019) Pragmatism as a Research Paradigm and Its Implications for Social Work Research. *Social Sciences [online]*. 8 (9), pp. 255. [Accessed 19 April 2020].

Kelley, K., Clark, B., Brown, V. and Sitzia, J. (2003) Good practice in the conduct and reporting of survey research. *Int J Qual Health Care* [online]. 15 (3), pp. 261-266. [Accessed 23 October 2016].

Kenny, F., Park, C., Neste-Kenny, J. M., Burton, P. A. and Meiers, J. (2009) Using Mobile Learning to Enhance the Quality of Nursing Practice Education . In: Ally, M. ed. (2009) *Mobile Learning Transforming the Delivery of Education and Training* [online]. Edmonton:AU Press, pp. 76-96. [Accessed 22 August 2018].

Killam, L. (2013) Research terminology simplified: Paradigms, axiology, ontology, epistemology and methodology [online]. Sudbury: Laura Killam. [Accessed 09 March 2019].

Kirkwood, A. and Price, L. (2014) Technology-enhanced learning and teaching in higher education: what is ‘enhanced’ and how do we know? A critical literature review. *Learning, Media and Technology* [online]. 39 (1), p. 6–36. [Accessed 23 October 2016].

Kohlbacher, F. (2006) The Use of Qualitative Content Analysis in Case Study Research. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research* [online]. 7 (2). [Accessed 27 October 2016].

Koole, M. L. (2009) Chapter 2: A Model for Framing Mobile Learning. In: Ally, M., ed. (2009) *Mobile Learning Transforming the Delivery of Education and Training* [online]. Edmonton, Canada: AU Press, pp. 25-50. [Accessed 23 November 2019].

Koole, M., McQuilkin, J. L. and Ally, M. (2010) Mobile Learning in Distance Education: Utility or Futility?. *Journal Of Distance Education Revue De L'éducation À Distance* [online]. 24 (2), pp. 59-82. [Accessed 26 October 2016].

Korucu, A. T. and Alkan, A. (2011) Differences between m-learning (mobile learning) and e-learning, basic terminology and usage of m-learning in education. *Procedia Social and Behavioral Sciences* [online]. Volume 15 , pp. 1925-1930. [Accessed 26 October 2016].

Krull , G. and Duarte, J. M. (2017) Research Trends in Mobile Learning in Higher Education: A Systematic Review of Articles (2011 – 2015). *International Review of Research in Open and Distributed Learning* [online]. 18 (7). [Accessed 29 October 2018].

Kukulka-Hulme, A. and Traxler, J. (2007) Design for Mobile and Wireless Technologies In. In: Beetham, H. and Sharpe R., ed., (2007). *Rethinking pedagogy for a digital age: designing*

and delivering e-learning [online]. London, UK: Routledge, p. pp. 180–192. [Accessed 25 November 2016].

Lacey, A. and Luff, D. (2007) *Qualitative Research Analysis* [online]. Yorkshire: The NIHR RDS for the East Midlands / Yorkshire and the Humber. [Accessed 27 October 2016].

Lan, Y.-J., Sung, Y.-T. and Chang, K.-E. (2009) Let us read together: Development and evaluation of a computer-assisted reciprocal early English reading system. *Computers and Education* [online]. 53 (4). [Accessed 30 October 2018].

Leontiev, A. N. (1979) The problem of activity in psychology. In: Wertsch, J. V., ed. *The concept of activity in Soviet psychology* [online]. Armonk, NY: Sharpe, pp. 37-71. [Accessed 30 March 2020].

Lim, C. P. and Hung, W. L. (2003) An activity theory approach to research of ICT integration in Singapore schools. *Computers and Education* [online]. 41 (1), pp. 49-63. [Accessed 02 April 2020].

Lisa, P. and Punya, M. (2004) Webs of activity in online course design and teaching. *ALT-J Research in Learning Technology* [online]. 12 (1), pp. 37-79. [Accessed 4 March 2019].

Madyarov, I. (2012) Distance Content-based Language Instruction: Activity Theory Perspective. In: Perrin, D. G., Perrin, E., Murihead, B. and Betz, M. eds. *International Journal of Instructional Technology and Distance Learning* [online]. 9 (6), pp. 3-16. [Accessed 13 April 2018].

Makhasane, D. S. and Fru, R. N. (2017) Chapter 2: Students' view on integrating technology in learning at a University in Lesotho. In: Meda, L. and Makura, A. H., eds. (2017) *Technology Driven Curriculum for 21st Century Higher Education Student in Africa* [online]. Cameroon: Langaa RPCIG, pp. 5-26. [Accessed 21 March 2020].

Malmqvist, J., Hellberg, K., Gunvie, M., Rose, R. and Shevlin, M. (2019) Conducting the Pilot Study: A Neglected Part of the Research Process? Methodological Findings Supporting the Importance of Piloting in Qualitative Research Studies. *International Journal of Qualitative Methods* [online]. Volume 18, pp. 1-11. [Accessed 30 November 2020].

Marzouki, O. F., Idrissi M. K. and Bennani, S. (2019) Context-sensitive mobile learning systems using the method for engineering learning systems MISA. *18th International*

*Conference on Information Technology Based Higher Education and Training (ITHET)*, 2019, pp. 1-7. [Accessed 13 March 2021].

Mehdipour, Y. and Zerehkafi, H. (2013) Mobile Learning for Education: Benefits and Challenges. *International Journal for Computational Engineering Research* [online]. 3 (6). [Accessed 12 September 2016].

Mensah, E. (2015) Exploring Constructivist Perspectives in the College Classroom. *SAGE Open* [online]. pp. 1-14. [Accessed 14 April 2020].

Moore, J. L., Dickson-Deane, C. and Galyen, K. (2011) e-Learning, online learning, and distance learning environments: Are they the same? *The Internet and Higher Education* [online]. 14 (2), pp. 129-135. [Accessed 23 April 2021].

Musa, U., Mahmud, R. and Jalil, H. A. (2018) A Review of Obstacles of ICT Usage in Nigerian Tertiary Educational Institutions. *International Journal of Human Resource Studies* [online]. 8 (4). [Accessed 28 March 2019].

National Assembly for Wales, Children, Young People and Education Committee (2017) *Report on the Teachers' Professional Learning and Education inquiry* [online]. Cardiff Bay: National Assembly for Wales. Available from: <https://senedd.wales/laid%20documents/cr-ld11338/cr-ld11338-e.pdf> [Accessed 25 November 2020].

National Commission for Colleges of Education NCCE (2012) *TESSA and NCE Minimum Standards Digitization*. [Online] Available from: <http://www.ncceonline.edu.ng/NCCE-Digitization/Welcome.html> [Accessed 10 January 2021].

Nielsen, T. W. (2006) Towards a pedagogy of imagination: a phenomenological case study of holistic education. *Ethnography and Education* [online]. 1 (2), pp. 247-264. [Accessed 28 April 2021].

Nerantzi, C., Wilson, J., Munro, N., Lace-Costigan, G. and Currie, N. (2014) Warning! Modelling Effective Mobile learning is infectious, an example from Higher Education. *UCISA Best Practice Guide using mobile technologies for learning, teaching and assessment* [online]. Available from: [https://www.academia.edu/8138964/Warning\\_Modelling\\_effective\\_mobile\\_learning\\_is\\_infectious\\_an\\_example\\_from\\_Higher\\_Education](https://www.academia.edu/8138964/Warning_Modelling_effective_mobile_learning_is_infectious_an_example_from_Higher_Education) pp. 11-17. [Accessed 19 November 2020].

Noble, H. and Smith, J. (2018) *Issues of validity and reliability in qualitative research* [online]. 18 (2), pp. 34-35. [Accessed 17 June 2019].

Federal Republic of Nigeria (2013) *National Policy on Education 6TH Edition*. [Online] Available from: <https://educatetolead.files.wordpress.com/2016/02/national-education-policy-2013.pdf> [Accessed 05 January 2018].

Nubiola, J. (2015) *Pragmatism and Relativism: A Defense of Pluralism* [online]. Pamplona, Spain: University of Navarra. [Accessed 19 June 2019].

Nvivo (2018) *About coding..* [Online] Available from: [http://help-nv10mac.qsrinternational.com/desktop/concepts/about\\_coding.htm](http://help-nv10mac.qsrinternational.com/desktop/concepts/about_coding.htm). [Accessed 05 March 2019].

Nyikes, Z. (2018) Contemporary Digital Competency Review. *Interdisciplinary Description of Complex Systems* [online]. 16 (1), pp. 124-131. [Accessed 21 October 2020].

O'Connor, H. and Gibson, N. (2003) A Step-by-Step Guide to Qualitative Data Analysis. *Pimatiziwin: A Journal of Aboriginal and Indigenous Community Health* [online]. 1 (1). [Accessed 16 September 2019].

Odukoya, J. A., Bowale, E. and Okunlola, S. (2018) Formulation and implementation of educational policies in Nigeria. *African Educational Research Journal* [online]. 6 (1), pp. 1-4. [Accessed 10 April 2019].

Odukoya, J. A., Bowale, E. and Okunlola, S. (2017) Social impact of mobile learning tablets on education and sustainable development: evidence from a private Nigerian tertiary institution. *WIT Transactions on Ecology and the Environment: WIT Press* [online]. 226 (9), pp. 705-712. [Accessed 29 April 2021].

Okafor, P. (2016) *Social Networking and IM most popular for Mobile users in Nigeria*. [Online] Available from: <https://www.naijatechguide.com/2012/01/social-networking-im-most-popular-for.html> [Accessed 18 February 2017].

Okeowo, G., Agunloye, T. and Johnson, F. (2018) *BudgIT Education Financing: Analysis and Recommendations*. [Online] Available from: <http://yourbudgit.com/wp-content/uploads/2018/11/Education-financing.pdf> [Accessed 10 February 2019].

- Okonji, E. (2015) *Bridging Technology Gap in Education*, Nigeria: ThisDay Newspaper [online]. 17 December. Available from: <https://www.pressreader.com/nigeria/thisday/20151217/281646779091212> [Accessed 23 June 2016].
- Omede, J. (2014) Awareness of Nigerian Students and Teachers about Potential Use of Cell Phone as a Teaching Aid. *British Journal of Education, Society and Behavioural Science* [online]. 4 (5), pp. 647-655. [Accessed 23 June 2016].
- Oni, S. (2012) *Revitalising Nigerian Education in Digital Age*. Lagos, Nigeria: Trafford Publishing. [Accessed 24 June 2016].
- Onwuagboke, B. B. C., Singh, T. K. R. and Fong, S. (2015) Need for ICT Integration for Effective Instructional Delivery in Nigerian Colleges of Education. *Journal of Education and Practice* [online]. 6 (3). [Accessed 27 June 2016].
- Ormerod, R. (2006) The History and Ideas of Pragmatism. *Journal of the Operational Research Society* [online]. 57 (8). [Accessed 23 July 2019].
- Osang, F. B., Tsuma, C. and Ngole, J. (2013) *Prospects And Challenges Of Mobile Learning Implementation In Nigeria: Case Study National Open University of Nigeria*. Harare, Zimbabwe, International Conference on ICT for Africa. [Accessed 23 June 2016].
- Oyelere, S. S., Suhonen, J., Sutinen, E. and Wajiga, M. G., (2018) Design, development, and evaluation of a mobile learning application for computing education. *Education and Information Technologies* [online]. 23 (1), pp. 467-495. [Accessed 29 July 2019].
- Oyelola, O. S. (2015) Lapses in Education Policy Formulation Processes in Nigeria: Implications for the Standard of Education. *Journal of Education and Practice* [online]. 6 (29). [Accessed 23 June 2020].
- Ozdamli, F. (2012) Pedagogical framework of m-learning. *Procedia - Social and Behavioral Sciences* [online]. Issue 31, pp. 927-931. [Accessed 20 June 2018].
- Ozdamli, F. and Asiksoy, G. (2016) Flipped Classroom Approach. *World Journal on Educational Technology: Current Issues* [online]. 8 (2), pp. 98-105. [Accessed 29 January 2017].



- Ozdamli, F. and Cavus, N. (2011) Basic elements and characteristics of mobile learning.. *Procedia - Social and Behavioral Sciences* [online]. Volume 28, pp. 937-942. [Accessed 29 January 2018].
- Ozlem, O. and Kesim, M. (2008) Ozan, O. and Kesim, M. (2008). Providing Scaffolding by Using Mobile Applications in Connectivist Learning Environment. *Research Gate* [online]. [Accessed 19 February 2017].
- Pardi, P. (2019) *What is Knowledge?*. [Online] Available from: [https://www.philosophynews.com/post/20\(11/09/22/What-is-Knowledge.aspx](https://www.philosophynews.com/post/20(11/09/22/What-is-Knowledge.aspx) [Accessed 06 April 2020].
- Partnership, G. S. (2013) *Education Reform: Learning Experience*. [Online] Available from: <https://www.edglossary.org/learning-experience/> [Accessed 20 April 2017].
- Pelzel, M. (2019) Competent, Literate, Fluent: The What and Why of Digital Initiatives. *EDUCAUSE Reviews* [blog]. 17 April Available from: <https://er.educause.edu/blogs/2019/4/competent-literate-fluent-the-what-and-why-of-digital-initiatives> [Accessed 10 November 2020].
- Policy, N. I. (2012) *National Information and Communication Technology (ICT) Policy*. [Online] Available from: <https://nitda.gov.ng/wp-content/uploads/2018/07/National-ICT-Policy1.pdf> [Accessed 03 March 2017].
- Prensky, M. (2001) Digital Natives, Digital Immigrants Part 1. *On the Horizon* [online]. 9 (5). [Accessed 28 January 2021].
- Price, S. and Oliver, M. (2007) A Framework for Conceptualising the Impact of Technology on Teaching and Learning. *Educational Technology and Society* [online]. 10 (1), pp. 16-27. [Accessed 03 February 2017].
- Price, S., Oliver, M. Fartunova, M., Jones, C., Meij, H. V., Stig, M., Mohammad, F., Nikolov, R., Wake, J. and Wasson, B. (2005) *Review of the impact of technology-enhanced learning on roles and practices in Higher Education*. [Online] Available from: <https://pdfs.semanticscholar.org/369b/4a902a77f75783f9b1100cfe25468931c1cc.pdf> [Accessed 5 May 2017].

Priest, H., Roberts, O. and Woods, L. (2002) An overview of three different approaches to the interpretation of qualitative data. Part 1: theoretical issues. *Nurse Researcher* [online]. 10 (1). [Accessed 29 August 2018].

Higgins, S., ZhiMin, X., and Katsipatak, M. (2012) The Impact of Digital Technology on Learning: A Summary for the Education Endowment Foundation. *Education Endowment Foundation* [online]. [Accessed 02 June 2016].

Rafidah, A. K., Abdul Ghani, B. A., Airil Haimi, M. A. and Astri Dwi, J. S. (2018) The Use of Mobile Technology in Promoting Education 4.0 for Higher Education. *Advanced Journal of Technical and Vocational Education* [online]. 2 (3), pp. 34-39. [Accessed 17 November 2019].

Rahman, M. S. (2017) The Advantages and Disadvantages of Using Qualitative and Quantitative Approaches and Methods in Language “Testing and Assessment” Research: A Literature Review. *Journal of Education and Learning*; [online]. 6 (1), pp. 102-112. [Accessed 12 February 2021].

Ratheeswari, K. (2018) Information Communication Technology in Education. *Journal of Applied and Advanced Research, Proceedings of the Conference on “Recent Trend of Teaching Methods in Education”* [online]. 3(1), India [Accessed 28 June 2021].

Redecker, C. and Punie, Y. (2017) *European Framework for the Digital Competence of Educators* [online]. Luxembourg: JRC Science for Policy Report. [Accessed 30 November 2021].

Rogers, C. (2019) *Pedagogical trends for 2019 balance tech with holistic learning*. [Online] Available from: <https://edtechnology.co.uk/latest-news/pedagogical-trends-for-2019-balance-tech-with-holistic-learning/> [Accessed 7 January 2020].

Roller, M. R. and Lavrakas, P. J. (2015) *Applied Qualitative Research Design* [online]. Washington DC: The Guildford Press. [Accessed 18 December 2019].

Ryan, G. T., Young, C. D. and Kraglund-Gauthier, L. W. (2017) Action Research within Pre-Service Teacher Education. *Transformative Dialogues: Teaching & Learning Journal* [online]. 10 (3), pp. 1-18. [Accessed 28 June 2021].

- Salmon, G. (2019) May the Fourth Be with You: Creating Education 4.0. *Journal of Learning for Development* [online]. 6 (2), pp. 95-115. [Accessed 02 July 2020].
- Samuel, A. O. and Adekunle, A. O. (2017) Teacher Preparation and Teaching Professional Competence among Federal Colleges of Education Graduates in South West-Nigeria. *Journal of Education and Human development* [online]. 6 (1), pp. 93-105. [Accessed 29 April 2021].
- Sangrà, A., Vlachopoulos, D. and Cabrera, N. (2012) Building an Inclusive Definition of E-Learning: An Approach to the Conceptual Framework. *The International Review of Research in Open and Distance Learning* [online]. 13 (12) pp. 145-159. [Accessed 28 June 2021].
- Saunders, B., Sim, J., Kingstone, T., Baker, S., Waterfield, J., Bartlam, B., Burroughs, H., and Jinks, C. (2018) Saturation in qualitative research: exploring its conceptualization and operationalization. *Qual Quant* [online]. 52 (1), pp. 1893-1907. [Accessed 13 February 2019].
- Saunders, M., Lewis, P., and Thornhill, A. (2015) Understanding research philosophies and approaches to theory development. In: M. N. K. Saunders, P. Lewis and A. Thornhill, eds. *Research Methods for Business Students* [online]. Harlow: Pearson Education, p. 122–161. [Accessed 22 February 2020].
- Scollard, S. (2020) Updating Vocational Curriculum in Two Year Diploma Programs at One Ontario College of Applied Arts and Technology to Align with Current Industry Practices. *Journal of Vocational Education and Training*[online]. 74 (4), p. 623. [Accessed 24 January 2021].
- Seipold, J. (2014) Mobile Learning: Structures, Concepts and Practices of the British and German Mobile Learning Discussion from a Media Education Perspective. *Medien Pädagogik* [online]. p. 30–52. [Accessed 15 June 2017].
- Sharpe, R. and Beetham, H. (2010) Understanding students’ uses of technology for learning: Towards creative appropriation. In: Sharpe, R., Beetham, H. and de Freitas, S., *Rethinking Learning for a Digital Age: How Learners are Shaping their own Experiences* [online]. 1<sup>st</sup> ed. New York: Routledge, pp 160-192. [Accessed 23 September 2020].

- Sharples, M. and Pea, R. (2014) Mobile Learning. In: Sawyer, K., ed. *The Cambridge Handbook of the Learning Sciences* [online]. 2<sup>nd</sup> ed. New York, NY: Cambridge University Press, pp. 501-521. [Accessed 16 January 2017].
- Shenton, A. K. (2004) Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information 22 IOS Press* [online]. Vol. 22, p. 63–75. [Accessed 17 April 2019].
- Singh, G., O'Donoghue, J. and Worton, H. (2005) A Study into The Effects Of eLearning On Higher. *Education, Journal of University Teaching & Learning Practice*, [online]. 2(1), pp. 14-24. [Accessed 02 May 2021].
- Simone, J. V. (2009) Institutional Culture. *Oncology Times* [online]. 31 (5), pp. 5-6. [Accessed 15 January 2021].
- Soini, H., Kronqvist, E. and Huber, G. L. (2011) Epistemologies for Qualitative Research Center for Qualitative Psychology. *Qualitative Psychology Nexus* [online]. 8 (11). [Accessed 15 April 2020].
- Stack, S. (2015) Learning Outcomes in an online vs traditional course. *International Journal for the Scholarship of Teaching and Learning* [online]. 9 (1). [Accessed 18 July 2018].
- Stake, R. E. (1995) *The Art of Case Study Research* [online]. London: Sage Publications. [Accessed 12 January 2021].
- Sukamolson, S. (2007) *Fundamentals of quantitative research* [online]. Bangkok: Language Institute Chulalongkorn. [Accessed 15 January 2021].
- Sumsion, J. (2002) Becoming, being and unbecoming an early childhood educator: a phenomenological case study of teacher attrition. *Teaching and the Teacher Education* [online]. 18 (7), pp. 869-885. [Accessed 30 April 2021].
- Sung, Y. T., Chang, K. E. and Liu, T. (2015) The effects of integrating mobile devices with teaching and learning on students' learning performance: A meta-analysis and research synthesis. *Computers and Education* [online]. [Accessed 04 March 2020].
- Teo, T. (2010) Examining the influence of subjective norm and facilitating conditions on the intention to use technology among pre-service teachers: a structural equation modeling of an

extended technology acceptance model. *Asia Pacific Education Review* [online]. Issue 11, pp. 253-262. [Accessed 18 January 2021].

Thüs, H., Chatti, M. A., Yalcin, E., Pallasch, C., Kyryliuk, B., Mageramov, T. and Schroeder, U. (2012) *Mobile Learning in Context*. [Online] Available from: [https://www.thues.com/upload/pdf/2012/MLC\\_IJTEL\\_final.pdf](https://www.thues.com/upload/pdf/2012/MLC_IJTEL_final.pdf) [Accessed 17 May 2016].

Thomas, D. R. (2006) A General Inductive Approach for Analyzing Qualitative Evaluation Data. *American Journal of Evaluation*[online]. 27 (2), pp. 237-246. [Accessed 09 March 2020].

Thomas, G. (2011) *How to do your Case Study: A Guide For Students And Researchers*. 1<sup>st</sup> ed. London, England: Sage Publication.

Toyo, O. D. (2017) Information and Communication Technology (ICT) Adoption and the Educational Growth of Colleges of Education in Agbor and Warri, Delta State, Nigeria.. *International Journal of Education and Evaluation* [online]. 3 (7). [Accessed 15 April 2020].

Trafford , P. and Shirota, Y. (2011) *An Introduction to Virtual Learning Environments*. [Online] Available from: [https://www.gakushuin.ac.jp/univ/eco/gakkai/pdf\\_files/keizai\\_ronsyuu/contents/contents2006/4803/4803paul/4803paul.pdf](https://www.gakushuin.ac.jp/univ/eco/gakkai/pdf_files/keizai_ronsyuu/contents/contents2006/4803/4803paul/4803paul.pdf) [Accessed 17 May 2016]

Traxler, J. (2009) Chapter 1: Current State of Mobile Learning. In: A. Mohamed, ed. *Mobile Learning Transforming the Delivery of Education and Training* [online]. Edmonton: AU PRESS, pp. 9-24. [Accessed 08 March 2020].

Uden, L. (2007) Activity theory for designing mobile learning. *International Journal of Mobile Learning and Organisation* [online]. 1 (1). [Accessed 17 April 2020].

UNESCO, (2013) *policy guidelines for mobile learning* [online]. Paris, France: UNESCO. [Accessed 16 January 2021].

UNESCO (2013) *UNESCO and Nokia to Use Mobile Technology to Improve Education in Nigeria*. [Online] Available from: <http://www.unesco.org/new/en/member-states/single-view/news/unesco-and-nokia-to-use-mobile-technology-to-improve-education-in-nigeria/> [Accessed 10 May 2018].

- UNESCO (2017) *Education for sustainable development goals*. [Online]  
Available from: <https://unesdoc.unesco.org/ark:/48223/pf0000247444> [Accessed 17 July 2018].
- Usono, A. and Abid, A. (2008) Conceptualising Quality E-learning in Higher Education. *E-Learning*, [online]. 5 (1), pp. 75-88. [Accessed 02 May 2021].
- Vali, R. (2015) *Five ways mobile technology is transforming education*. [Online]  
Available from: <https://www.techradar.com/uk/news/mobile-computing/tablets/five-ways-mobile-technology-is-transforming-education-1282557> [Accessed 20 June 2017].
- Valk, J.-H., Rashid, A. T. and Elder, L. (2010) Using Mobile Phones to Improve Educational Outcomes: An Analysis of Evidence from Asia. *Pan Asia Networking IDRC* [online]. [Accessed 29 July 2016].
- Vanguard Newspaper (2020) *Senate President Calls for Review of Nigeria's Education Curricula*. [Online] Available from: <https://www.vanguardngr.com/2020/03/senate-president-calls-for-review-of-nigerias-education-curricula/> [Accessed 12 February 2021].
- Wang, C. X. and Kinuthia, W. (2004) Defining Technology Enhanced Learning Environments for Pre-Service Teachers. *Conference: Society for Information Technology & Teacher Education International Conference* [online]. Research gate. [Accessed 28 June 2021].
- West, D. M. (2013) *Connected learning: How mobile technology can improve education*, Brookings: Centre for Technology Innovations [online]. [Accessed 30 July 2016].
- White, O., Madgavkar, A., Manyika, J., Woetzel, J., Mahajan, D., J Bughin, J., McCarthy, M. and Sperling, O. (2019) Digital identification: A key to inclusive growth. A report by McKinsey Global Institute [online]. [Accessed 28 June 2021].
- Wiles, G., Crow, G., Charles, V. and Heath, S. (2007) Informed Consent and the Research Process: Following Rules or Striking Balances?. *Sociological Research* [online]. 12 (2). [Accessed 02 July 2018].

Williams, M. and Moser, T. (2019) The Art of Coding and Thematic Exploration in Qualitative Research. *International Management Review* [online]. 15(1), pp. 45-55. [Accessed 14 April 2020].

Wu, W. H., Wu, Y. J., Chen, C. Y., Kao, H. Y., and Lin, C. H. (2012) Review of trends from mobile learning studies: A meta-analysis.. *Computers and Education* [online]. Volume 59, p. 817–827. [Accessed 28 July 2016].

Xu, M. A. and Storr, G. B. (2012) Learning the Concept of Researcher as Instrument in Qualitative Research.. *The Qualitative Report* [online]. 17 (21), pp. 1-18. [Accessed 8 October 2017].

Yardi, S. (2010) *A Theory of Technical Capital*. [Online] Available at: <http://tmsp.umd.edu/position%20papers/Yardi-SocialMediatingTech.pdf> [Accessed 12 January 2021].

Yau, J. Y., Joy, M. and Dickert, S. (2010) A Mobile Context-aware Framework for Managing Learning Schedules – Data Analysis from a Diary Study. *Educational Technology and Society* [online]. 13 (3), pp. 22-32. [Accessed 19 April 2019].

Yazon, A. D. Ang-Manaig, K., Buama, C. A. C. and Tesoro, J. F. B., (2019) Digital Literacy, Digital Competence and Research Productivity of Educators. *Universal Journal of Educational Research* [online]. 7 (8), pp. 1734-1743. [Accessed 10 November 2020].

Yusuf , O. M. and Yusuf, H. . T. (2009) Educational reforms in Nigeria: The potentials of information and communication technology (ICT). *Educational Research and Review* [online]. 4 (5), pp. 225-230. [Accessed 24 October 2016].

Zainal, Z. (2007) Case study as a research method. *Journal Kemanusiaan bil*, [online]. Volume 9. [Accessed 26 March 2018].

Zur, O. and Walker, A. (2015) *On Digital Immigrants and Digital Natives: How the Digital Divide Affects Families, Educational Institutions, and the Workplace*. [Online] Available at: [http://www.zurinstitute.com/digital\\_divide.html](http://www.zurinstitute.com/digital_divide.html) [Accessed 02 February 2021].

# Appendices

## Appendix A: Sample Information Sheet



### Participants Information Sheet for Educators

#### **Technology Enhance Learning: A Case Study of the Potentials of Mobile Technologies in Nigerian College of Education**

##### **Introduction**

My Name is Mrs Arit E. Tabowei a PhD student in Information Technology at the Faculty of Environment and Technology (FET), University of the West of England, Bristol. I am conducting out a research to investigate how to enhance learning using digital and mobile technologies.

##### **What is the study about?**

Studies have shown that there is a technological gap in the Nigerian Education sector due to lack of proper infrastructure to implement policies that encourages the use of technology in teaching and learning in our classrooms. However, there is a rise in the use of mobile and digital technologies such as Android and IOS smart phones and tablets amongst students in higher education institutions. These devices are used for social media, communications, games etc. but hardly used for learning. Therefore, the aim of this study is to explore some of the potentials of mobile technologies and how they can be used to address the educational challenges in Nigeria's education system.



**Why have I been approached?**

You have been approached because the study seeks to engage with educators from a Nigerian Colleges of Education to get information and opinions on the subject.

**Do I have to take part?**

No. It's completely up to you to decide whether you take part in the study.

**What will I be asked to do if I take part?**

If you decide you would like to take part, you would be asked to fill and return the consent form to me. Arrange a date and time to join one of your lectures to observe the pedagogical approach used in teaching and learning within the college. Once this is done, we will then arrange a place and time to meet, either within the campus, or via Skype for a follow up interview. It will be a one-to-one interview with myself during which I will ask you questions from the interview questionnaires. The interview is expected to last no longer than 15 minutes and is a one-off event.

Please note that signing the consent form is **completely voluntary**. If you however decide you would rather not participate in this study, simply ignore this letter and no further contact will be made.

**Can I withdraw if I change my mind and no longer want to participate in this study?**

Yes. You are free to withdraw from this study within 60 days of signing the consent form without giving a reason or completing the withdrawal form. If you do withdraw from a study after some data have been collected, you will be asked to complete a withdrawal form to know if you are comfortable with the data collected thus far to be retained and included in the study.

If you prefer, the data collected can be destroyed and not included in the study.

However, once the research has been completed, and the data analysed, it will not be possible for you to withdraw your data from the study.

Please contact me directly if you wish to withdraw and you will be advised to complete the withdrawal form and send to me. My contact details are provided below.

### **How much of your time will participation involve?**

The observation will last for 30minutes of class session. While the interview will take not more than 15 minutes.

### **Will your participation in the project remain confidential?**

The information you provide is confidential. The data collected for this study will be stored securely and only the researcher conducting this study will have access to this data:

- Audio recordings will be destroyed and/or deleted once the thesis has been submitted and examined.
- The files on the computer will be encrypted (that is no-one other than the researcher will be able to access them) and the computer itself password protected.
- At the end of the study, hard copies of observation notecards will be kept securely in a locked cabinet for 2 years. At the end of this period, they will be destroyed.
- The interview transcript will be made anonymous by removing and replacing any identifying information including your name with a pseudonym. Anonymised direct quotations from your interview may be used in the reports or publications from the study, so your name will not be attached to them.
- All your personal data will be confidential and will be kept separately from your interview responses.

There are some limits to confidentiality: if what is said in the interview makes me think that you, or someone else, is at significant risk of harm, I will have to break confidentiality and speak to a member of staff about this. If possible, I will tell you if I must do this.

### **What will happen to the results?**

The results will be summarised and reported and submitted in a thesis and may be submitted for publication in an academic or professional journal.

### **Are there any risks?**

There are no risks anticipated with participating in this study. However, if you experience any distress following participation you are encouraged to inform the researcher and contact the resources provided at the end of this sheet.

**What are the advantages of taking part?**

Although you may find participating interesting, there are no direct benefits in taking part as you will be doing so voluntarily.

**Who has reviewed the project?**

This study has been reviewed by the Faculty Research Ethics Committee, and approved by the University Research Ethics Committee, University of the West of England, Bristol, United Kingdom.

**Where can I obtain further information about the study if I need it?**

If you have any questions about the study, or wish to withdraw please contact me directly on:

**Complaints**

If you wish to make a complaint or raise concerns about any aspect of this study and do not want to speak to the researcher, you can contact: (*Personal data removed for data protection*).

**Appreciation**

Thank you for taking time to read this information sheet and for considering volunteering for this research. If you do agree to participate your consent will be sought; please see the accompanying consent form. Once signed, you will then be given a copy of this information sheet and also a copy of your signed consent form, to keep.

## Appendix B: Sample Consent Form



### Technology Enhance Learning: A Case Study of the Potentials of Mobile Technologies in Nigerian College of Education

#### Participants Consent Form

*(Please note that signing of this consent form is completely voluntary)*

I have read and understood the information provided about this study on the information sheet and I have been given the opportunity to ask questions.

I hereby give my consent to participate in this study.

Participant's Name: \_\_\_\_\_

Participant's signature: \_\_\_\_\_ Date: \_\_\_\_\_

Researcher's signature: \_\_\_\_\_ Date: \_\_\_\_\_

*A copy of this consent form should be given to you.*

## Appendix C Sample Observation Notecard

### Observation Collection Notecard

#### Technology Enhance Learning: A Case Study of the Potentials of Mobile Technologies in Nigerian College of Education

Tick type of participant:

Student

Lecturer

Type of Observation	Setting	Time	Description of findings
Planning and delivery of lesson			
Accessibility to learning materials			
Accessibility to online learning materials			
Mode of communication with peers and tutors			
ICT systems in place to support learning			

Notes

---

---

---

---

---

---

---

---

## **Appendix D: Sample Interview Questions**

### **Technology Enhance Learning: A Case Study of the Potentials of Mobile Technologies in Nigerian College of Education**

#### **Interview Questions for Educators.**

*These are guidance questions for the semi-structured interviews for participants. These questions are likely to change during this research and there may also be follow up questions depending on participant's response.*

**Question 1.** What is your role in the institution? (Job title and department and levels they teach)

**Question 2.** What is your teaching experience and background? (Qualifications obtained and years of teaching experience)

**Question 3.** Can you describe the pedagogic approach used in this college compared to the higher institution where you studied? (How's the style of teaching here compared to the schools they attended? Meaning any improvements in learning methods over the years or are things the same or worse, is it student centred learning, teacher centred or a mixture of both)

**Question 4.** What is different in terms of teaching and learning method? (Outline the methods used here that is different from the institution you studied)

**Question 5.** Do you interact with your students outside the classroom? (If yes answer Q6 otherwise skip to Q7)

**Question 6.** How do you interact or communicate with them? (This is to know how information is sent e.g., class rep, notice board, emails or VLE.)

**Question 7.** Can you describe some of the ways learning materials are designed and presented in the classroom? (Manually or electronically? E.g., Presentation slides, printed handouts, tutor presentation using chalk board, tutorials etc)

**Question 8.** From your response Is it challenging preparing and getting lesson materials to students?

**Question 9.** Do you believe that learning Technology has/can address some (if not all) of these challenges? (E.g., VLE, computers with classroom projectors, student emails and staff emails, online library etc)

**Question 10.** Considering the technologies listed previously, can you describe some of the learning technologies that are currently used to aid learning in this institution? (If none or not in use answer question 11 otherwise skip to 13).

**Question 11.** Can you identify some of the factors affecting the use of these technologies in your institution?

**Question 12.** What is the College doing about this?

**Question 13.** What sort of mobile device do you use? (Smartphones, tablets, PDA's)

**Question 14.** What do you use it for mostly?

**Question 15.** What are your thoughts on the use of mobile technologies/devices to support teaching/ learning?

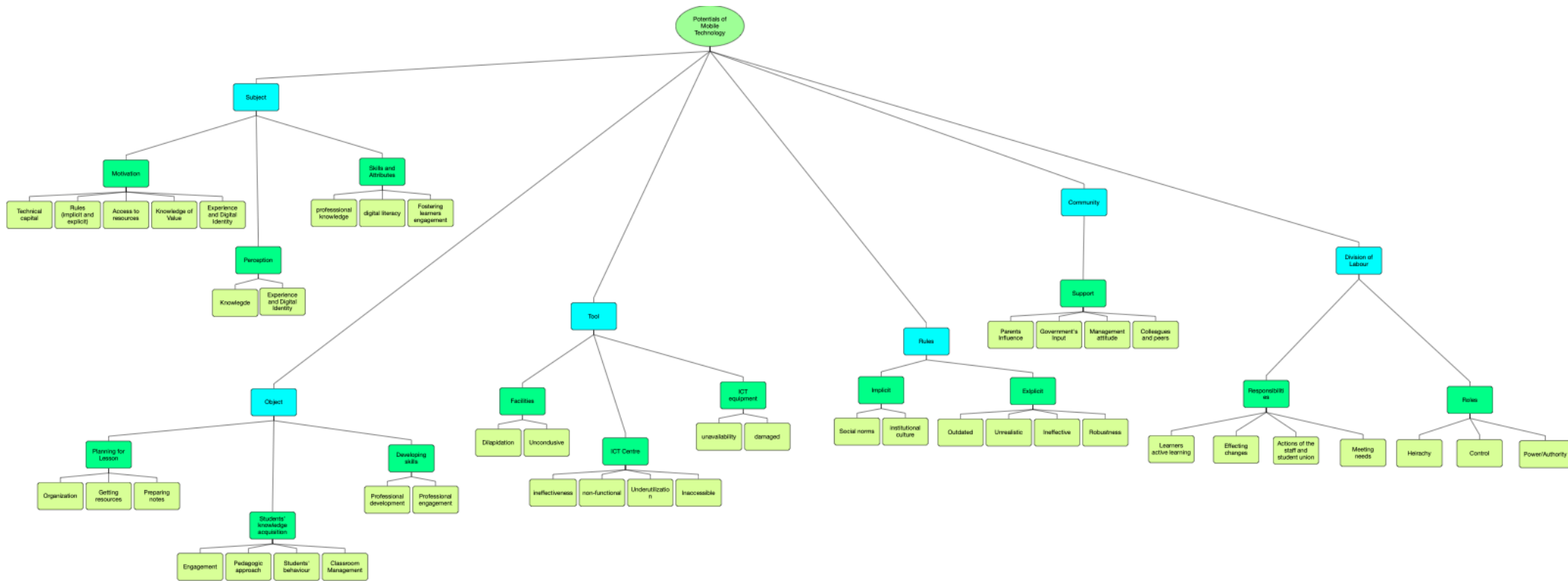
**Question 16.** Do you think that mobile devices can act as a tool to provide access to learning technologies which can overall enhance teaching and learning?

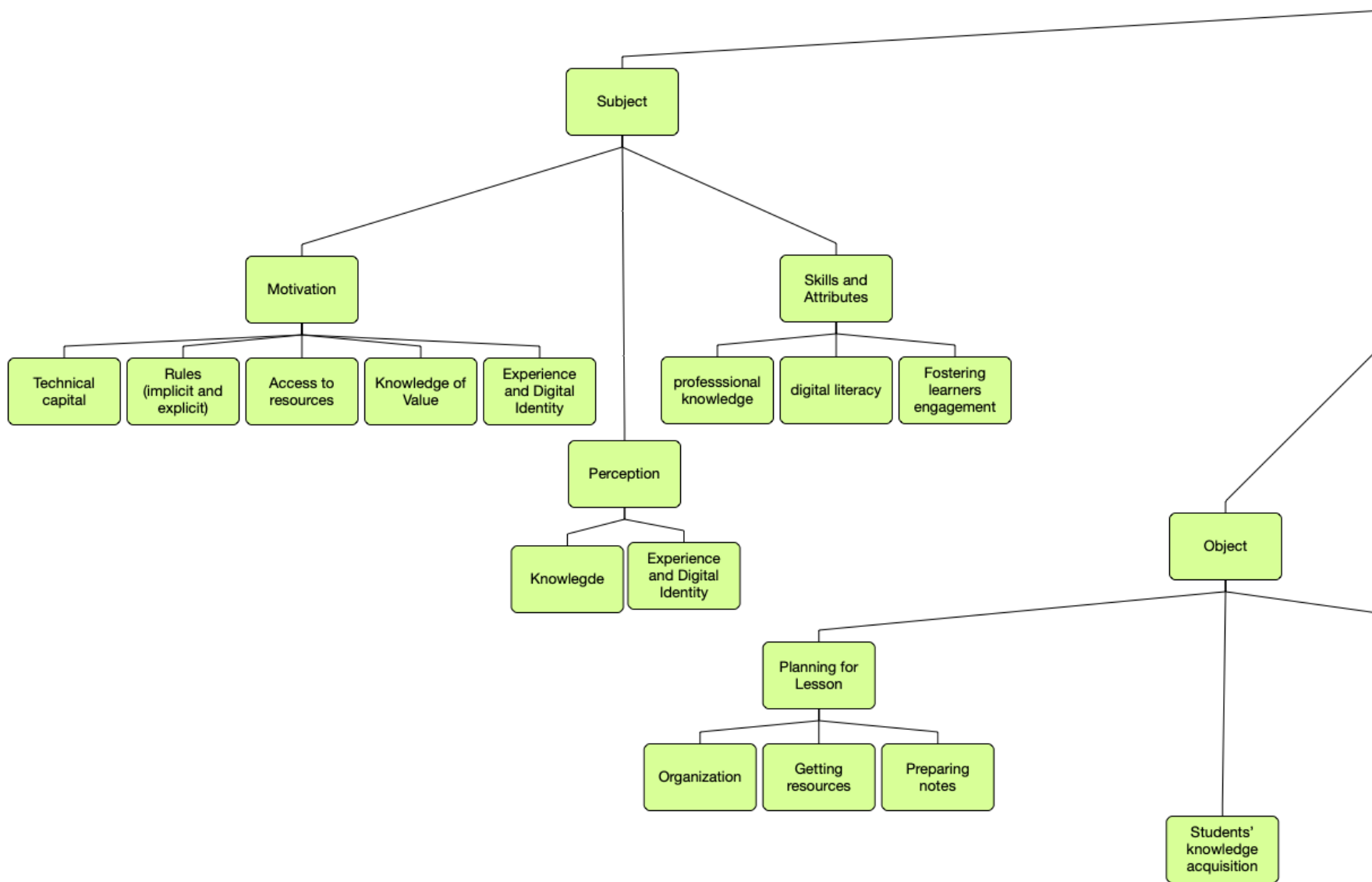
### *Appreciation*

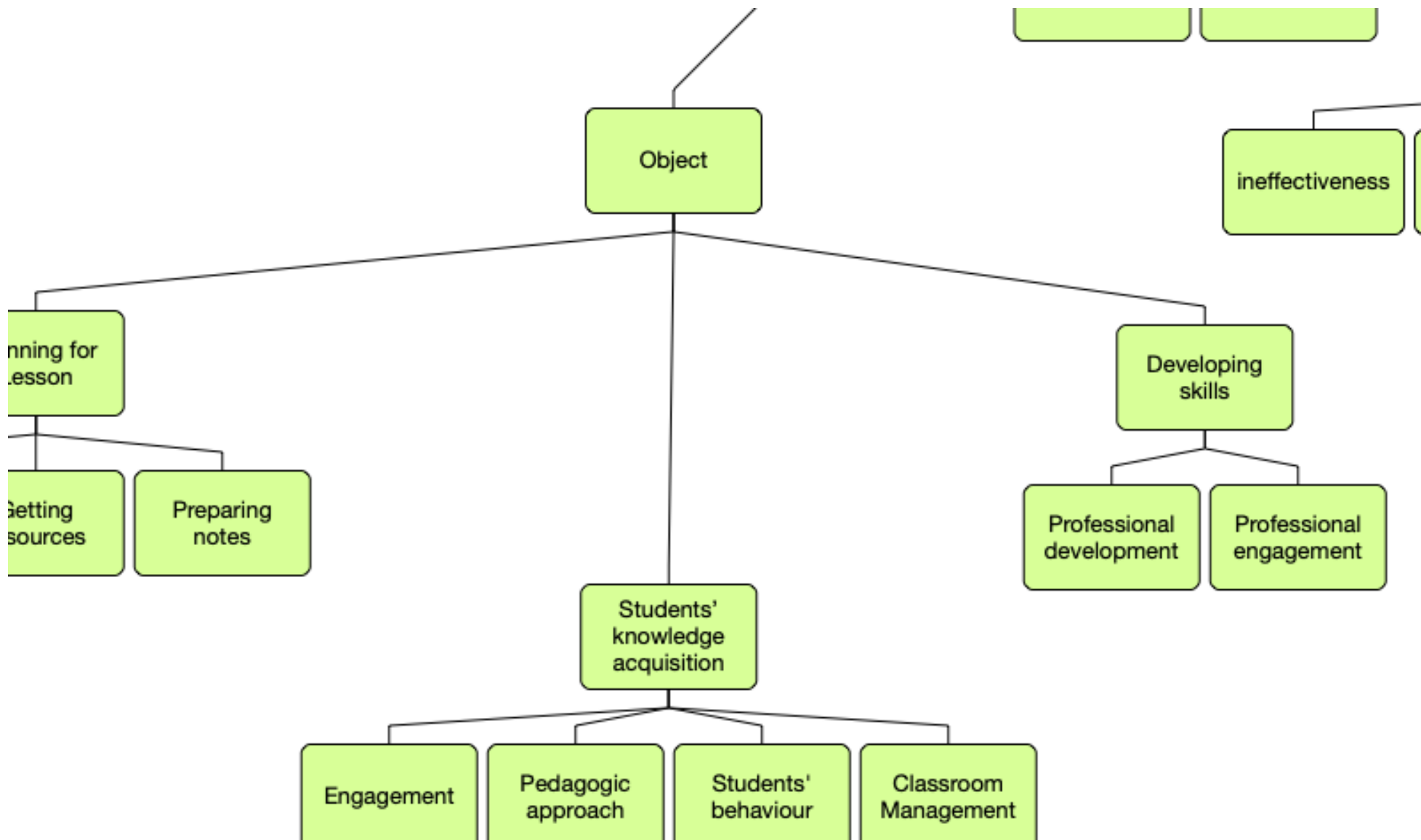
I want to personally thank you for participating in this interview and this study. Your time and support mean a lot as you're helping to build a better learning environment with technology for students and future teachers. You are highly appreciated.

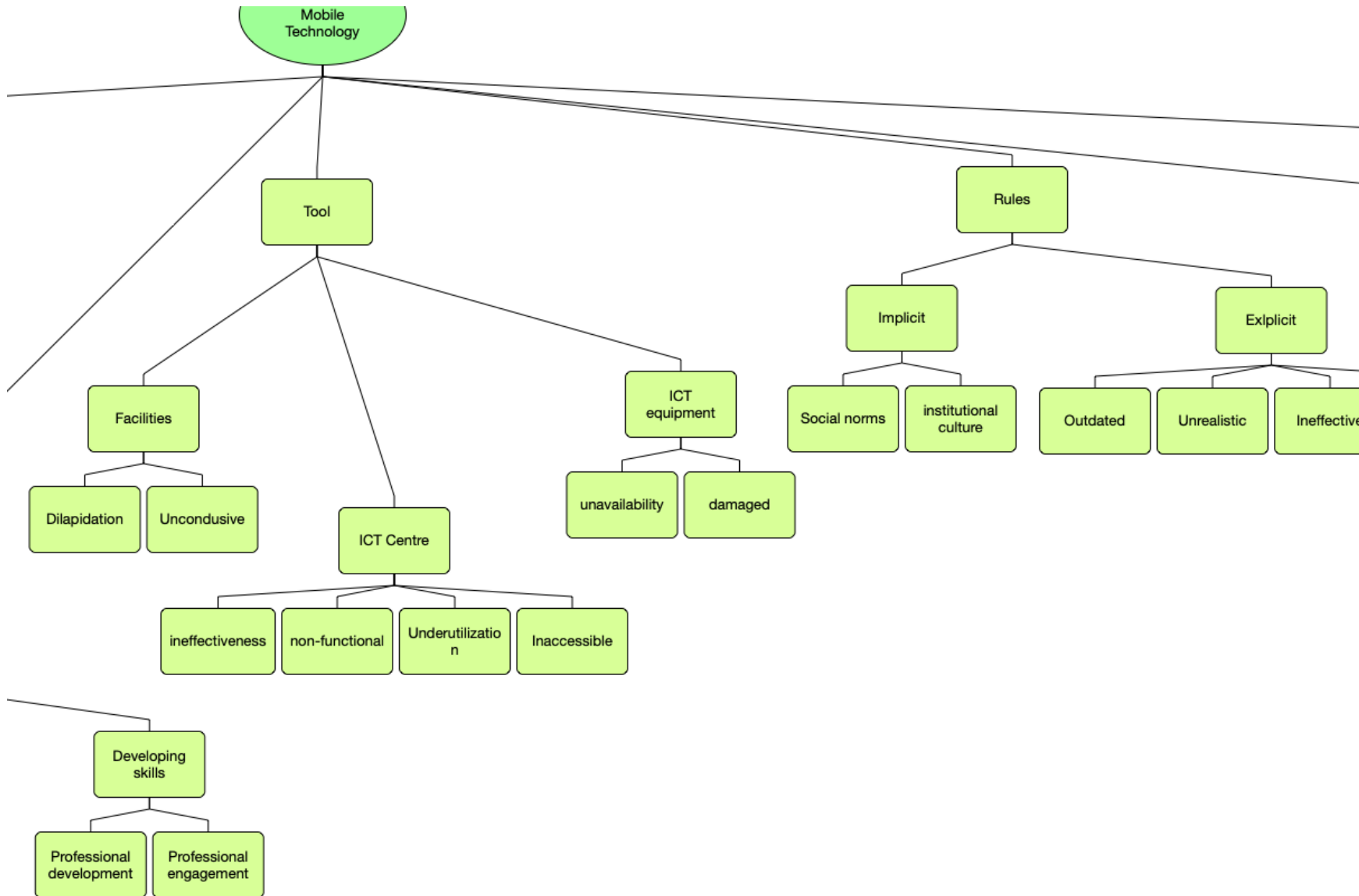


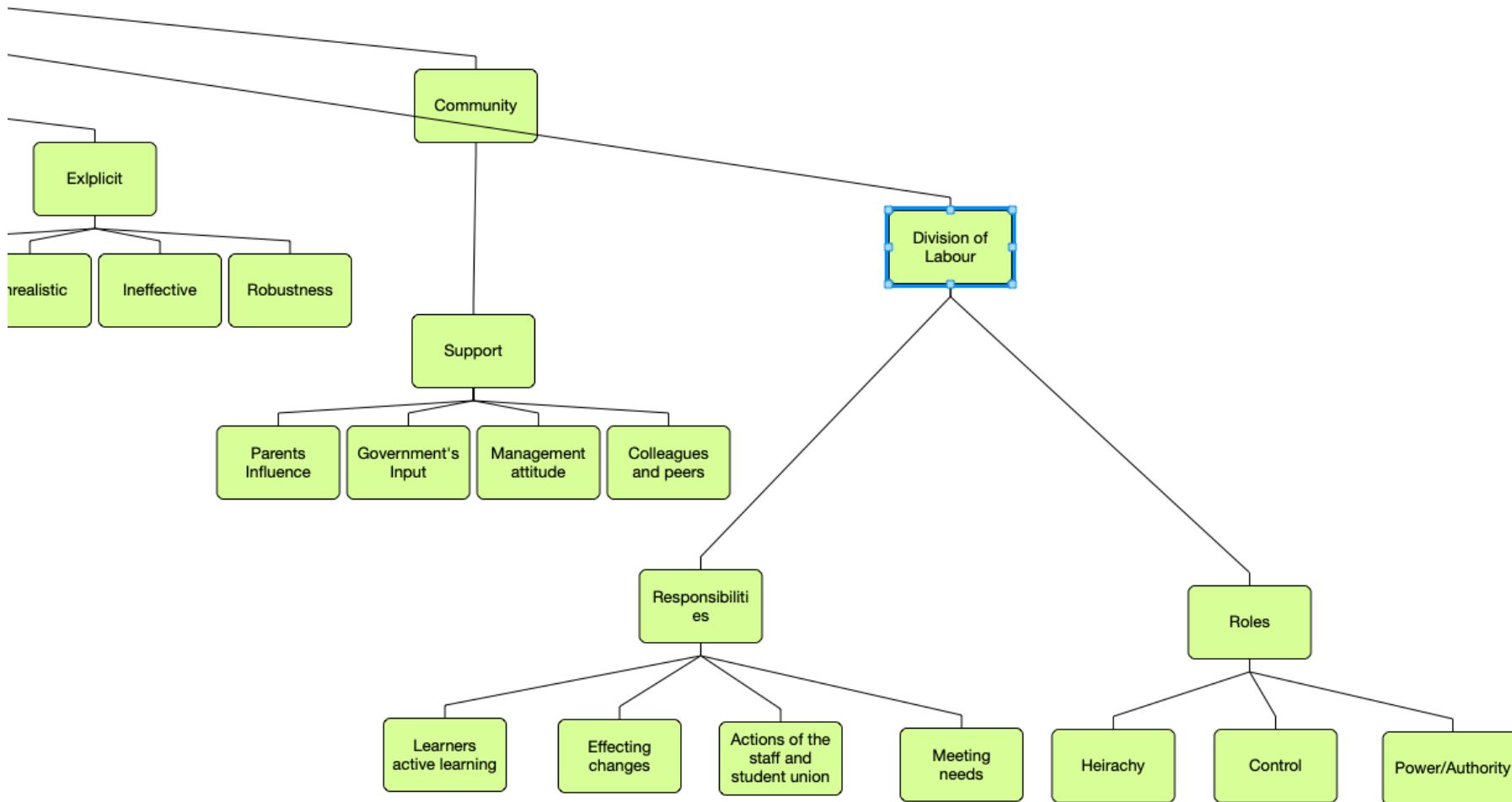
# Appendix E: Themes, and Sub-themes Flow Diagram











## Appendix F: Topics and Description of Contradictions Identified

Themes	Topic	Data Excerpts	Activity system	CHAT Construct	Description of Contradictions	Transformation	Transformation
<b>Current Pedagogic Approach</b>	Teaching and learning method	<i>DICTINT8L106-107:</i> getting the materials to ALL the students is the problem. It's the people's attitude towards trying to access it that is the problem.	<i>Teaching activity</i>	<b>Community</b>	<i>A primary contradiction</i> within the community (All students). The attitude of students towards trying to access learning resources.	No	No
	Communicating learning	<i>FMIINT1L46-49:</i> as you notice in the classroom, some of the students did not participate in the learning because they had to materials. if there was an easier way to prepare the lesson, and send it to them, then	<i>Teaching activity</i>	<b>Community-tool-object</b>	<i>Secondary contradiction</i> as some students (community) cannot participate as the lesson	No	No

	<p>Access to resources</p>	<p>the classroom lesson will be more about explaining than dictating notes.</p> <p><b>FM2OBS7143-144:</b> not every student had the textbook and had to share with classmates who had during the activity.</p>	<p><i>Learning Activity</i></p>	<p><b>Subject-tool-Object</b></p>	<p>due to no access to learning resources.</p> <p><b>Secondary contradictions</b> as the tools are limiting the learners. students who cannot access these resources cannot learn at their own pace.</p>	<p>No</p>	<p>No</p>
	<p>Planning and preparing</p>	<p><b>MLIINT2L68-77:</b> it is highly challenging because not everything, not every updated information that we see is in the textbook. You know as at the time textbook is designed; you see like today new technologies comes out, so we need to get</p>	<p><i>Teaching Activity</i></p>	<p><b>Subject-Tool-Object</b></p>	<p><b>Secondary contradictions:</b> The current learning tool creates contradictions that</p>	<p>The Yes</p>	<p>Yes</p>

<p>lesson materials.</p>	<p>ourselves updated with the new technology. right now, we are faced with so many challenges because we cannot restrict ourselves only to textbooks, it is highly challenging using only textbook and other manual materials to deliver our lectures.</p> <p><b>ML5INT6L42:</b> Through their class representative and phone call to the class rep.</p>			<p>negates the subject from achieving their object.</p>		
<p>Communicating with students</p>		<p><i>Joint activity system</i></p>	<p><b>Community-Tool-Object</b></p>	<p><b>Secondary contradiction</b> as the mode of communication (tool) limits the way and manner information is shared between the educators and learners.</p>	<p>Yes</p>	<p>No</p>



<p><b>Current State of ICT implementation</b></p>	<p>Current state of ICT infrastructure</p>	<p><b>FM2OBS7L132-142:</b> The lesson was conducted in the computer lab in computer science department, which was different considering that all lessons are conducted in the lecture halls. The lab had about 20 computers and a projector section with white board, however the lessons carried on without the use of the technologies in the classroom because there was no electricity (the usual power cuts).</p>	<p><i>Learning activity</i></p>	<p><b>Tool</b></p>	<p><b><i>Quaternary contradiction</i></b> between the tool and the tool producing activity system. Tools not functioning due to environmental factors that should enable the tool function.</p>	<p>No</p>	<p>No</p>
	<p>Access to facility</p>	<p><b>ML3OBS4L184-186:</b> There are sparing locations with collection of computers on campus. There are no computers in the classrooms, neither are the classrooms equipped to accommodate technology.</p>	<p><i>Joint activity system</i></p>	<p><b>Tools</b></p>	<p><b><i>Quaternary contradictions</i></b> between the tool and the tool producing activity. The ICT is situated in a way</p>	<p>No</p>	<p>No</p>

	Usability of ICT facility	<p>There is no podium or computer stations available in the classrooms.</p> <p><b>FM2OBS7L162-163:</b> This educator says she must depend on her own network data to research some information for her students due to lack of WIFI in the school.</p>	Teaching activity	Subject-Tool-Object	<p>that impairs easy access to subjects and community.</p> <p><b>Secondary contradiction</b> as the lack of functioning tool prevents subject from preparing learning resources for students.</p>	Yes	No
<b>Challenges of ICT implementation</b>	Perception of educators and students.	<p><b>ML4OBS5L196-200:</b> For this lesson students depended more on the textbooks. Manuals were only to support additional topic reading. The library and bookshop are where students primarily obtain lesson materials from, and they are of course</p>	Learning activity	Subject-Rule-Tool	<p><b>Secondary contradiction</b> as Rules such as buying a textbook or manual forming part of student assessment, negates their</p>	No	No

	Funding	<p>recommended textbooks which they mostly must buy. Apparently, buying this manual, forms part of their continuous assessment.</p> <p><b>DICTINT8L161-163:</b> We can do better in terms of adopting more sophisticated technologies to address these problems but it's costly, and funding for the college is the major issue.</p>	<p><i>Joint activity system</i></p>	<p><b>External</b></p>	<p>interest in utilizing technology for learning.</p> <p>A <b>quaternary contradiction</b> between the object producing activity and the object. As the college's role of providing the necessary tools for both activity systems to meet their object, is</p>	<p>No</p>	<p>No</p>
--	---------	--	-------------------------------------	------------------------	--	-----------	-----------

Literacy	<p><b>ML3INT4L60-61:</b> the challenge is that most of the students are not computer literate, you must go as low as digging them up from the beginning.</p>	<p><i>Teaching activity</i></p>	<p><b>Subject</b></p>	<p>affected by lack of funding.</p>	<p>No</p>	<p>No</p>
	<p><b>ML5INT6L60-62:</b> if the staff are not trained or know how to use the technology, likewise the students, the challenges will still be there. So, it will only address the challenge when everybody both students and staff are trained.</p>	<p><i>Joint activity system</i></p>	<p><b>DOL-Community-Object</b></p>	<p><b>Primary Contradiction.</b> The community lack the skills to use the tools to achieve its object.</p>	<p>No</p>	<p>No</p>
	<p><b>DICTINT8L63-64:</b> because we have analogue managers functioning in digital age.</p>	<p><i>Teaching activity</i></p>	<p><b>DOL-Rule-Object</b></p>	<p><b>Secondary contradiction</b> Management negating to train staff and students on how to utilise current ICT facilities for learning.</p>	<p>Yes</p>	<p>No</p>

	Underutilization	<p><b>DICTINT8L149-151:</b> Like I mentioned earlier, some of these technologies are in place, but they are hardly used by students and staff. The attitude of management towards technology is also a challenge.</p> <p><b>DICTINT8L117-121:</b> we already created a federal college email platform where the staff and student are supposed to have their email and they are supposed to have on the website a forum for interactions I can bet</p>	<p><i>Joint activity system</i></p> <p><i>Joint activity system</i></p>	<p><b>New mode of activity and existing</b></p> <p><b>New mode of activity and existing</b></p>	<p><b>Secondary contradiction</b></p> <p>Lack of technology knowledge of the community affects the rules they make with regards to the use of ICT in teaching.</p> <p><b>Tertiary contradiction</b> as some members of the community is refusing to utilise the new mode of activity.</p> <p><b>Tertiary contradiction</b> as some members of the</p>	<p>Yes</p> <p>No</p>	<p>No</p> <p>No</p>
--	------------------	--	---	---	---	----------------------	---------------------

	Power	<p>you as I am talking to you, no lecturer has utilized that platform.</p> <p><b>DICTINT8L157-159:</b> First of all, we already know the power situation in the country, so we opted for an alternative power source that is why you can see the solar panels. The solar power only powers the ICT centre and computers and not the entire campus</p>	<p><i>Joint activity system</i></p>	<p><b>Subject-tool-object</b></p>	<p>community is refusing to utilise the new mode of activity.</p> <p><b>Secondary contradiction</b></p> <p>as despite the reconstruction of the tools, it is still limiting the subject from teaching with ICT as the new power source, only generates power for the centre and not the rest of the classrooms.</p>	Yes	No
--	-------	---	-------------------------------------	-----------------------------------	---	-----	----

<p><b>Potentials of Mobile Technology</b></p>	<p>Funding</p>	<p><i>MIL2INT3L89-97</i>: sometimes you drop a message to students on email or in the chat, students will complain that they did not see it because of lack of funds. Most often, to communicate assignments to students, notify them at the beginning, first or second week of every month and their assignment will be done. Once it enters 3rd or 4th week their allowances or pocket money might have gone down for them to recharge or buy data to view the message and it will require the lecturer to visit the school to give out the assignment or call upon the course rep to notify him or her of the assignment on WhatsApp or email for its circulation.</p>	<p><i>Joint activity system</i></p>	<p><b>New mode of activity and the old</b></p>	<p><i>Tertiary contradiction</i> between the new mode of activity, as students are not properly utilizing the communication channel causing educators to juggle between the old mode of communication and new.</p>	<p>No</p>	<p>No</p>
---	----------------	---	-------------------------------------	--	--	-----------	-----------

Attitude of Management	<p><b>DICTINT8L130-134:</b> At a point I was trying to attract a foreign innovation hub in this college, where they produce iPads and tablets for lecturers and students to make us imbibe this new technology so that all of us can benefit from it, at the last trial we find that the college management was not so interested in delivering that type of learning to this institution, so I had to pull out.</p>	<i>Joint activity system</i>	<b>External</b>	<p>A <i>quaternary contradiction</i> between the new object of the joint activity system and the object of the external activity system.</p>	No	No



## **Appendix G: Documents Reviewed**

### **National Teacher Education Policy**

[http://planipolis.iiep.unesco.org/sites/planipolis/files/ressources/nigeria\\_teacher\\_policy.pdf](http://planipolis.iiep.unesco.org/sites/planipolis/files/ressources/nigeria_teacher_policy.pdf)

### **National Commission for Colleges of Education Curriculum Implementation Framework**

<http://www.ncceonline.edu.ng/NCCE-Digitization/base.html>

### **National Policy on ICT In Education**

<https://education.gov.ng/national-policy-on-ict-in-education-2019/#2>

### **National Commission for Colleges of Education Minimum Standard**

<http://www.ncceonline.edu.ng/NCCE-Digitization/base.html>