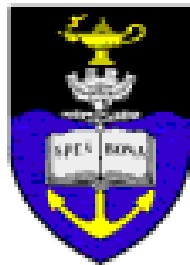


**THE INFLUENCE OF EFFECTIVE USE OF MOBILE DEVICES  
FOR LEARNING OUTSIDE THE CLASSROOM: CASE STUDY  
OF SECONDARY SCHOOL STUDENTS IN TANZANIA AND  
SOUTH AFRICA**

By  
**Samwel Dick Mwapwele**  
**MWPSAM001**

A thesis submitted in fulfilment of the requirements for the Degree of  
Doctor of Philosophy in Information Systems

Faculty of Commerce  
University of Cape Town



August 2017

**Supervisor: Dr Sumarie Roodt**

**DEDICATION**

The copyright of this thesis vests in the author. No quotation from it or information derived from it is to be published without full acknowledgement of the source. The thesis is to be used for private study or non-commercial research purposes only.

Published by the University of Cape Town (UCT) in terms of the non-exclusive license granted to UCT by the author.



To Mom (Prof Rosalia Sam Katapa). As a parent, you gave me all a child could have. Your love for my siblings and I is a blessing. You have pushed me in belief of achieving better. There is no bar I haven't passed. Thank you for being the secret weapon in comforting, guidance and support. Your love is everlasting.

To Dad (Mr Dick Willie Kibisya Mwapwele). I wish you could be on the stage for my graduation. I wish I could have traded places and be with you as God was calling you. I wish success in this world could have not gotten to me so that I spend that one precious minute with you. Only God knows how hard you made sure I was happy. I still recall each visitation you paid to my primary school. I still remember hearing you being happy of my success. I cherish every second these days. I hope this PhD rests well with you. I still love and miss you Dad.

\*\*\*Sleep well in God's comfort Dad\*\*\*



## ACKNOWLEDGMENTS

First and foremost, to God be the Glory. I couldn't have written anything without God's guidance. You have been with me through thick and thin.

To Dr Sumarie. Thank you for being more than a supervisor. As a supervisor, you gave me guidance and prosperity to completion. Unlimited access to your office and ready to hear anytime. As a friend, you were there when I lost my father. I wouldn't be able to thank you enough. I started with a supervisor, now I have a friend.

Prof Ojelanki Ngwenyama opened my eyes to the processes towards a PhD. Prof Irwin Brown polished my views on IS. Prof Wallace and Prof Kyobe provided for informal discussions. Dr Salah Kabanda and Gwamaka Mwalemba, those questions and brainstorming sessions were helpful. To Paul, Carrington, Yasser, Laban, Gordon, Deborah, Shallen, Sikhulile, Deon, Abbey, Mohammed, Tapfuma, Musa, Gordon, Dorothy, Genevieve, Khadija and Selina, those secret hot-chocolate meetings, outings and hiking opened a different view of concepts unimagined before. The entire Information Systems staff and students, thank you for your endless support.

To the Western Cape department of education thank you for quick response during email interactions and providing ethics clearance in time. A special thank you to the principal and teachers of School B, the headmaster and teachers of school A and all the students that participated during data collection. This PhD wouldn't have been complete without your input.

To John, Felimina, Collins and Luciana. Thank you for just being family. Every call ended with "take your time and finish". Thank you for Dick III and Samwel Jnr.



## PLAGIARISM DECLARATION

I, Samwel Dick Mwapwele, hereby declare that this thesis titled “*The influence of effective use of mobile devices for learning outside the classroom: Case study of secondary school students in Tanzania and South Africa*” is my own work.

All sources have been acknowledged through referencing. Neither the substance nor any part of the above thesis has been, is being, or is to be submitted for another degree in this or any other university.

I empower the university to reproduce for research either the whole or any portion of the contents in any manner whatsoever.

Word count of thesis including references, appendixes, table of content, list of tables, list of figures, acknowledgements and dedication is 88,579.

Signed: 

Signed by candidate
---------------------

Date: 17 August 2017



## PUBLICATIONS

Part of this thesis has already appeared in publications. These include:

Conference proceeding:

- Mwapwele, S.D., Roodt, S. (2016). The extent of usage of mobile devices for learning outside the classroom in a secondary school in Tanzania. In Proceedings of International Conference on Information Resource Management (CONF-IRM). University of Cape Town, South Africa. 17-20 May 2016
- Mwapwele, S.D., Roodt, S. (2018). Teachers' adoption and use of mobile devices outside the classroom for learning in Africa: Complementary case study of secondary school teachers in South Africa and Tanzania, *ICTAS 2018 Proceedings*, 28, 74-80

Acceptance by the scholarly community has given direction, encouragement and impetus to the production of this thesis. In all cases, the published works have been reformatted, updated and synthesized into this thesis.



## TABLE OF CONTENTS

Dedication.....	i
Acknowledgments.....	iii
Plagiarism Declaration.....	iv
Publications.....	v
Table of Contents.....	vi
List of Tables.....	xvi
List of Figures.....	xvii
List of acronyms.....	xviii
Abstract.....	xix
Chapter 1: Introduction.....	1
1.1 Introduction.....	1
1.1.1 Problems facing secondary schools in Tanzania and South Africa.....	3
1.1.2 Government and other stakeholder’s solutions to reduce secondary school challenges in Tanzania and South Africa.....	3
1.1.3 Research Question.....	4
1.2 Preliminary literature Review.....	5
1.2.1 Access to mobile devices.....	5
1.2.2 Ability of a student to multi-task.....	5
1.2.3 Students being able to learn from peers.....	6
1.2.4 Students preference of audio, visual and graphical information.....	6
1.2.5 The shift from teacher based learning to student-centred learning.....	6
1.2.6 Teachers supporting students’ use of mobile devices for learning.....	7
1.2.7 Teachers opposing students’ use of mobile devices for learning.....	7
1.2.8 Conclusion.....	7
1.3 What is special with (why) mobile learning?.....	8
1.3.1 Reasons for students’ use of mobile devices for learning.....	9
1.3.2 What are the types of mobile learning?.....	10
1.4 Academic performance in Tanzania and South Africa.....	11
1.4.1 Similarities between schools in South Africa and Tanzania.....	13
1.4.2 Difference between schools in Tanzania and South Africa.....	13
1.5 Potential Contribution.....	15
1.5.1 Practical contributions.....	15



1.5.2	Theoretical contributions .....	15
1.5.3	Contribution to methodology .....	15
1.6	Ethical Considerations .....	16
1.7	Research limitations and assumptions .....	16
1.8	Thesis layout .....	17
Chapter 2: Literature Review .....		18
2.1	Approach used to discuss mobile learning .....	18
2.2	Multiple definitions of mobile learning .....	22
2.2.1	Techno-centric approach to mobile learning vs. education centred approach .....	22
2.2.1.1	Techno-centric approach to mobile learning .....	22
2.2.1.2	Education centred approach to mobile learning .....	23
2.2.2	Mobile learning as an extension of e-learning vs. disruptive technology view of mobile learning.23	
2.2.2.1	Mobile learning as an extension of e-learning .....	23
2.2.2.2	Disruptive (pure) mobile learning .....	24
2.2.3	The application of mobile learning: inside classroom vs. outside classroom use .....	25
2.2.3.1	Inside the classroom application of mobile learning .....	25
2.2.3.2	Outside the classroom application of mobile learning .....	25
2.2.4	What is mobile: student, mobile device, content or context? .....	26
2.2.5	Mobile learning definition for this study .....	28
2.3	Developing countries and their educational problems .....	29
2.3.1	Shortage of teaching and learning materials .....	30
2.3.2	Shortage of teachers .....	31
2.4	Mobile learning affordances .....	32
2.4.1	Students ability to multitask .....	32
2.4.2	Students ability to communicate and collaborate with peers .....	33
2.4.3	Students prefer audio, visual and graphical information as opposed to text only .....	34
2.4.4	Support student-centred learning .....	35
2.4.5	Teachers supporting students use of mobile devices for learning .....	36



2.4.6	Teachers opposing students use of mobile devices for learning .....	36
2.5	Effective use of mobile devices for learning outside the classroom .....	38
2.6	Students' use of mobile devices for learning in South Africa and Tanzania .....	39
2.7	Conclusion .....	40
Chapter 3: Theoretical framework .....		41
3.1.	Introduction.....	41
3.1.1	Limitations of existing adoption theories .....	41
3.1.2	Philosophies and methodological justification of the theories .....	43
3.1.3	Theoretical contribution of the research.....	43
3.1.4	Framework for students' effective use of mobile devices for learning outside the classroom .....	44
3.2	The theory of diffusion of Innovation.....	45
3.2.1	Innovation .....	46
3.2.1.1	Relative advantage .....	46
3.2.1.2	Trialability.....	47
3.2.1.3	Compatibility.....	47
3.2.1.4	Observability .....	48
3.2.1.5	Complexity .....	48
3.2.2	Social systems (process).....	49
3.2.2.1	The norm and its influence on adoption of mobile devices for learning.....	49
3.2.2.2	Network interconnectedness and how it assists in adoption of mobile devices for learning	50
3.2.2.3	Consequences of using mobile devices for learning .....	50
3.2.3	The innovation to decision process .....	51
3.2.4	Disadvantages of diffusion of innovation theory .....	52
3.3	The theory of moral panic.....	53
3.3.1	Moral entrepreneurs and their role in creating moral panic on students use of mobile devices	53
3.3.1.1	Rule creators that introduce moral panic in the society .....	54



3.3.1.2	Rule enforcers and the upholding of norms in the society .....	54
3.3.2	Role of communication channels (mass media and elders) as they discuss students use of mobile devices for learning outside the classroom.....	54
3.3.3	Stages of moral panic .....	55
3.3.4	Fear (concern) on students use of mobile devices for learning outside the classroom	56
3.3.5	Disadvantages of theory of moral panic .....	57
3.4	The theory of positive deviance .....	57
3.4.1	Availability of mobile devices that can be used for learning outside the classroom..	58
3.4.2	Students ability to sustain mobile devices used for learning outside the classroom ..	59
3.4.3	Effective use of mobile devices for learning outside the classroom .....	59
3.4.4	Disadvantages of positive deviance theory .....	60
3.5	Limitations of framework for students' use of mobile devices for learning outside the classroom.	60
3.6	Conclusion .....	61
Chapter 4: Research Design.....		63
4.	Introduction.....	63
4.1	Philosophical approach .....	64
4.1.1	Ontological approach used on this research .....	64
4.1.2	Epistemological approach.....	64
4.1.3	Conclusion on philosophical approach.....	65
4.2	Methodological approach.....	66
4.2.1	Preferable conditions for using case study .....	67
4.2.2	Choice of single vs. multiple case study.....	68
4.2.3	Justification of location for data collection .....	69
4.3	Research methods .....	71
4.3.1	Different approaches to mixed methods.....	71
4.3.2	Independent and dependent variables .....	73
4.3.3	Unit of observation and unit of analysis .....	73
4.3.4	Quantitative approach.....	74



4.3.4	Qualitative approach.....	75
4.3.5	Validity and reliability.....	77
4.3.6	Timeframe .....	79
4.4	Ethics.....	79
4.5	Expected research outcomes .....	81
4.6	Conclusion .....	81
Chapter 5: Quantitative data analysis and findings of School A in Dar-es-salaam .....		83
5.1	Case description .....	83
5.2	Data collection .....	86
5.2.1	Assessment of completed questionnaires from students and teachers .....	87
5.2.2	Data omission during data collection .....	88
5.2.3	Creation of unique numbers on questionnaires .....	88
5.3	Preparation of quantitative data entry and analysis tool .....	89
5.4	Descriptive Analysis .....	90
5.5	Students data analysis and findings .....	91
5.5.1	Availability of mobile devices.....	92
5.5.2	Innovation.....	93
5.5.2.1	Relative advantage offered by mobile devices.....	94
5.5.2.2	Compatibility of mobile devices with textbooks as supplementary sources.....	95
5.5.2.3	Trialability using Google search, YouTube, camera and maps .....	95
5.5.2.4	Observability from peers.....	96
5.5.2.5	Complexity of using mobile devices for learning .....	96
5.5.3	Social system .....	97
5.6	Teachers data analysis and findings.....	98
5.6.1	Availability of mobile devices.....	100
5.6.2	Innovation.....	100
5.6.2.1	Relative advantage offered by mobile devices.....	101
5.6.2.2	Compatibility of mobile devices with textbooks as supplementary sources.....	101
5.6.2.3	Trialability using Google search, YouTube, camera and maps .....	102
5.6.2.4	Observability from peers.....	102



5.6.2.5	Complexity of using mobile devices for learning .....	103
5.6.3	Social system .....	103
5.6.4	Teachers' concerns .....	104
5.7	Conclusion .....	104
Chapter 6: Qualitative data analysis and findings from School A in Dar-es-salaam, Tanzania .....		106
6.1	Introduction.....	106
6.2	Data collection .....	107
6.3	Preparation of qualitative data analysis tool .....	109
6.4	Thematic Analysis .....	110
6.4.1	Familiarization with data .....	111
6.4.2	Generating initial codes .....	114
6.4.3	Searching for themes .....	117
6.4.4	Reviewing themes.....	119
6.4.5	Defining and naming themes .....	123
6.4.6	Producing the report .....	124
6.5	Findings.....	124
6.5.1	Innovation.....	124
6.5.1.1	Relative advantage .....	125
6.5.1.2	Observability .....	129
6.5.1.3	Trialability.....	132
6.5.1.4	Compatibility.....	136
6.5.1.5	Complexity .....	141
6.5.2	Social systems.....	142
6.5.2.1	Norm.....	143
6.5.2.2	Network interconnectedness .....	144
6.5.2.3	Consequences .....	145
6.5.3	Concern.....	146
6.5.3.1	Moral enforcers .....	147
6.5.3.2	Moral creators .....	149



6.5.4	Availability of mobile devices.....	150
6.5.4.1	Mobile device affordances .....	150
6.5.4.2	Risks students take by using mobile devices .....	151
6.5.5	Students ability to sustain mobile devices (sustainability).....	152
6.5.5.1	Self-determination.....	152
6.5.5.2	Self-motivation.....	153
6.5.6	Effective use of mobile device .....	153
6.5.6.1	Better explanation of academic content .....	154
6.5.6.2	Use mobile devices to plan and manage school work.....	156
6.6	Conclusion .....	156
Chapter 7: Quantitative data analysis and findings of School B in Cape Town, South Africa.....		158
7.1	Case description .....	158
7.2	Data collection .....	160
7.2.1	Assessment of completed questionnaires from students and teachers .....	161
7.2.2	Creation of unique numbers on questionnaires .....	162
7.3	Preparation of quantitative data entry and analysis tool .....	162
7.4	Descriptive Analysis .....	163
7.5	Students data analysis and findings .....	163
7.5.1	Availability of mobile devices.....	165
7.5.2	Innovation.....	165
7.5.2.1	Relative advantage offered by mobile devices.....	167
7.5.2.2	Compatibility of mobile devices with textbooks as supplementary sources.....	167
7.5.2.3	Trialability using Google search, YouTube, camera and maps .....	167
7.5.2.4	Observability from peers.....	168
7.5.2.5	Complexity of using mobile devices for learning .....	168
7.5.3	Social system .....	168
7.6	Teachers data analysis and findings.....	169
7.6.1	Availability of mobile devices.....	171
7.6.2	Innovation.....	171



7.6.2.1	Relative advantage offered by mobile devices.....	172
7.6.2.2	Compatibility of mobile devices with textbooks as supplementary sources.....	172
7.6.2.3	Trialability using Google search, YouTube, camera and maps .....	172
7.6.2.4	Observability from peers.....	173
7.6.2.5	Complexity of using mobile devices for learning .....	173
7.6.3	Social system .....	173
7.6.4	Teachers' concerns .....	174
7.7	Conclusion .....	175
Chapter 8: Qualitative data analysis and findings of School B in Cape Town, South Africa.....		176
8.1	Introduction.....	176
8.2	Data collection .....	177
8.3	Preparation of qualitative data analysis tool .....	178
8.4	Thematic Analysis .....	179
8.4.1	Familiarization with data.....	180
8.4.2	Generating initial code.....	182
8.4.3	Searching for themes .....	184
8.4.4	Reviewing themes.....	185
8.4.5	Defining and naming themes.....	189
8.4.6	Producing the report .....	190
8.5	Findings.....	191
8.5.1	Innovation.....	191
8.5.1.1	Relative advantage .....	191
8.5.1.2	Observability .....	193
8.5.1.3	Trialability.....	194
8.5.1.4	Compatibility.....	196
8.5.1.5	Complexity .....	198
8.5.2	Social system .....	199
8.5.2.1	Norms in the society students operate affect use of mobile devices for learning	



8.5.2.2	Network interconnectedness .....	201
8.5.2.3	Consequences .....	201
8.5.3	Concern.....	202
8.5.3.1	Moral enforcers .....	203
8.5.3.2	Moral creators .....	206
8.5.4	Availability of mobile devices.....	206
8.5.4.1	Mobile device affordances .....	206
8.5.4.2	Loss or damage of mobile devices .....	207
8.5.5	Students ability to sustain mobile devices.....	207
8.5.5.1	Self-determination in maintaining a mobile device .....	208
8.5.5.2	Students self-motivation in maintain mobile devices .....	208
8.5.6	Effective use of mobile devices for learning.....	209
8.5.6.1	Better explanations received from using mobile devices.....	209
8.5.6.2	Students use of mobile devices to plan school related activities.....	211
8.6	Conclusion .....	212
Chapter 9: Discussion and conclusion .....		213
9.1	Innovation .....	214
9.2	Social system .....	217
9.3	Concern.....	218
9.4	Sustainability.....	219
9.5	Effective use.....	219
9.6	Experienced realities.....	220
9.7	Recalling research sub-questions .....	221
9.7.1	To what extent are secondary school students in Tanzania and South Africa using mobile devices for learning outside the classroom? .....	221
9.7.2	What mobile device affordances do secondary school students use outside the classroom for learning?.....	222
9.7.3	What influences secondary school students use of mobile devices for learning outside the classroom?.....	222



9.7.4	What does effective use of mobile devices for learning outside the classroom infer in the context of secondary school students' in Tanzania and South Africa and how does it influence academic performance?.....	223
9.7.5	What are teachers' perceptions of students' use of mobile devices for learning outside the classroom?.....	224
9.8	Response to the main research question .....	225
9.9	Conclusion .....	228
Chapter 10: Conclusion.....		229
10.1	Evaluation of Interpretive research .....	229
10.2	Contribution .....	232
10.2.1	Contribution to literature .....	232
10.2.2	Contribution to theory .....	232
10.2.3	Contribution to methodology .....	233
10.3	Conclusion .....	234
10.4	Area for future research .....	235
References.....		237
Appendix 1: Student Questionnaire .....		257
Appendix 2: Teacher Questionnaire .....		260
Appendix 3: Student Interview .....		263
Appendix 4: School A initial codes .....		265
Appendix 5: School B initial codes.....		269
Appendix 6: Ethics application to Faculty of Commerce .....		273
Appendix 7: Ethics application to Doctoral Degree Board at University of Cape Town .....		280
Appendix 8: Ethics approval from University of Cape Town .....		281
Appendix 9: Ethics application to Western Cape department of Education .....		282
Appendix 10: Ethics approval from Western Cape department of Education .....		285
Appendix 11: Consent forms sent to schools (Principals and parents) where data was collected .....		286



## LIST OF TABLES

Table 1: Limitations of existing adoption theories. ....	42
Table 2: Framework for students’ effective use of mobile devices for learning outside the classroom. ....	62
Table 3: Philosophical and methodological approach. ....	82
Table 4: Students demographics and general information. ....	92
Table 5: Hours students spend on mobile devices and using Internet .....	92
Table 6: Students and use of mobile devices. ....	93
Table 7: Students use of networks on academic issues. ....	97
Table 8: Teachers demographic and access to mobile devices. ....	99
Table 9: Time spent by a teacher on a mobile device in a day. ....	100
Table 10: Teachers and their use of mobile devices. ....	101
Table 11: Teachers use of networks for academic purpose. ....	103
Table 12: Teachers views on students’ use of mobile devices. ....	104
Table 13: Phases in thematic analysis. ....	111
Table 14: Organizing of data into data table. ....	113
Table 15: Identification of initial codes. ....	116
Table 16: Searching for themes on what influences students use of mobile device for learning. ....	118
Table 17: Reviewed themes. ....	122
Table 18: Influence of effective use of mobile devices outside the classroom by secondary school students. ....	124
Table 19: Students demographics and general information. ....	164
Table 20: Hours spent by students on mobile devices and Internet. ....	165
Table 21: Students view on using a mobile device. ....	166
Table 22: Students use of networks for learning. ....	169
Table 23: Teachers demographics and ownership of mobile devices. ....	170
Table 24: Hours teachers spend on mobile devices and social media. ....	171
Table 25: Teachers general use of mobile devices and affordances of the innovation. ....	172
Table 26: Teachers identification of network interconnectedness. ....	174
Table 27: Teachers concerns on student use of mobile devices. ....	174
Table 28: Thematic analysis processes. ....	180
Table 29: Familiarization with data. ....	182
Table 30: Generating initial code. ....	183
Table 31: Searching for themes. ....	184
Table 32: Reviewing themes. ....	188
Table 33: Defining and naming themes. ....	190



## LIST OF FIGURES

Figure 1: Framework on students' effective use of mobile devices for learning outside the classroom. ...	44
Figure 2: Map of Charambe .....	83
Figure 3: Zonnebloem district.....	158
Figure 4: Revised framework on students' effective use of mobile devices for learning outside the classroom. ....	214



## LIST OF ACRONYMS

<b>Acronym</b>	<b>Meaning</b>
ICT's	Information and communication technologies
IS	Information Systems
SEUMD	Framework for students' effective use of mobile devices for learning outside the classroom
SMS	Short message service
TV	Television



## ABSTRACT

There is an ongoing debate on whether students' use of mobile devices extends to academic purposes. In developing countries, mobile devices are argued to assist in reducing digital divide and foster educational use leading to poverty alleviation. Framework on students' effective use of mobile devices for learning outside the classroom (SEUMD) is applied as lens. This research investigates, what influence effective use of mobile devices for learning outside the classroom has on academic performance of secondary school students in Tanzania and South Africa.

An Interpretive approach on multiple case studies is employed. A mixed method approach is used that includes, close ended questionnaires, semi-structured interviews and direct observations. A secondary school in Dar-es-salaam and a high school in Cape Town were selected for data collection. Data was collected with Form IV students and their teachers and Grade 12 learners and their teachers. Mixed method is applied to investigate students' and teachers' use of mobile devices for learning outside the classroom. Descriptive statistics is used to analyse questionnaires and thematic analysis for interviews and observations.

Both, students' and teachers' use mobile device to socialize, recreational purposes, searching for information and academic purposes. On academic purposes, mobile devices are used to make phone calls, send short message services and on Internet. Internet use encompass websites, search engines, social networks and instant messaging applications. Students' save pocket money to buy airtime and Internet bundles. Students' receive advice and assistance from peers on mobile devices to acquire and technical help.

Key findings demonstrate students' effective use of mobile devices includes WhatsApp and Facebook to communicate to peers, friends and teachers on educational issues. Students' assist peers by sending pictures, audio and video files that expound on topic of interest. Academic content acquired through other Internet sources is shared to groups students interact with.

The use of SEUMD provides for a new framework that merges technology adoption, concerns in the society and providing a sustainable solution. SEUMD extends discussion on technology adoption by focusing on adopters' goals and analysing sustainability of attaining the goal through effective use. Adoption of a technology is thus assessed as a process that starts before adoption and continues after through sustainability.

# CHAPTER 1: INTRODUCTION

This chapter provides the roadmap for the research. The chapter begins by discussing the use of mobile devices inside and outside the classroom. The chapter discusses problems encountered by secondary schools in Dar-es-salaam and Cape Town and government's interventions. The research gap is explained and the research question developed. The chapter proceeds by discussing literature related to students use of mobile devices outside the classroom. The Theoretical framework is described and related to the research approach. The potential contributions of the research is described and the ethical considerations are discussed followed by limitations and assumptions of the researcher. Finally, the thesis layout is provided.

## 1.1 Introduction

There is an on-going discussion on mobile device affordances for students outside the classroom. The discussion primarily focuses on sending short message services (SMS's), calling, online messaging, searching for information, taking pictures and sharing personal feelings on social media (Hargittai, 2010).

Inside the classroom, the debate is on whether mobile devices should be allowed. Proponents argue, mobile devices increases students' understanding of concepts, content creation, team work, scaffolding and awakens students' participation (Ahmed & Parsons, 2013; Haßler, Major, & Hennessy, 2016; Markett, Sanchez, Weber, & Tangney, 2006).

Opponents raise concerns stating that mobile devices cause chaos, noise from phone ringing, lack of attention and the feeling of inequality by students without access (O'Bannon & Thomas, 2014). This research focuses on students' use of mobile devices for learning outside the classroom where students spend more hours than in classrooms.

Outside the classroom students use mobile devices with the intention of acquiring knowledge and socializing (Wang, Wu, & Wang, 2009). When using mobile devices students want to attain a specific goal that assists in simplifying life and accessing expected content. When this goal is linked to learning, effective use is termed to happen (Burton-Jones & Grange, 2013). The Effective use of mobile devices is dependent on affordances that the mobile device has (Wright & Parchoma, 2011), a students' ability to use the mobile device (Haßler et al., 2016) and assistance offered by peers and teachers (Ciampa, 2014; Parajuli, 2016).

Mobile devices are the most available technology in the world (Kafyulilo, 2014). Use of mobile devices for learning has been a topic of discussion to researchers and has warranted review of literature in the area (Crescente & Lee, 2011; Rajasingham, 2011; Sharples, Taylor, & Vavoula, 2005; Traxler, 2010). The review of literature has focused on understanding mobile devices from developed countries where it is used to enhance and extend content discussed during classroom interactions.

In developing countries, mobile devices are argued to help overcome problems prevalent in the education sector such as shortage of teaching and learning material and shortage of teachers (Scala, 2015). South Africa and Tanzania are two developing countries found in Africa (Mtebe & Raisamo, 2014). This study was conducted in South Africa and Tanzania as the two countries share two common characteristics, an increase in mobile subscription and the presence of students owning mobile devices.

Census report from South Africa in 2011 revealed a decrease of 9.4% in fixed line subscription as reported in Sooryamoorthy (2017). The 2012 census report from Tanzania reported an increase of 0.1% in fixed line subscription (National Bureau of Statistics, 2013). Based on the same documents, mobile subscription increased to 57% in both countries. The second characteristic is studies done in both countries reveal secondary school (matric) students own mobile devices (Chambo, Laizer, Nkansah-Gyekye, & Ndume, 2013; Kreutzer, 2009). The data creates an importance in explaining students' effective use of mobile devices for learning outside the classrooms.

Both countries prohibit the use of mobile devices inside the school. The ban is enforced by the department of basic education and the ministry of education (Chambo et al., 2013). Researches and reports of studies on use of mobile devices for learning inside the classroom emerge from projects that are conducted with different objectives. Conducting a study based on projects is hindered by issues affecting sustainability especially on students side once the project sponsor leaves the project site (Ampofo et al., 2014). To avoid sustainability concerns, this study focuses on outside the classroom use of mobile devices for learning. The study relates effective use of mobile devices and learning which requires analysis of the state of the education sector and where mobile devices are complementing shortages.

### **1.1.1 Problems facing secondary schools in Tanzania and South Africa**

Secondary schools in Tanzania and South Africa are facing several challenges. These include lack of teaching aids (Lujara, Kissaka, Bhalalusesa, & Trojer, 2007; Modisaotsile, 2012), few practicals for science subjects (Semali & Mehta, 2012), shortage of teachers (Modisaotsile, 2012; Wedgwood, 2007) and overcrowding in classrooms (Modisaotsile, 2012; Semali & Mehta, 2012). Other challenges include high student dropout rate (Modisaotsile, 2012; Wedgwood, 2007), shortage of books and reading materials (Chambo et al., 2013; Probyn, 2005), frequent syllabus changes (Modisaotsile, 2012; Vavrus, 2009), shift of the medium of instruction from mother tongue to English (Probyn, 2005; Wyse, Sugrue, Fentiman, & Moon, 2014) and recruitment of teachers with limited proficiency (Nkyabonaki & Mkunde, 2013; Probyn, 2005). Employment of teachers with limited proficiencies is argued to lead to poor attitude towards the teaching profession by both students and teachers (Modisaotsile, 2012; Wyse et al., 2014).

### **1.1.2 Government and other stakeholder's solutions to reduce secondary school challenges in Tanzania and South Africa**

For years the governments have tried to reduce challenges above (Modisaotsile, 2012; Wyse et al., 2014). Governments responses have included opening secondary schools in every ward which reduces overcrowding and time used for travelling to and from school (Nkyabonaki & Mkunde, 2013; Phillips, 2013) and equipping schools with teaching aids and offering alternative to practicals (Jinyevu, 2013; Modisaotsile, 2012; Probyn, 2005). Governments have also introduced change in policies by regularly reviewing curricula and printing syllabus that are distributed countrywide (Brock-Utne, 2007) and offering education on teen-pregnancy to reduce the high dropout rate (Modisaotsile, 2012; Nkyabonaki & Mkunde, 2013).

To date, mother tongue is still used at primary school and English at secondary school as the medium of instruction (Probyn, 2005; Wyse et al., 2014). This is contrary to evidence provided, that use of mother tongue in African countries is important in fostering education (Brock-Utne, 2007; Rubagumya, 1991). The use of English limits students understanding of content and relating context explained to their environments.

To reduce the shortage of teachers in secondary schools, the South Africa and Tanzania governments offer teaching jobs to education graduates (Modisaotsile, 2012; Nkyabonaki & Mkunde, 2013). These Governments provide bursaries and loans to in-service teachers and

university students (Nyahende, 2013) as a motivation to increase secondary school teachers. The decision has reduced high demand for teachers with competitive skills.

Despite government efforts, secondary schools in South Africa and Tanzania still face problems in terms of shortage of textbooks and learning materials as well as shortage of teachers (Bartlett & Vavrus, 2014; Modisaotsile, 2012). In view of these shortages, it is imperative in this study to understand ways that secondary school students are effectively using their mobile devices for learning outside the classroom. This study intends to complement formal learning and not to substitute it.

### **1.1.3 Research Question**

This research will be informed by the research question, *What influence does effective use of mobile devices for learning outside the classroom have on academic performance of secondary school students in Tanzania and South Africa?*

Linked to the above question are the following Sub questions:

- a. To what extent are secondary school students in Tanzania and South Africa using mobile devices for learning outside the classroom?
- b. What mobile device affordances do secondary school students use outside the classroom for learning?
- c. What influences secondary school students use of mobile devices for learning outside the classroom?
- d. What does effective use of mobile devices for learning outside the classroom infer in the context of secondary school students' in Tanzania and South Africa and how does it influence academic performance?
- e. What are teachers' perceptions on students' use of mobile devices for learning outside the classroom?

While answering the main research question, the researcher expounds on the what question by providing explanation on *How* secondary school students use mobile devices outside the classroom and *why* the use is important through linking the discussion to academic performance. The research thus provides explanation on the phenomenon of interest and linking it to academic performance by using 'influence on' as a verb to show contribution the research makes to theoretical framework by interrogating effective use of mobile devices from secondary school students.

There is little empirical and theoretical research done on effective use of mobile devices for learning outside the classroom environment (Parajuli, 2016), specifically in the context of secondary school students in Tanzania and South Africa (Brown, 2005, Kafyulilo, 2014).

## **1.2 Preliminary literature Review**

Worldwide, mobile devices are used for learning outside the classroom at primary schools, secondary schools and universities (Jones, Ramanau, Cross, & Healing, 2010; Oblinger, Oblinger, & Lippincott, 2005; Santos & Ali, 2012). Students start using the Internet at 8 years, mostly through computers and later mobile devices (Hargittai, 2010; Oblinger et al., 2005). Mobile devices offer several affordances to students which enhance students' effective learning and influence academic performance (Melhuish, Falloon, & Melhuish, 2010).

### **1.2.1 Access to mobile devices**

The discussion on mobile device affordances begins by realizing that the technology in question is widely available in the society. Throughout the world, secondary school students use mobile devices outside the classroom for learning (Mohamad & Woollard, 2012; Oblinger et al., 2005). Outside the classroom, studies on use of mobile devices for learning are written either from projects or courses taught (Bappah, 2013; Cloete, de Villiers, & Roodt, 2009). In these studies, students use of mobile devices is related to socializing, entertainment, refreshment and academics (Bappah, 2013; Singh, 2014).

Mobile devices in students' hands offer more than access. Students ownership of mobile devices includes ability to use the technology and finding means to sustain ownership with limited assistance from other stakeholders (Crescente & Lee, 2011). In previous studies on use of mobile devices for learning sustainability has not been given much attention. The Ability for a student to sustain a mobile device comes from pocket money offered by parents, or wages that few studies have acknowledged (Kreutzer, 2009; Twebaze, 2015).

### **1.2.2 Ability of a student to multi-task**

Students perform several activities on their mobile devices when using them (Carlson, 2005 and Jones et al, 2010). Much like in a typical classroom where a student would read what is written on the board, take notes while the teacher continues with explanation, and talks to desk mates (Carlson, 2005), students have employed their mobile devices in the same format. Students would be chatting to peers physically and through devices. On mobile devices, students might be chatting,

watching a video, listening to audio, taking pictures or reading (Kafyulilo, 2014; Singh, 2014). The content interacted with, could be academic or non-academic (Bappah, 2013; Twebaze, 2015).

### **1.2.3 Students being able to learn from peers**

Outside the classroom, students interact with peers and friends. Students are on the quest of receiving information and research shows peers are of main preference (Ciampa, 2014; Tapscott, 1999). Students hold conversations, through phone (or Internet calls), messages (SMS and instant messaging), or on social media (Kumar, Jamatia, Aggarwal, & Kannan, 2011). Students' intention is informing each other on content covered or interactions during formal classes. Students also practice based on academic content that was taught in class and assist others in understanding (Bappah, 2013).

### **1.2.4 Students preference of audio, visual and graphical information**

Apart from preferring information from peers, students understand concepts and retain if provided by using audio, visual and graphical data than text on a ratio of 3:1 (Oblinger et al., 2005). While text is limiting students thinking, audio, or pictorial representation assist them to understand concepts as they can relate to what they know in their environment (Berk, 2009; Hashemi, Azizinezhad, Najafi, & Nesari, 2011). The environment in this case would include home, surrounding areas near home, school, rural areas they have visited, friends' place, church, sporting facilities and any other area the student has once visited.

### **1.2.5 The shift from teacher based learning to student-centred learning**

Worldwide, there has been a shift from teacher based learning to student centred learning where students take control of their learning environment (O'Bannon & Thomas, 2014; Tapscott, 1999). This shift is moving much of the learning to the students and teachers become facilitators instead of initiators. Students are expected to be given the curriculum and the teacher to inform them of the content they have to prepare (Cheon, Lee, Crooks, & Song, 2012).

As such, the class is assumed to be a room for discussion and the teacher provides input which will guide students towards that intended to be learnt. Through student centred learning, students are given competencies of independent learners (Tanzania Institute of Education, 2013).

### **1.2.6 Teachers supporting students' use of mobile devices for learning**

Research shows that there are teachers who support students using their mobile devices for learning (Campbell, 2006; Ciampa, 2014). These teachers even teach students how to use mobile devices for learning. This is part of the effective use of mobile devices. The outcome is that it enriches students' knowledge. It also allows students to understand that they have teachers' support when struggling.

Students thus contact teachers by calling or sending SMS to receive support on academic content (Chiluwa, 2008). Teachers are not forced to give their mobile phone numbers to students (or email addresses), but they voluntarily provide them. Teachers know giving mobile phone numbers will enhance efficient communication with students and ensures learning at any point, inside and outside the classroom (Kafyulilo, 2014; Mtega, Bernard, Msungu, & Sanare, 2012)

### **1.2.7 Teachers opposing students' use of mobile devices for learning**

Teachers are concerned that students are using mobile devices to access inappropriate materials and this has created fear on teachers (Carlson, 2005; Ito, 2005). This fear is coming from teachers feeling they are losing control. Teachers do not know what students are doing on mobile devices. Parents too do not know what their children are doing on mobile devices (Chigona & Chigona, 2008). As a result, teachers argue students are misusing mobile devices (Johnson, Maasdorp, & McElwee, 2014).

### **1.2.8 Conclusion**

Outside the classroom, students in South Africa and Tanzania have access to mobile devices (Chambo et al., 2013; Kreutzer, 2009). Mobile devices are argued to be offering students affordance of multitasking as they hold conversations with peers in physical space and use them (Prensky, 2001; Woempner, 2007).

South African students have preference of audio, visual and graphical information than text (Roodt, 2013). While the preference was deducted from a study on the use of YouTube as learning tool, it can be deduced that students used their mobile devices.

With the shift of learning from teacher centred to student centred (Isaacs, 2007; Tanzania Institute of Education, 2013), mobile devices aid in students understanding concepts. All this is happening with mobile devices students can sustain. Teachers have shared phone numbers and email addresses to assist students on academic issues.

For both countries, little is known of students' preference when receiving information from peers. The situation in Tanzania is worse as information on students' preference on whether audio, video and pictorial content is better than text is not available. Because of the uncertainty, teachers are fearful of students' use of mobile devices and argue for misuse which has ensured that mobile devices are not available at schools. The outcome has been less information on South African and Tanzanian secondary school students' use of mobile devices for learning. This is accompanied by the prohibition of mobile devices which has necessitated a research on outside the school use.

By understanding students' sustainable and effective use of mobile devices, it allows students to use mobile devices to acquire knowledge and skills they can use for life. This form of lifelong learning is another way of understanding effective learning (Brown et al, 2008). A student does not need to pass examinations by getting 100%. To some students, being able to acquire skills they can employ in the working world is perceived as effective learning (Brown et al, 2008).

Beyond access to mobile devices, effective use of mobile devices for learning by secondary school students in Tanzania and South Africa is not discussed. Let alone the use being outside the classroom. As an innovation, certain information about mobile devices is not clear in South African and Tanzanian contexts. Lack of information necessitates collection of empirical evidence that can inform the community of students' effective use of their mobile devices for learning outside the classroom. To this end, justification that necessitates a study on mobile devices is relevant to ensure the right technology is assessed and can offer contribution where most innovations have struggled.

### **1.3 What is special with (why) mobile learning?**

Mobile learning is argued as closest technology that can bridge digital divide prevalent in African countries (Kreutzer, 2009). Discussion of digital divide is beyond the scope of this study. Africa is articulated as the fastest growing continent in mobile learning (Kemp & We Are Social, 2016). It is imperative to understand what motivates students' use of mobile devices for learning.

Habler, Major, & Hennessy (2016) depicted motivational affordance includes team work, scaffolding, self-directed learning and device personalization. Motivational affordance for using mobile devices for learning relates to formal application of mobile device. Students use of mobile devices for learning in an informal context provides convenience, increase motivation, high mental

and physical activities and enrichment of environment (Cavus, Bicen, & Akcil, 2008; Frohberg, Göth, & Schwabe, 2009).

### **1.3.1 Reasons for students' use of mobile devices for learning**

Mobile learning offers convenience to students (Falloon, 2013; Wu et al., 2012). When students are on the move, so are their mobile devices. Students access different content on the Internet, choose what and where to learn from. Convenience provides students ease of learning environment that is not cluttered by organization and set expectations. Students own mobile devices and use is not at an additional cost. It is a daily account of that students are exposed to. Thus, students control all aspects of learning including learning goals.

Students enjoy using mobile devices for learning as it gives confidence on using a technology they are familiar with (Alvarez, Brown, & Nussbaum, 2011; Kumar et al., 2011; Mohamad & Woollard, 2012; Oz, 2014). Confidence increases students' motivation to learn. Students view mobile learning as fun with no boundaries of what, how and why learn certain content. When faced with problems, students know peers will help.

Using mobile devices for learning, students reflect on what they are learning (Sharples, Arnedillo-Sanchez, Milrad, & Vavoula, 2007). Reflection is argued by Frohberg et al. (2009) to offer students elevated level of mental or physical activities. Students' question that learnt, students relate it to content in their immediate surroundings. Students imagine different scenarios of content and can conduct physical tests. Students maintain power of ownership that stimulates reasoning, remembering and learning.

Mobile learning enriches students learning environment (Bappah, 2013, Brown, 2005). Students learn using multiple sources than dependence on selected few that teachers provide. Students access sources of information at a cheaper price as less printing is done (Falloon, 2013). Students learn from audio, video and text based content or a blend of these.

Students use virtual or augmented reality to get better understanding of concepts (Furió, Juan, Seguí, & Vivó, 2015; Rochadel, Da Silva, Da Silva, Luz, & Alves, 2012). Mobile learning provides unlimited learning experiences that is otherwise controlled or hindered in a formal environment.

Reasons provided above resonate with mobile learning as defined by this study. To enrich the study, a discussion on types of mobile learning is necessary.

### **1.3.2 What are the types of mobile learning?**

Mobile learning is categorized and explained by different extensions emergent of it. Categories and extensions are related to theories used in explaining mobile learning. These categories hold different viewpoints from lenses used, they enact and enrich the discussion of mobile learning.

As argued by Crescent & Lee (2011), Frohberg et al. (2009), Kalolo (2015) and Tao (2013), mobile learning can emerge from behaviourist, constructivist, situated, collaborative, support coordination and informal and lifelong learning theories. The categories are from formal definition of mobile learning and extended on this study for informal learning.

Behaviourist theory is on premise that students' observable change in education is re-enforced by a stimulus. The stimulus is feedback from the system (application, or website) the student is accessing. The focus is on students' objective change as an approach to learning using a mobile device.

Students communicate with peers and expect feedback. Peers either verify or nullify students understanding of content. Students might extend by offering better explanation. Mobile learning from behaviourist theory allows students to pace their learning knowing peers will help when they struggle.

Constructivist theory affords students understanding of concepts through incorporating content learnt and prior knowledge. Students have knowledge on scientific studies and observations. Students construct knowledge through different mobile learning environments they engage. Gaming (Gamification) is one experiences students acquire while using mobile devices (Seixas, Gomes, & Filho, 2016). Through games, students relate concepts to different observed objects.

Situated learning theory argues for authentic environment for learning (Bappah, 2013). The theory places emphasizes on the environment that students learn from. The theory supports students' use of mobile devices and demands for active participation in acquiring and generating knowledge. Students use mobile devices with augmented or virtual reality to observe portrays of art, museums and to create impression of these realities (Furió et al., 2015).

Collaborative learning theory demands for students' contribution towards that learnt by drawing on experiences (Mtega et al., 2012). Students organize that intend to learn and extent of learning with a specific goal. The goal is either problem solving or product development. Each student presents skills to peers. When completing activities such as assignments and projects, peers assess and decide on inclusive and discarded content. Examples of students' collaborative learning is

creation of a wiki, group blog, or a group on social networks (i.e. Facebook) and instant messaging (i.e. WhatsApp, Viber, WeChat or MXit) (Kemp & We Are Social, 2016; Keren-Kolb, 2013; Kreutzer, 2009; Singh, 2014). Students enact rich discussions on these platforms without concern on operation. Of vital importance is the discussion held. Each student is a contributor and editor. Group work is achieved with ease.

Support coordination theory is a type of mobile learning that affords students identifying, developing and accessing different activities and technologies. These technologies assist students to access resources to attain targets. Students use mobile devices to create study schedules, enter progress and share with peers. Peers offer input and raise challenges. Through challenges, students increase motivation to learn and acquire knowledge and skills.

Informal and lifelong learning theory in mobile learning demands for understanding that students are constantly learning. The theory affords continuous improvement in students' knowledge and skills (Keren-Kolb, 2013). Lifelong (life-long) learning happens consciously or unconsciously and is based on surroundings or response to stimulus. Informal and lifelong learning theory allows students not to schedule learning but divert learning to understand unclear phenomenon. Students assist peers by finding solutions to a problem. Solutions can be in forms of recording audio, using voice note or immediate by calling, texting or Internet services.

Behaviourist theory lacks appreciation of independent students learning. Constructivist theory does not offer explanation on long-term learning. Collaborative learning assumes individual learning has occurred. The environment is not completely situated as situated learning suggests. Support coordination theory assist where other mobile learning theory exists. It is evident that informal and lifelong learning (referred to as lifelong learning from this point on) is advanced for use on this research as it relates to definition of mobile learning offered.

#### **1.4 Academic performance in Tanzania and South Africa**

Mobile learning affordances are realized when research is conducted in a neutral environment. For this research to produce contributions towards theory and practice, it is important to understand academic systems in South Africa and Tanzania. Explanations from other countries might not work on these settings (Motlik, 2008) due to social, economic and political factors. The research discusses meaning of academic performance, explaining developments and problems in education systems in South Africa and Tanzania.

Academic performance is attached to multiple definitions. One of the definitions relates to short term class results. While the other, long term understanding of concepts (lifelong learning). Short term class results is an efficient way of rating students' performance (Brown, Moola, Mugjenkar, & Sands, 2008, Hew & Leong, 2011). Students are given assignments, homework, projects, tests and examinations. From which, students are ranked from first to last per subject (Ndume, Tilya, & Twaakyondo, 2008).

Results are later aggregated to all subjects per student. A new results list is created organizing students from first to last by percentage, point standards, or alphabetical grades. This form of grading is used in South Africa and Tanzania (Modisaotsile, 2012, Tanzania Institute of Education, 2013). The approach is used to grade students on final year results and final level (ordinary and matric) (Modisaotsile, 2012). Final examinations are done in writing or practical's (laboratories). The results are an indication of academic quality. Arguably, downfalls of the approach is, no consideration on students' oral ability, current state (emotional and psychological) and resources at disposal (Brock-Utne, 2005; Semali & Mehta, 2012). The short term academic performance enforces and is a mere reflection on students cramming ability (Semali & Mehta, 2012). Students join higher level and university where independent critical skills are relevant and struggle (Vavrus, 2009).

The second definition relates to long term acquisition of knowledge. Students relate that learnt in class and their environment (Kreutzer, 2009). The continuous reflection assists students grasp concepts and enhances skills and knowledge. Using continuous reflection and ability to detour during learning, students acquire skills used for a lifetime.

Students acquire skills they can employ in working world or develop personal working world of it (Brown et al., 2008). This is lifelong learning students receive and employ. Examinations are represented as challenges in real life.

This research uses lifelong learning definition of academic performance as it resonates with mobile learning outside the classroom. The short-term definition of academic performance is used to justify certain aspects, selection of school, selection of respondent's grade and respondents for data collection. Having provided the definition, the researcher will now discuss similarities and differences between schools in South Africa and Tanzania.

### **1.4.1 Similarities between schools in South Africa and Tanzania**

Both countries rely heavily on government support in their education system. At secondary school level (grade 8 to 12 and form I to IV) governments have invested heavily to foster distribution of education countrywide.

South Africa has a total of 6772 matric schools with a ratio of 27 students to one qualified teacher (Department of Basic Education, 2016b). At least 70% of the schools are government owned. Tanzania has 4773 registered secondary schools with a teacher to students ratio of 22 (Wakala ya Serikali Mtandao, 2016). 3,601 schools are government owned.

South Africa requires students to pass at least 6 designated subjects from a list of 16 for University entry. One of the subjects must be a first additional language (Department of Basic Education, 2016b). Tanzania education requires a minimum of 7 subjects from at least 13 subjects (Tanzania Institute of Education, 2013). In Tanzania's case, pass leads a student to advanced level education (A-level). Both countries rely on short term academic performance for students' educational advancement.

South Africa and Tanzania have uneven distribution of school resources. Distance to and from school, water, number of teachers, classrooms, teaching and learning material and student to desk ratio is not adequate (Isaacs, 2007; Semali & Mehta, 2012; Visser, Juan, & Feza, 2015). Availability of electricity and Internet has hindered e-learning as access to resources is not guaranteed (Swarts & Wachira, 2010). Most importantly, resources are unevenly distributed to schools in town versus rural areas, suburbs and economic status (Wedgwood, 2007).

### **1.4.2 Difference between schools in Tanzania and South Africa**

South African secondary schools have more students compared to those in Tanzania. There are at least 3.9 million students in secondary schools in South Africa compared to 1.7 million students in Tanzania (Department of Basic Education, 2016a; Wakala ya Serikali Mtandao, 2016).

Resource wise, schools in South Africa are equipped in comparison to Tanzania. Schools in South Africa have laboratories (both for science subjects and computers), relatively more teachers and better facilities i.e. class to student ratio, electricity and other teaching and learning material (Brock-Utne, 2005; Mtebe & Raisamo, 2014; Semali & Mehta, 2012).

While in both countries English is used as the medium of communication in secondary schools, South Africa has also adopted Afrikaans (Brock-Utne, 2005). Afrikaans affords natives to

understand content better (Visser et al., 2015). Despite not benefiting majority in the country, it leads discussions on inclusion of native languages in South Africa. The discussion of using Swahili in secondary school in Tanzania as the medium of communication seems to be closed (Bartlett & Vavrus, 2014; Rubagumya, 1991; Wedgwood, 2007).

Having aligned and compared the two countries and understood the environments, it is evident shortage of qualified teachers, teaching and learning material and overcrowding of concern. Governments have provided solutions but problems are prevalent (section 1.1.2). Use of computers for learning and later formal application of mobile devices have been advocated as solutions, to no avail (Frohberg et al., 2009). These approaches have ended up being project that collapse upon completion (Haßler et al., 2016).

Schools are left with computers but cannot use as electricity and technical personnel are not available (Kreutzer, 2009; Ndume et al., 2008; Swarts & Wachira, 2010). If the intention in African countries is to use technology to enhance learning, it is vital to use technology widely available to students. It is necessary, to look at enhancing learning from informal use before introducing in classrooms. Students would feel connected to approach offered and contribute.

Africa has a total of 1.2 billion people. 986 million are mobile subscribers and 349 million have access to Internet (broadband and fixed) (Kemp & We Are Social, 2016). From a population of 54.7 million people, 35.6 million South Africans have mobile devices (Kemp & We Are Social, 2016). South Africa uses the Internet more than other African countries (Internet World Stats, 2016). The country is ranked second in the world (Kemp & We Are Social, 2016). From a population of 52.4 million Tanzanians, 39.6 million own mobile devices (Tanzania Invest, 2016). 17.2 million Tanzanians use the Internet with 94.3% using mobile devices (Tanzania Invest, 2016). Apart from using mobile devices for calling, sending SMS, setting alarms and reminders, using calendar, calculator and recording (audio and visual), mobile devices are used to access social networks and instant messaging applications.

The social networks famously visited include Facebook, Instagram and Twitter. Messaging applications used include WhatsApp, Facebook Messenger, WeChat, Skype, Viber, BBM and Snapchat (Kemp & We Are Social, 2016). This research that plays a critical role in not only providing a developing country definition of mobile learning but also offering contribution to research in terms of practical, theoretical and methodological using the new framework identified in section 3.1.4 and empirical evidence discussed in chapter 5 to 8.

## **1.5 Potential Contribution**

This research intends to contribute to the Information Systems community, to education stakeholders in Tanzania, South Africa and Sub-Saharan countries (Ciampa, 2014, Gregor, 2006, Tanzania Institute of Education, 2013, Webster & Watson, 2002). Further details are found in section 10.2.

### **1.5.1 Practical contributions**

This research contributes to practice by equipping Tanzanian students with techniques colleagues in South Africa use on mobile devices for learning outside the classroom and vice versa. The research explains to policy makers on the important aspects for development of curriculum in terms of resources students have. It informs students and teachers of effective use of mobile devices for learning and how this helps knowledge on different subject matters based on peer input. Lastly, it assists teachers and parents in understanding students' use of mobile devices outside the classroom.

In response to the research gap on students' lack of knowledge on effective use of mobile devices for learning outside the classroom, this research will contribute to literature on mobile learning in informal environments (Webster & Watson, 2002). Outside the classroom use of technology in other cases is referred to as informal learning. Thus, the research contributes to adoption of technology to learning.

### **1.5.2 Theoretical contributions**

This research uses the framework on students' effective use of mobile devices for learning outside the classroom (SEUMD) as an explanatory theoretical lens. The theoretical framework is new and offers a theoretical contribution to the Information Systems community (Gregor, 2006; Spreitzer & Sonenshein, 2004). The framework merges three theories and merges adoption, fear and sustainability in understanding secondary school students' use of mobile devices outside the classroom.

### **1.5.3 Contribution to methodology**

The research applies mixed methods on multiple case studies on SEUMD to collect and analyse data which provides for a first approach combining these approaches and offers a methodological contribution. The research offers rich description of the cases where data was collected from which beginning researchers may find relevant and can learn from the approach.

## **1.6 Ethical Considerations**

Information Systems research is considerate of ethics and researchers ought to explain procedures and protocols followed during data collection, analysis and reporting (Klein & Myers, 1999; Myers & Newman, 2007). In this research, schools, teachers, parents and students are considered as individuals that would not want to disclose their information and based on ethics requirements, there details are hidden by using pseudo names.

The following ethical issues were considered; the secondary schools were informed on research purpose, how and when data will be collected, the respondents' names and the school name will remain anonymous and data collected will be used for publication. Respondents were informed of the procedure on how data collected will be protected. Respondents were informed that participation was voluntary and can withdraw from participation at any point without providing reasons for such a decision. As such, permission was sought from respondents and upon their permission data collection commenced. Questionnaires did not include respondent's names and are stored in a locked cabinet. Interviews are saved on a computer, encrypted and password protected.

## **1.7 Research limitations and assumptions**

The research was conducted with several limitations that if addressed can provide rich information that further the field of technology adoption and learning. The research is limited in that data was collected from students using mixed methods and for teachers only questionnaires were used. The research is thus limited in stakeholders data was collected from and could have provided multiple narratives if teachers were interviewed, parents and policy makers had contributed to data.

Instead of using multiple case studies that assist in understanding the phenomenon of interest but lack depth in terms of understanding issues around cultural existence of education and value placed in different societies and the contribution of language, an ethnographic study would have been employed. An ethnographic study would have afforded the research access to stakeholders that inform decision on the ban of mobile devices and their justification. Ethnography would have also provided cultural explanation of embedded assumption that respondents do not include during semi-structured interviews.

The researcher operated under the assumption that students use mobile devices daily for several purposes with less focus on learning. The researcher assumed teachers oppose students' use of

mobile devices not only in classrooms but even outside the classroom environment. The researcher assumed that students shall Internet plans and airtime with parents or parents provide for this demand to their children.

## **1.8 Thesis layout**

A deeper discussion on secondary school students' use of mobile devices for learning outside the classroom is covered in chapter 2. Chapter 3 deliberates the theoretical framework leading to creation of SEUMD. Chapter 4 looks at methodology employed on the study while chapters 5 to 8 provide the case descriptions, explain how data analysis was undertaken for each case and provide findings. Chapter 9 delivers a discussion and review of the research question and chapter 10 offers a reflection as an interpretivist, the study contribution to practice, theory and methodology and conclude by offering suggestions for future studies.

## **CHAPTER 2: LITERATURE REVIEW**

Information and Communication Technologies (ICTs) offer several benefits in a community (Avgerou, 2008; Gurstein, 2003) where the technology is adopted. Technology adoption in education provides students and teachers with access to abundant resources that are important and currently not at reach (Donner & Toyama, 2009; Ngwenyama, Andoh-Baidoo, Bollou, & Olga, 2006). ICTs have penetrated Africa and are argued to aid in curbing shortage of teaching and learning resources in education (Ampofo et al., 2014; Isaacs, 2007).

Research depict ICTs are used to aid in reducing inequality and the digital divide (Ferrer, Belvís, & Pàmies, 2011; Kreutzer, 2009). When implemented in schools, ICTs assist with transformation of teaching and learning (Khaddage et al., 2015; Ng'ambi, 2013) from a teacher centred approach to student centred. ICTs include computers, internet and networking platforms, projectors, televisions and mobile devices.

Of the world population, 7.4 billion people, 95% are in areas where mobile network is available (International Telecommunication Union, 2016). There are 3.4 billion internet users and 3.7 billion unique mobile users (Kemp & We Are Social, 2016). Mobile devices are thus the technology most available not only in school but in the world (Kafyulilo, 2014).

A study on how students effectively use mobile devices for learning is imperative. Chapter 2 is structured as follows, I begin by providing multiple definitions of mobile learning (also known as mLearning, M-Learning, or Ubiquitous learning), followed by elaboration of what is mobile and finally craft a new definition of mobile learning the study will use. The Relevance of mobile learning is discussed, after which types of mobile learning are deliberated. Education in terms of academic performance is argued with specifics to similarities and differences of secondary schools from Tanzania and South Africa. A discussion on what influences students' use of mobile devices for learning follows and finally, shortage of research on effective use of mobile devices for learning outside the classroom is described in order to depict the gap in research and empirical evidence.

### **2.1 Approach used to discuss mobile learning**

A discussion on mobile learning must begin with acknowledging fundamental issues that are embedded on literature by examining the types of literature review, concept-centric approach, publications, continents and philosophies. Mobile learning is defined in multiple formats by researchers as explained in section 2.2. Formats used create confusion to new comers and experts

alike. A reviews of arguments in mobile learning has noted multiple definitions and using the traditional approach to literature review a single definition will be developed. However, the researcher begins by explaining assumptions held in review literature on mobile learning.

Literature review can be conducted using systematic or a traditional method. This research uses traditional literature review as a method. Systematic literature review uses comprehensive, rigorous and explicit process in reviewing existing body of scholarly published work in mobile learning (Nguyen, Barton, & Nguyen, 2014; Okoli & Schabram, 2010) by including years, keywords, journal names, city (or country) and bibliometric data to justify importance of conducting review of literature. Systematic literature review thus uses quantification of articles in the process of reviewing relevant literature.

Traditional (also known as conventional or narrative) literature review uses qualitative approach to understand mobile learning studies with quest of narrating human explanations (Nguyen et al., 2014). Traditional literature review uses themes, relationships and contributions to literature in reviewing journal articles, books, reports or any published work related to phenomenon of interest. The contribution is used to praise available research or identify gap related to literature (Boell & Cecez-Kecmanovic, 2014).

Traditional literature review was chosen as it provides depth of phenomenon of interest compared to systematic literature review as explained by Nguyen et al. (2014). The researcher engaged with scholarly published work, reports (not included in journals but relevant) and important unpublished work (Haßler et al., 2016). The researcher read articles with intentions of understanding content, context, researcher (or investigator) role, assumptions held, expected outcomes and influence.

Traditional literature review includes philosophy, approach, purpose, method and theory (or model) used in the researches to provide justification on content of interest. The Approach used is critical in identifying multiple understandings of that stated and purposively left-out. The continual process of interpreting, questioning, argumentation and writing provided in-depth understanding of discussions on mobile learning compared to results that would have been found by systematic literature review which focuses on replicability (Boell & Cecez-Kecmanovic, 2014).

Content wise, I follow a concept centric approach to literature review as identified by Webster & Watson (2002). Concept-centric approach focuses on literature and organize arguments to form concepts (themes) (Webster & Watson, 2002). It is different to author-centric approach where argumentation is on listing researchers and main arguments they have discussed. Based on a

concept, related researches are linked to understand relevant findings on phenomenon of interest (Sylvester, Tate, & Johnstone, 2011). Concept-centric approach is appropriate as it synthesizes literature and allows for detailed explanations that provide depth in understanding students' effective use of mobile devices for learning outside the classroom.

Literature on mobile learning dates back to the 1990s. Mobile learning was a new phenomenon then as it is argued today (Kaliisa & Picard, 2017; Sung, Chang, & Liu, 2016; Weiser, 1993). Following the traditional literature review approach, it is important to identify sources of publications reviewed in order to show depth. Research on mobile learning has been published in academic journals such as ACM, Communication Education, Computer & Education, Computers in Human Behaviour, IEEE, Information Technology for Development, Information Systems Journal, International Journal on E-Learning and International Journal of Technology in Teaching and Learning. Other journals include International Journal of Mobile and Blended Learning, Journal of Computer Assisted Learning, Journal of Emerging trends in Computing and Information Sciences, MIS Quarterly, South Africa Computer Journal and South Africa Journal of Education. Research work that was presented in conferences emerged as conference proceedings in ACIST, ICIS, IEEE related conferences, International Conference on Educational Sciences, mLearn and PACIS. Written reports on mobile learning were sponsored by profound organizations such as SIDA, UNDP, UNESCO and UNFPA to mention a few.

The research considers several technologies as innovations included in the word mobile devices. These technologies are cell phones, smart phones, Personal Digital Assistant (PDA), Netbooks, Tablet PC, Laptop computers, mp3 players and eBook readers (Georgiev, Georgieva, & Smrikarov, 2004; Mtega et al., 2012; Sung et al., 2016). Mobile learning research is discussed in different academic disciplines including, humanities, social science, natural sciences, formal sciences and applied sciences as identified by Wu et al. (2012).

The continent of America (North and South America) has seen low penetration and adoption of mobile learning, but acquiring higher financial revenues compared to other continents (Educational Technology, 2014). Middle East had 18.4% growth rate and Africa was the fastest continent with 38.9%. Africa is experiencing fastest growth in adoption of mobile devices with other continents bridging the gap. Unfortunately, worldwide mobile learning is viewed as a branch of eLearning (Habler et al., 2016; Sharples et al., 2007) and therefore little attention has been given to informal use of mobile devices for learning.

Previous studies have employed different philosophies to understand access, use and perceptions of mobile learning. Positivism, interpretivist, constructivism, instructionism and pragmatic philosophies are used as foundations of knowledge and stance for researcher's arguments (Ally, Lin, McGreal, Woo, & Li, 2005; Frohberg et al., 2009; Looi, Sun, Seow, & Chia, 2014) with constructivism being the dominant philosophy.

Meta theories such as Connectivism are used to show the relationship between use of mobile devices and learning (Siemens, 2005). Within the philosophies, researchers have employed case study (Shonola, Joy, Oyelere, & Suhonen, 2016), action research (X.-B. Chen, 2013), design science (Ahmed & Parsons, 2013), ethnography (Seixas et al., 2016) and literature reviews as methodologies (Wu et al., 2012). The leading methods have been action research and design science.

Using traditional literature review, it was identified that the following theories have received much attention in mobile learning, Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), Activity Theory, Actor Network Theory (ANT), Theory of Planned Behaviour (TPB), Theory of Reasoned Action (TRA), Critical theory and Diffusion of Innovation (DoI) (Sung et al., 2016; Wright & Parchoma, 2011). From theories identified, several models were developed. Koole's FRAME model and Sharples's framework for analysing mobile learning are examples (Koole, 2009; Sharples et al., 2005). Theories that have received much attention of the ones identified earlier are TAM and DoI.

Research related to mobile learning is either written from individuals using their mobile devices for learning or from projects that distribute mobile devices to a society (or school) and collects data. Individual research explains students' use of mobile devices while project research is written to meet objectives (Sung et al., 2016). The problem with research written from projects is the sustainability once funders leave the community while individual projects suffer from inability in some respondents to offer detailed insight due to limit access to certain mobile device affordances. Projects equip students, schools, and communities with mobile devices, applications, or soft skills. Projects intend to fulfil an agenda (Frohberg et al., 2009). Organizations such as United Nations Development Program (UNDP), United Nations Educational, Science and Cultural Organization (UNESCO), Swedish International Development Cooperation Agency (SIDA), International Labour Organization (ILO) and WORLD BANK (WB) have disseminated technology and

knowledge to individuals and communities (Lindhe, Malmberg, & Temu, 2004) as projects and provided interesting findings.

Despite constructivism taking precedence in the philosophies and action research in methods used to discuss mobile learning, much of the research reported was based on projects. Understanding that projects suffer from sustainability issues it was important to offer explanation of mobile learning from an individual point of view as it offers sustainability and has limited empirical evidence published. Further, explanation provided has to incorporate a theory (or framework) that offers sustainability and ensures academic performance as the end goal for students practicing mobile learning. To this end, the research revisits existing definitions of mobile learning in the quest of crafting a new definition that offers sustainability.

## **2.2 Multiple definitions of mobile learning**

There are multiple definitions of mobile learning as discussed by Crescente & Lee (2011). Mobile learning is defined based on technology, dimension and application. Based on technology, mobile learning is defined as either a techno-centric approach or educational approach. Dimension wise, mobile learning is either an extension of electronic learning (e-learning) or a standalone field. Finally, mobile learning is defined by the environment it operates. The environment could be inside or outside a classroom.

### **2.2.1 Techno-centric approach to mobile learning vs. education centred approach**

#### **2.2.1.1 Techno-centric approach to mobile learning**

Techno-centric approach defines mobile learning as students using mobile devices at anyplace and anytime for learning (Hashemi et al., 2011; Nguyen et al., 2014). Mobile devices are used in train stations, at home and at school. Techno-centric approach focuses on mobile device affordances that individual acquire.

Techno-centric approach claims, students do not need study times as argued by Kafyulilo (2014) and Lai (2015). When a student has access to a mobile device they can learn of any content based on their interest. The belief is on technology dominance (Furió et al., 2015). Students access YouTube, Google, Wikipedia and even social media platforms that offer academic content (Berk, 2009; Lai, 2015; Mtega et al., 2012). Focus should be on effective learning and empowering

students (Furió et al., 2015; Hashemi et al., 2011; Kafyulilo, 2014). In a different view, education centred approach calls for organization.

### **2.2.1.2 Education centred approach to mobile learning**

Education centred approach returns education to the traditional format and is favoured by several researchers including Keren-Kolb (2013) and O'Bannon & Thomas (2014). Traditional education gives control to teachers in class (Frohberg et al., 2009; O'Bannon & Thomas, 2014). Teachers use mobile devices to engage, enhance and extend classroom interaction (Keren-Kolb, 2013; Wright & Parchoma, 2011).

Education centred approach includes different technologies, podcasts, blogs and video cast (Keren-Kolb, 2013; Krutka, Bergman, Flores, Mason, & Jack, 2014) in delivering academic content. Teachers control content taught and means of delivery. Mobile devices extend classes and allow for students' participation (Mifsud, Mørch, & Lieberg, 2013). The education centred approach affords teachers retaining instructor role and students' recipient role. Students are active contributors in constructing understanding of content. Teachers are passive and assist where possible.

The two approaches are deeply embedded in discussions of mobile learning. Mobile learning discussions might not explicitly state approach favoured. Active reading of research papers, writing, discussions and conclusions reveals the approach. Information Systems (IS) researchers follow the techno-centric approach (Avgerou, 2008) where the focus is on mobile devices and influence on learning (Donner & Toyama, 2009). When mobile devices are discussed as artefacts, attention is on technology than pedagogies (Falloon, 2013; Winters, 2007). IS research looks at emergent issues when mobile devices and learning interact (Gregor, 2006). The researcher uses techno-centric approach to understand mobile learning as it allows a researcher to focus on effective use instead of its application to teaching where issues around technical assistance, funds for internet and sustainability emerge as obstacles.

## **2.2.2 Mobile learning as an extension of e-learning vs. disruptive technology view of mobile learning.**

### **2.2.2.1 Mobile learning as an extension of e-learning**

Mobile learning is an extension of electronic learning (e-learning) (Crescente & Lee, 2011). E-learning is the use of technology to enhance traditional classroom interaction (Crescente & Lee, 2011; Shudong & Higgins, 2006). E-learning offers notes, tutorials, discussion, marks and several

administrative tasks over the Internet. The traditional class is extended for those who cannot attend. Absenteeism is due to distance, health, or work (Bates, 2005). Mobile learning as an extension of e-learning affords access to e-learning features (Ally et al., 2005, Brown, 2005, Georgiev et al., 2004). Students access systems like blackboard using mobile devices. Mobile learning as an extension of e-learning relates to education centred approach.

Mobile learning as an extension of e-learning provides formal application of mobile learning (Thornton & Houser, 2005). The approach assumes a passive role on students content creation (Trifonova & Ronchetti, 2003). The approach limits students' collaboration. Teachers control content and have power over what students can do as opposed to disruptive mobile learning (Mifsud et al., 2013). Mobile devices are given to students as part of projects to observe use for learning (Markett et al., 2006).

#### **2.2.2.2 Disruptive (pure) mobile learning**

Pure mobile learning affords students control of everything and has been termed as pervasive technology by Jeng et al. (2010) and Traxler (2010). Students own mobile devices, use them daily and deduct when to learn with mobile devices (Furió et al., 2015; Oblinger & Oblinger, 2005). This is viewed as disruptive technology in that it changes mode of communication and learning (Nguyen et al., 2014). Pure mobile learning allows students to set own learning goals, time, content, peers to learn with and breaks.

Content covered relate to that taught in class, current news, or peer request. Students have total control of what, where and why they read. Learning is at the speed of the student and also happens spontaneously (Rozario, Ortlieb, & Rennie, 2016). Pure mobile learning is related to technocentric approach.

Students use mobile devices to search for meanings, define terms or acquire better explanation of content. Outside the classroom use of mobile devices for learning is inferred as informal learning (Santos & Ali, 2012). The approach equips students with knowledge from multiple sources including books and the Internet (Bappah, 2013). Students understand different viewpoints, provide better explanation and critic teachers' explanations.

Perhaps, it is the last part on using mobile devices for learning, critic teachers' explanation that has created fear in teachers. Teachers question content students learn using mobile devices outside the classroom (Kafyulilo, 2014; O'Bannon & Thomas, 2014). Teachers (or parents) have no

control on what the student is learning. Fear is on the critic emerging from use of mobile device for learning and related to quality of material acquired.

This research follows the pure mobile learning approach as it affords control on students where goals, content and time to access material is left to the student especially outside the classroom. Researchers in pure mobile learning call for focus on the praxis and allowing students control over content read (Furió et al., 2015). Informal mobile learning is portrayed as without teachers' control.

### **2.2.3 The application of mobile learning: inside classroom vs. outside classroom use**

#### **2.2.3.1 Inside the classroom application of mobile learning**

Mobile devices are used inside classroom environments with different intentions and in diverse ways. Mobile devices inside the classroom are used to provide explanation, assist with voting or support peer learning (Trifonova & Ronchetti, 2003). Inside the classroom conforms physical space mobile devices are used (Sharples et al., 2007). It was identified that inside the classroom approach to mobile learning includes, classes, laboratories and assembly halls as venues. Inside classroom use of mobile devices follows a structured format. Students are told what to do, how and when. Inside classroom use is related to education centric approach (Furió et al., 2015).

Students follow teachers' instructions in reaching classroom targets on completing content and offering explanations. Discussions on mobile devices inside classroom use emerge mostly from projects and in developed nations (Haßler et al., 2016; Trifonova & Ronchetti, 2003). Inside the classroom application of mobile learning is linked to mobile learning as an extension of e-learning (Melhuish et al., 2010) which is not the approach followed by this research. Inside classroom use of mobile devices offers students access to organized content from an organization (or institution). The content is mobile friendly and easily loaded on mobile devices (Wright & Parchoma, 2011). The main advantage is that, students follow syllabus requirements and centres students learning towards completion of academic goals.

#### **2.2.3.2 Outside the classroom application of mobile learning**

Outside the classroom students use mobile devices independently (Oz, 2014; Sharples et al., 2007; Thornton & Houser, 2005). The independence allows students to socialize, entertain themselves, use the devices for recreational and academic purposes. Outside the classroom as the physical space includes outside the classroom itself (within school premises) and outside school premises.

Students have full control of mobile device whereby students own mobile devices and use them (Traxler, 2010).

Students use mobile devices to acquire better explanation on concepts discussed in class or learn new concepts of interest. Outside the classroom, students read vast content from multiple sources (Bappah, 2013) and the approach relates to techno-centric mobile learning. Both, outside the classroom approach and techno-centric approach to mobile learning suffer from credibility of content (Melhuish et al., 2010) where teachers are interested in knowing what students are learning using mobile devices.

Teachers question students use of mobile devices because of research accounts that have termed use of mobile devices by students as misuse (Mtega et al., 2012; O'Bannon & Thomas, 2014). Few accounts have been given on actual students' use of mobile devices for learning. Further, as studies conducted on individual use of mobile devices no specific devices are available to all students. Devices come from different manufactures (Ally et al., 2005). Devices include recent releases and old versions, distinctive features and classes.

Projects using standardized mobile devices have thrived by receiving attention through publications despite problems with sustainability (Swarts & Wachira, 2010). What affects projects has been argued as sustainability. Ownership of mobile devices by students depends on family income, different social and financial background account. These aspects affect equality and equity in mobile devices used in class as students might struggle to load a page or watch a video based on teachers instructions due to a slow mobile device or no internet credit (Viriyapong & Harfield, 2013). Outside the classroom, students do not focus on equality or equity as they use mobile devices they own. The research follows outside the classroom approach to mobile learning where not only students have control over mobile devices but also can learn at a pace of choice and search for content based on their demand.

#### **2.2.4 What is mobile: student, mobile device, content or context?**

A definition of mobile learning cannot be complete without a review on mobility as argued by Sharples et al. (2007). Mobility in mobile learning is argued from different angles including student, device, content and context (Hashemi et al., 2011; Sharples et al., 2007) with each providing a unique way of viewing mobile learning and enhancing understanding of content students learn.

Students are always on the move (Sharples et al., 2005, Wright & Parchoma, 2011). This can be while going to school, or at school. Students' mobility at school includes at sports grounds, when holding informal discussions with peers, at cafeteria and while in class. Outside the school, students use public transport (buses, taxis and trains), bicycles and walk. Students visit friends and relatives. Students visit restaurants and hold conversations with peers and relatives. This research argues for students' use of mobile devices outside the classroom. Outside the classroom includes sports grounds, cafeteria, in transports, at home and in restaurants.

Mobility on the devices is based on portability and affordances (Ozdamli & Uzunboylu, 2015; Sharples et al., 2007). Mobile devices weigh less than desktop computers and are placed on pockets or bags. Mobile devices incorporate unique affordances from different devices, camera, GPS, recorder, calendar, music player, mobile phone and networking (Bappah, 2013).

Students access different networks on mobile devices. Networks prevalent on mobile devices include second generation (2G), third generation (3G), fourth generation (4G and LTE) and wireless technologies. Networks offer mobile phone calls, short message services and Internet enabled affordances. Students communicate to peers moving between places or buildings. Mobility of a mobile device does not force a student to be stationary. Rather, mobility assists students to complete academic tasks while on the move. Students inform peers of changes in assignment, test or examination date, content covered in class (to absentees) and share pictures, audio and videos taken on different topics.

Content accessed is important when defining mobile learning (Frohberg et al., 2009). In a traditional classroom, content is produced by a teacher. The student is responsible to copying of notes in a class. Students become passive users of information. Mobile learning offers students ability to access content available on Internet (Crescente & Lee, 2011). Students access content, use it and reconstruct certain aspects of it. Using mobile devices, students not only download information, but also construct it (Khaddage et al., 2015). The content is not fixed for computer use, but also for mobile devices. Students access information that is available in another device in a mobile location. This follows techno-centric approach where information is everywhere (Norqvist, 2016) and the content is mobile.

Lastly, the context in which mobile devices operate is important. The context is equated to the environment<sup>1</sup> (Crescente & Lee, 2011; Kumar et al., 2011). The environment mobile devices operate is either formal or informal. Some environments support student use of mobile devices and offer good network reception, while others hinder (Shudong & Higgins, 2006). An example of areas where network reception is a hindrance is next to trees, tall buildings, underground and in remote areas. During network problems, formal context is favoured in some cases.

Informal environment relates to students having full control of device. Informal mobile learning is linked to techno-centric approach, pure mobile learning and outside the classroom use of mobile device for learning. Students become experts of the environments. Students understand places with poor network reception compared to good reception. This research resonates with blended definition of mobility. In it, the researcher argues for mobility of all elements i.e. students, mobile device, content and context. The definition affords students control of mobile devices.

### **2.2.5 Mobile learning definition for this study**

Drawing from techno-centric approach, pure mobile learning, outside classroom learning and blended learning (in relation to mobility) this research does not intend to replace the traditional learning structure at schools but complement current learning structure. This research supplements shortage of teaching and learning material and shortage of teachers by effectively using mobile devices for learning.

Sharples (2005) argues “Learning needs emerge when a person strives to overcome a problem or breakdown in everyday activity” (p.5). Outside the classroom, students face academic problems and either use mobile devices directly (searching for answers) or indirectly (contacting peers to assist). Students have a high reliability on devices they own.

For this research, mobile learning is defined as,

*Informal students’ effective use of mobile devices and technologies outside the classroom with the intention of creating, comprehending and complementing content covered in classroom and beyond.*

This definition allows students to be active content creators, consumers and users of technology. The definition gives students and devices mobility advocated by techno-centric approach. The

---

<sup>1</sup> Context includes historical position, socioeconomic upbringing and political condition. These aspects were not discussed on this chapter. While they impact the study, they are not of significant importance for this study.

definition calls for outside the classroom and informal understanding of students' use of mobile devices. This is opposed to project based studies where sustainability is a concern. More importantly, this research intends to complement traditional learning, not substitute (Hashemi et al., 2011).

Mobile learning is an interesting phenomenon and researches written from developed countries offer insightful information in terms of use of mobile devices for learning and affordances that make application easy, convenient and relevant. Some developing countries have allowed students use of mobile devices in classrooms and researches emerging from such context have offer rich accounts of the actual use. Developing countries context is different to that of developed countries in relation to mobile device access and application in classrooms where a ban has existed for years. Developing countries offer a peculiar context that is relevant to understand in order to acquire insight to what mobile devices can achieve in such a context.

### **2.3 Developing countries and their educational problems**

Mobile devices in developed countries are used to foster further learning (Pelgrum, 2001). Due to low education, literacy rate and economic issues, developing countries have not attained social goals (Ally & Tsinakos, 2014) related to United Nations sustainable development goals (UN-SDG) which includes educational goals. Educational problems have affected not only academic performance, but also physical structures and human resources (Brock-Utne, 2007; Lewin, 2009; Lujara, 2008). Developing countries struggle with shortage of teaching and learning material and shortage of teachers.

Developing countries are reducing education budgets and donors reducing funds (Bartlett & Vavrus, 2014; Swarts & Wachira, 2010) due to economic hardships. Mobile devices are the technology aiding developing countries education outside the classroom (Ally & Tsinakos, 2014). Mobile devices are widely spread in developing countries and increasing faster than desktop computers (Ally & Tsinakos, 2014; Chigona & Chigona, 2008; Kafyulilo, 2014; Kemp & We Are Social, 2016). Leveraging on mobile device benefits (section 1.3.1), mobile devices aid developing countries students learn outside the classroom. The affordances assist students in developing countries learn using mobile devices (Ally & Tsinakos, 2014).

Use of mobile devices in classrooms is prohibited in secondary schools (Kafyulilo, 2014). Teachers are divided on whether students' should or shouldn't be allowed to use mobile devices

for learning (Kihwele & Bali, 2013). Meanwhile, the education system has suffered from same shortages for years (Lujara, Kissaka, Trojer, & Mvungi, 2006) including in teaching and learning materials and teachers.

### **2.3.1 Shortage of teaching and learning materials**

The shortage of teaching material affects developing countries tremendously. Students struggle with basic concepts as aiding tools are in short supply. Teaching material such as, printed and supplementary material, sound and visual tools, pictorial representation, timelines, atlases, plant and animal specimen, apparatus and chemicals are at best limited and worse, not available (Brock-Utne, 2007; Lindhe et al., 2004; Lujara, 2008; Lujara et al., 2006; Mtebe, Mbwilo, & Kissaka, 2016; Semali & Mehta, 2012).

Print material include, textbooks, workbooks, magazines, newspaper and reference books. Supplementary material comprises, teachers' manual, test questions, transparencies, bulletin boards and lesson plans. Examples of sound and visual tools are, films, projectors, television, video tapes, cassette tapes, DVD, VCD, CD, radio and tape recorders. Pictorial representation embraces, photographs, drawings, slides, still pictures, post cards, study prints, albums, scrap books, collages, murals, numbers, symbols and story boards.

These materials are necessary in different subject's secondary school teachers provide. Some materials are found in laboratory comprising computers, language and science (Semali & Mehta, 2012).

For students, learning material aid understanding of content. Learning material include, textbooks, workbooks, programmed materials, television programs, flat pictures, maps, charts, models, mock up, chalkboard, CD and real objects (Lujara, 2008). Learning materials assist students develop a link between their environment and that narrated by the teacher.

Students relate to content through reading, writing, thinking, visualizing, evaluating, discussing and reflecting (Berk, 2009; Boell & Cecez-Kecmanovic, 2014; Lindhe et al., 2004). Different learning materials assist students hold interviews, run presentations, perform drama and create judgement (Lindhe et al., 2004).

Shortage of teaching and learning material mean students fail to relate to content resulting in cramming. Simple concepts are assumed complex because of not relating to content. Some of the teaching and learning material are accessed on mobile devices and reduce complexity students' face.

### **2.3.2 Shortage of teachers**

Economic hardships affect governments in developing countries resulting in poor students to teacher ratio in secondary schools. Governments are the biggest employer of teachers in developing countries (Lujara et al., 2006; Swarts & Wachira, 2010). Employing more teachers means spending more while budget contributions come from donors (Bennell & Mukyanuzi, 2005). Donors have reduced funds. Governments are forced to reduce expenses. Education is affected by number of teachers employed and deployed to schools.

Vacant positions left by teachers that retire, ill, or deceased are not filled (Bennell & Mukyanuzi, 2005). This is besides schools having few teachers. Teachers do not report to posted schools (Bennell & Mukyanuzi, 2005). Reasons for not reporting include, school being in rural area where transport, electricity, water and housing are scarce resources, delay in promotion and provision of allowances (Lujara et al., 2007, 2006; Semali & Mehta, 2012). Teachers get employed in other schools or industries.

Governments provide short term solutions by shortening teachers training (Wedgwood, 2007). Shortening teachers training comes at a cost. Researchers argue, teachers have little grasp of content, lack confidence in classrooms and are not motivated (Bennell & Mukyanuzi, 2005; Mtebe et al., 2016). Teachers are not well trained and enter teachers' college's with low qualifications (Wyse et al., 2014). Secondary school students are taught by less equipped teachers.

Unless the economic situation changes and governments in developing countries increase budgets in education, most secondary schools continue facing shortages (Lujara, 2008; Lujara et al., 2006). Education is the sector providing knowledge and skills for manpower in other sectors (Ampofo et al., 2014). Increase in education leads to development (Rena, 2006). Finding ways of assisting secondary school students complement formal learning is imperative.

While not a solution and rather a complementary tool, students can use mobile devices for learning. Mobile devices aid students learning as they access content, through peers and online. Students access high quality teaching material on mobile devices. Students bridge the gap created by shortage of teachers and teaching material (Kumar et al., 2011; Scala, 2015).

Mobile devices on students hands assist by listening to audio, watch videos, pictures and animated graphics that aid understanding of content (Hashemi et al., 2011; Nguyen et al., 2014; Wu et al., 2012). By accessing such affordances, mobile devices improve students learning which assists with shortage of learning material. Students contact peers and teachers when in need of help.

Students multitask during learning using mobile devices. Students learning is enhanced by affordances offered by mobile devices (Keren-Kolb, 2013).

## **2.4 Mobile learning affordances**

Several studies have been conducted on mobile learning affordances (Domingo & Garganté, 2016; Dunleavy, Dede, & Mitchell, 2009; Mifsud et al., 2013; Norman, 1999). Norman (1999) provides an account of discussion held with Gibson, the person who coined the word affordance. Wright & Parchoma (2011) provide a critique of affordance using actor network theory and focus their study on mobile learning. Cheng & Tsai (2013) look at affordance from an augmented reality study in science learning in the quest of providing direction for future studies. While these studies are relevant and have contributed immensely in studies on mobile learning, lack of identification of necessary issues such as sustainability and its importance in developing countries has not received attention.

Studies on mobile devices in education argue for access, use (intended or actual) and perception (Kafyulilo, 2014). Secondary school students access mobile devices daily (Bappah, 2013; Chambo et al., 2013; Oblinger & Oblinger, 2005). Students use mobile devices for different reasons outside the classroom as identified in section 1.3.1 (Cloete et al., 2009; Mohamad & Woollard, 2012).

The term affordance refers to activities a student performs with a mobile device (Wright & Parchoma, 2011). Affordances come from mobile devices and are extended for learning purposes in an informal environment that supports lifelong learning. The use of mobile devices for learning engages, enhances, extends and enriches students' knowledge acquisition, skills development and creation (Keren-Kolb, 2013).

Mobile learning offers students ability to multitask, peer learn, accommodates preference of audio, visual and graphical information and supports student-centred learning (Melhuish et al., 2010). Teachers (and parents alike) play a vital role in assisting (or disabling) students' access to affordances.

### **2.4.1 Students ability to multitask**

Mobile devices that students use for learning provides ability to multitask. Students perform more than one activity at a time. The argument on students' attention on each task and cognitive distribution allowing learning is beyond this study. Identification of students multitasking is still

important. The importance is in providing better explanation and expansion of students previous understanding (Berk, 2009).

In a traditional classroom, students perform a number of activities at once (Jones et al., 2010). Students listen to the teacher, write notes and discuss content (can be related to that explained or completely unrelated) with desk mates (Carlson, 2005). This ability shows presence of multiple attention span on students.

Outside the classroom, students search for material on mobile devices, while chatting to peers using instant messaging applications (WhatsApp, Kik, WeChat, or Viber). Students chat to peers while listening to radio or watching television. Student learn of recent news, see videos of that unfolding and share with peers (Oblinger et al., 2005). Students use information towards providing better explanation on news.

Students take pictures, record audio and video and share with friends (Bappah, 2013; Keren-Kolb, 2013). Students use all the above to provide better explanation. At the same time, students chat to peers on academic issues. Students show multiple approaches to multitasking.

#### **2.4.2 Students ability to communicate and collaborate with peers**

Outside the classroom, students communicate of what was taught in class. Students hold discussions to cafeteria, to sport fields and when relaxing. Going home, students reflect on central concepts of discussion and relate to things within environment (Bappah, 2013). Students are collaborating and empowering peers. Peer learning is not new and limited to traditional environments.

Mobile learning affords students ability to hold discussions using mobile devices. Students communicate not only to peers at school, but distance friends (and relatives alike) and teachers (Cardoza & Tunks, 2014; Kumar et al., 2011). Students exchange ideas on that taught at school and how they understood it. Some students offer examples peers can relate to. Collaboration provides students with vivid examples they can relate (Rajasingham, 2011). Collaboration allows students to continuously learn when the main intention of communicating with a friend was just greetings (Kearney, Burden, & Rai, 2015).

In older generation, a telephone conversation was expensive and hindered long and in-depth discussions (Gurstein, 2003). Expansion of Internet and presence of instant messaging and social media, mobile Internet calls are less expensive. Ingredients required are Internet access and an Internet bundle. Students use home Internet for communication to peers. Students inform peers of

current developments and the discussion develops to one on academic content e.g. assignments, homework and projects (Ciampa, 2014; Oblinger et al., 2005; Ziani, Elareshi, & Gunter, 2015). Students assist peer's complete tasks that seem hard or unclear.

### **2.4.3 Students prefer audio, visual and graphical information as opposed to text only**

Mobile learning offers students ability to record audio format (also known as voice note) and share with peers (Crescente & Lee, 2011; Oblinger et al., 2005). Peers record views on the topic and respond. This is between peers and in groups.

The application of audio records extends during interviews (Norqvist, 2016). Outside the school, students use mobile devices to record respondents and share with group members. It might be to illicit opinion or share experiences towards task on hand (Martin & Ertzberger, 2013).

Visuals in the form of video clips, movies and YouTube video offer better explanation. Students record themselves completing an assignment and share to peers (Mtebe et al., 2016). The use of videos elicit students' attention, generate interest and creates sense of participation (Berk, 2009). Students' record videos with different intentions. Students record videos to share with peers and for future reference. An unfolding discussion that a student wants to get back to at a later stage can be recorded. Students search for videos on mobile device, or online storage (cloud) facilities (Mtega et al., 2012).

Graphical information includes pictures, diagrams, sketches, tables and charts. Graphical information are enhanced with text to provide explanation (Ciampa, 2014). Graphical information provides representation of information of different format compared to video and allow for multiple interpretations. Graphical information are accessible on mobile devices and students use them to offer elaboration on arguments in assignments (Rochadel et al., 2012). Students share graphical information with peers. A graphic that best represent students' ideas is used in projects. Text infers to use of alphabets, numbers and symbols for information representation. Books, websites and a host of sources of information are predominantly in text. Cameron (2005) depicts students preference of text is 47%. Text is used independently or as an extension (to elaborate) for message delivery.

Research illustrates students preference of audio, visual and graphical information higher at a ratio of 3 to 1 to text only (Oblinger & Oblinger, 2005). Cameron (2005) notes, perhaps, text being rated

higher, is because most of the content for education purposes is in text. Students prefer combination of audio, visual and graphical information compared to text only.

Students show preference by offering feedback on social networks when used for learning (Roodt, de Villiers, & Joubert, 2012). Students use mobile devices while accessing social networks. Students access audios, videos and graphical information in major platforms. Google, YouTube, Vimeo and Netflix are used with intention of acquiring knowledge and skills (Norqvist, 2016).

#### **2.4.4 Support student-centred learning**

Mobile learning supports student-centred learning. Students with mobile devices engage with content and peers collaborate during learning (Frohberg et al., 2009). Whether seated, or on the move, students constantly use mobile devices. Students read, create understanding and share with peers (Oblinger et al., 2005). This depicts student to student learning. Students willingly assist peers on academic issues when using mobile devices.

In a traditional classroom, the approach supports student-centred learning as opposed to teacher-centred (Straub, 2009). Student-centred learning allows for students' creativity to emerge as active creators and users of information (O'Bannon & Thomas, 2015; Oblinger et al., 2005). Teacher-centred learning conforms students to a passive role and lacks entertainment. Students are entertained when engaging with peers using mobile devices. Teacher-centred learning is not fun but a tedious task.

Mobile learning provides students with a voice, activeness and it is fun. Students engage with mobile devices productively by reading, listening, watching and experimenting on content in a subjects of interest (O'Bannon & Thomas, 2015; Thornton & Houser, 2005). Students set own goals which ensure completion.

Mobile learning offers these affordances by equipping students with knowledge and skills of different content (Bappah, 2013; Thornton & Houser, 2005). Mobile learning provides student with skills on how and where to find the content. It is evident that teachers and parents plays a vital role in students' use of mobile devices for learning outside the classroom.

Teachers' approval provides students with confidence and relate by enquiring when struggling. Teachers denial mean students will not contact them. The consequence of students not reaching out includes, lack of knowledge on content, lack of knowledge on where to find information and fear of the teacher during class. The intention of this study is not to supplement traditional classrooms, but comprehend for better students learning.

#### **2.4.5 Teachers supporting students use of mobile devices for learning**

Teachers supporting students' use of mobile devices have given phone numbers or accepted friendship on social media (Kafyulilo, 2014). Students have access to teachers. Students contact teachers by calling, sending short message services and messages on social networks (Kafyulilo, 2014; Mtega et al., 2012).

Communications intend on receiving clarification, source of information or guideline on academic content (Cavus et al., 2008; Chilwa, 2008). Students explore these options to even enquire on administrative information from teachers. Students treat teachers with respect and as "buddies".

Teachers have explained to students how they may effectively use mobile devices to enrich their knowledge (Campbell, 2006; Ciampa, 2014). These teachers take the role of facilitator and extended subjects to include blogs or allow students to share experiences using videos.

Teachers explain different software applications and websites students can access and acquire information (Lai, 2015). Teachers have explained to colleagues the essence of mobile learning.

Teachers use mobile device affordances just as students (Oz, 2014).

#### **2.4.6 Teachers opposing students use of mobile devices for learning**

Teacher fear that students use mobile devices for other purposes than learning (Hashemi et al., 2011). Teachers claim students use mobile devices to hide inappropriate material (Carlson, 2005; Ito, 2005; Leung, 2004). Teachers, especially female teachers, have been sceptical on offering mobile numbers to students. Teachers have received late calls, SMS's and chat (Mtega et al., 2012). This has affected the trust on student use of devices and rename it, misuse.

The fear has created a ban on use of mobile devices at schools (Kafyulilo, 2014; Markett et al., 2006). Media outlets report on isolated cases where inappropriate behaviours were linked to students' use of mobile devices. The result has been more fear (Chigona & Chigona, 2008).

Indirectly, researchers are arguing for power play. Teachers hold parent's role when students are at school. Teachers had control of punishing students and knowing what a student is up to. Mobile devices have made teachers feel they have lost control. Teachers do not know when students are using their mobile devices if it is for learning or not.

The inability to control students use of mobile devices outside the school environment enacted the quest for ban (Chigona & Chigona, 2008; Kafyulilo, 2014; Markett et al., 2006; O'Bannon &

Thomas, 2014). With students using mobile devices, neither teachers, nor parents have control of students (Chigona & Chigona, 2008).

As part of mobile learning affordance, effective use is central. Mobile devices must be used effectively to assist students in acquiring knowledge and skills. Acquiring skills assists with continuation of daily learning and reflecting. Effective learning incorporates experimenting or practicing and observations by students (Lujara, Kissaka, Bhalalusesa, & Trojer, 2007). For this research, effective mobile learning is the act of students using mobile devices to experiment and observe peers in the process of acquiring knowledge and skills.

Students' use of mobile devices outside the classroom is argued to interfere with daily life. Researchers argue, students who constantly use Internet on mobile devices, miss out on other activities peers are performing (Karim & Nigar, 2014). This discussion is facilitated by media outlets as they portray students' use of mobile devices leading to bad behaviour.

Teachers argue students access inappropriate material including pornography, flirt with peers and elders and do not have long attention span (O'Bannon & Thomas, 2014). The adverse has been parents banning or monitoring children mobile devices (Kafyulilo, 2014; Markett et al., 2006). Measure that made students feel controlled by parents and teachers. Students argue their use of mobile devices is for learning (Kafyulilo, 2014).

Research on students' ability to multitask, peer learning and preference for audio, visual and graphical information in South Africa and Tanzania is either unavailable or written from projects. The shift from teacher-based learning to student (learner) centred learning is equipping students in both countries with independent learning skills they require (Roberts, Spencer-Smith, Vanska, & Eskelinen, 2015; Tanzania Institute of Education, 2013).

South Africa and Tanzania have seen the ban of mobile devices at school premises (Chigona & Chigona, 2008; Kafyulilo, 2014). With lack of empirical explanation of the phenomenon in both countries outside the classroom, it calls for research explaining students' effective use of mobile devices for learning.

The discussion of affordances has relied much on that reported from classroom use of mobile devices and few projects that reported on students' use of mobile devices for learning. Worse of, much of the discussion has emerged from developed nations where mobile devices are argued to be allowed in classrooms and students access shared Internet from schools or with parents. Developing countries offer a different context with mobile devices prohibition in secondary

schools and lack of empirical evidence to account for students' use of mobile devices outside the classroom and application of Internet.

## **2.5 Effective use of mobile devices for learning outside the classroom**

The issue of access and use of mobile devices is important during adoption (Gurstein, 2003). Post adoption, focus is on effective use. The term effective use is defined as “using a system in a way that helps attain the goals for using the system” (Burton-Jones & Grange, 2013:633). The definition is developed from system use, centred on three concepts, user, system and task (Burton-Jones & Grange, 2013; Gurstein, 2003).

Task relates to activities performed and goals attained. Effective use of mobile devices is, using a mobile device that helps attain learning goals identified. The learning goals are related to discussion on section 1.3.

According to Burton-Jones & Grange (2013), discussion on effective use holds four important assumptions. First, use of mobile devices for learning occur at any level of analysis and focus is on individuals, communities, organizations or nations (Gurstein, 2003). To this research, analysis is viewed from students as individuals.

Second, student are not just using mobile devices, they have an intention (Schwonke et al., 2013). The intention is related to a goal. The goal of student using their mobile devices is to learn outside the classroom.

Third, they argue, there objective qualities in goal attainment and evaluation is hard in certain instances “but it is not completely subjective” (Burton-Jones & Grange, 2013:633). Use of mobile devices for learning as a goal is attained by linking mobile device use to academic performance. Academic performance is discussed on section 1.4.

Finally, several stakeholders exist with different viewpoints on students' personal goals. Stakeholders include, students, teachers, parents, siblings, relatives, peers, friends, head teacher(s), school(s), community, ministry of education, ministry of science and technology, non-government organizations (NGO) and not for profit organizations (Lujara, 2008; Swarts & Wachira, 2010).

Burton-Jones & Grange (2013) argue for importance of providing each stakeholders perspective. This research focuses on students as individuals, peers, friends, siblings, parents and teachers. The scope for this research is at individual level.

Post adoption insists on behaviour change that is engaged with activities. As argued on section 2.4.6, certain fears exist from teachers. Teachers insist students are misusing mobile devices (Schwonke et al., 2013). The use to socialize, entertain and recreational has blinded teachers and not acknowledging academic. Misuse of mobile devices is related to ineffective application of mobile device affordances (Kihwele & Bali, 2013; Sung et al., 2016).

For students using mobile devices to socialize, recreational purposes and entertainment, there is need to explain academic use that can change their behaviour. For teachers, explanation of students' effective use of mobile devices can assist in changing perceptions and follow colleagues as argued on section 2.4.5.

## **2.6 Students' use of mobile devices for learning in South Africa and Tanzania**

Given the previous discussion, students in South Africa and Tanzania benefit enormously from using mobile devices for learning outside the classroom. Use of mobile devices for learning provides students with source of information and resources that enhance learning.

Student use mobile devices as a source of information. Students use Internet to get access to news, websites or social media (Johnston, 2013; Kreutzer, 2009). With Internet, student have access to a myriad of information. Students contact peers and spread information or enquire (Chigona & Chigona, 2008; Kafyulilo, 2014).

Students inform one another of what happened in class (to students absent), share solutions to assignments and collaborate in projects. Student contact teachers for clarification (Oblinger et al., 2005). When contacting teachers, students enquire of next assignment, scope for upcoming test and marks. Students use mobile devices for learning and administrative matters.

Mobile devices are used as resources. Students use mobile devices to take pictures, record audio and video of activities encountered with intention of informing peers (Johnston, 2013; Kreutzer, 2009). Students send multimedia with text explanation to peers (Kafyulilo, 2014; Mtebe et al., 2016). Multimedia are sent to individuals or groups. Peers response creates a debate and informal learning. The discussion is performed in group setting. Each group member contributes to the group. Mobile devices then enhance information generation.

Mobile devices are used by students to continue discussion outside the classroom. Students discuss nitty issues with peers. Students elaborate to peers on that understood during class (Kreutzer, 2009; Vainio, Walsh, & Varsaluoma, 2014). Those able share examples found on Internet and explain

the concept. Mobile devices become extended source of informing peers of a new location (website or a physical space) where information is found.

Continuous interaction of students with mobile devices assist peers to overcome failures, in short term academic performance. Long term, use of mobile devices assists students to overcome shortage of teaching and learning material, shortage of teachers and overcrowding. There is more to be learnt from student use of mobile devices outside the classroom. To foster for formal mobile learning, one needs to understand it from informal approach.

## **2.7 Conclusion**

Affordance offered by mobile devices have received much attention from students that use mobile devices for learning outside the classroom. Research in South Africa and Tanzania on mobile device use for learning outside the classroom has depicted secondary school students own mobile devices. These researches are written either from courses taught or projects which necessitate the query for sustainability.

Nevertheless, outside the classroom, students use mobile devices to call, text, or use Internet to communicate to peers. Students chat to peers, while holding a physical conversation with friends. Mobile devices afford students to watch videos, listen to audio (from radio to voice notes) and view graphical information (pictures, graphs, charts etc.) and supports the shift to student centred learning. Teachers are divided with few supporting students' use of mobile devices for learning outside the class and majority opposing. To acquire a clear understanding, a theoretical framework is necessary as it assists in using a lens to understand students in developing countries approach to informal learning using mobile devices that they sustain.

## **CHAPTER 3: THEORETICAL FRAMEWORK**

### **3.1. Introduction**

The framework for students' effective use of mobile devices for learning outside the classroom is used as lens for this study. The framework is deducted from three theories, diffusion of innovation, moral panic and positive deviance.

Deduction of theories (or framework or models) is using existing theories to gauge respondents or literature discussion. Findings explain existence of concepts in the society (Becker & Niehaves, 2007; Dubois & Gibbert, 2010). Deduction provides a lens the researcher uses during data collection.

This research starts explanation on adoption of mobile devices by secondary school students, using theory of diffusion of innovation. Proceeds by society (teachers as representatives of the society) views on students' use of mobile devices for learning outside the classroom. Lastly, centres behavioural explanations that assist secondary school students to use mobile devices effectively. Effective use of mobile devices for learning by secondary school students is a post adoption approach. The approach affords explaining of several aspects that students encompasses for academic development.

This chapter is organized as follows, begins with discussion on existing theories, followed by justification of philosophies and methodologies of theories. Immediately after, the theoretical contribution of this research is highlighted followed by a brief discussion of the framework. Finally, the different concepts on the framework are discussed and limitations of the framework.

#### **3.1.1 Limitations of existing adoption theories**

Research on secondary school students' use of mobile devices for learning outside the classroom follows the traditional IS approach on adoption in isolation. Adoption is argued with theories like Technology acceptance model (TAM) (Mac Callum, 2010), Unified theory of acceptance and use of technology (UTAUT and UTAUT II) (Ifenthaler & Schweinbenz, 2013; Mtebe et al., 2016; Mtebe & Raisamo, 2014), concern based adoption model (CBAM) (Cardoza & Tunks, 2014; Straub, 2009), Framework for the rational analysis of mobile education (FRAME) (Bairagi, Roy, & Polin, 2011; Crescente & Lee, 2011; Khaddage et al., 2015; Koole, 2009; Wright & Parchoma, 2011), Theory of planned behaviour (TPB) (Cheon et al., 2012) and Theory of reasoned action (TRA) (Teo, 2015).

Theories argue for access, use and perception of use of a technology (Kafyulilo, 2014). Adoption of mobile devices has called for formalization of mobile device. Recent research, depicts a gap these theories do not attend to, inclusion of other stakeholders (Falloon, 2013; Straub, 2009).

While theories explain behaviours inherent in adopters and rate of adoption, they lack in depicting behaviours displayed by other stakeholders. Teachers and parents are important stakeholders (Kalolo, 2015; Semali & Mehta, 2012) to a students’ academic performance. Moral panic and concern based adoption models (developed on concerns that teachers and parents have) fail to show techniques to use resources in the society. Resources should be used effectively for students and the society to overcome shortages in teaching and learning material and teachers.

Adoption theories like TAM fail to consider the power that networks students have play in introducing peers to an innovation and leading to adoption. In societies where individuals share not only information but also technical details to overcome difficulties, adoption theories should be fluid to support such interactions. These interactions occur at school and outside the school environment. Students in Tanzania and South Africa have a culture of open sharing and ‘community of property’ that many adoption theories do not consider as networking that assists in decision to adopt.

This research looks at effective use of mobile devices for learning outside the classroom which accounts for informal application.

Concept	Explanation
Formal	Theories provided discuss use of mobile devices for learning as an extension of e-learning or enforce formalizing in classroom.
Adoption and post adoption view as a continuum	Previous theories look at either adoption or post adoption use. Theories do not at the adoption and post adoption as a continuum. During post adoption, effective use is not central to the discussion but perceived usefulness (performance expectancy).
Concern	Existing theories do not align different stakeholders for better explanation of the phenomenon of interest. Previous researches have provided explanations from single stakeholders at the expense of others. Researches have been based on either students or teacher and not both to untangle any myth.

Table 1: Limitations of existing adoption theories.

### **3.1.2 Philosophies and methodological justification of the theories**

While developed through different philosophies, theories applied have been used in Interpretivist studies, diffusion of innovation (Mac Callum, 2010; Valente & Rogers, 1995), moral panic (Cohen, 1999; M. Young, 1997) and positive deviance (Ochieng, 2007; Spreitzer & Sonenshein, 2004).

Theories have been applied in case studies (Cohen, 1972; Doyle, Garrett, & Currie, 2014; Ochieng, 2007). They offer explanatory contribution to research (Hughes & Coakley, 1991; Lyytinen & Damsgaard, 2001; J. Young, 2009). Lastly, theories are used in studies on students use of mobile device for learning, diffusion of innovation (Doyle et al., 2014) and moral panic (Chigona & Chigona, 2008). Little is known on theory of positive deviance and use of mobile devices for learning outside the school.

### **3.1.3 Theoretical contribution of the research**

The framework for students' effective use of mobile devices for learning (SEUMD) merges three theories in a manner that introduces it as a new framework. The new framework offers an explanatory contribution (Fereday & Muir-Cochrane, 2006; Rivard, 2014). The explanatory contribution is on how effectively students use mobile devices for learning and what effective means to students (Gregor, 2006).

The framework explains a process from adoption to post adoption approach where focus is on effective use. Rather than focusing on use, students have goals when using mobile devices for learning outside the classroom.

The theory explains to peers behavioural changes they can adopt and are at reach. The intention is for peers to effectively use mobile devices for learning outside the classroom. The behavioural change is possible as students learn from peers using mobile devices for learning in secondary schools.

The research is based on mobile devices students own. It is hereby assumed students will easily relate to the study and extend use of mobile devices to learning. That is, if students are using mobile devices for entertainment, recreational purposes and socialization.

### 3.1.4 Framework for students' effective use of mobile devices for learning outside the classroom

Students' effective use of mobile devices for learning outside the classroom is discussed using the framework (SEUMD) provided on **Error! Reference source not found.**

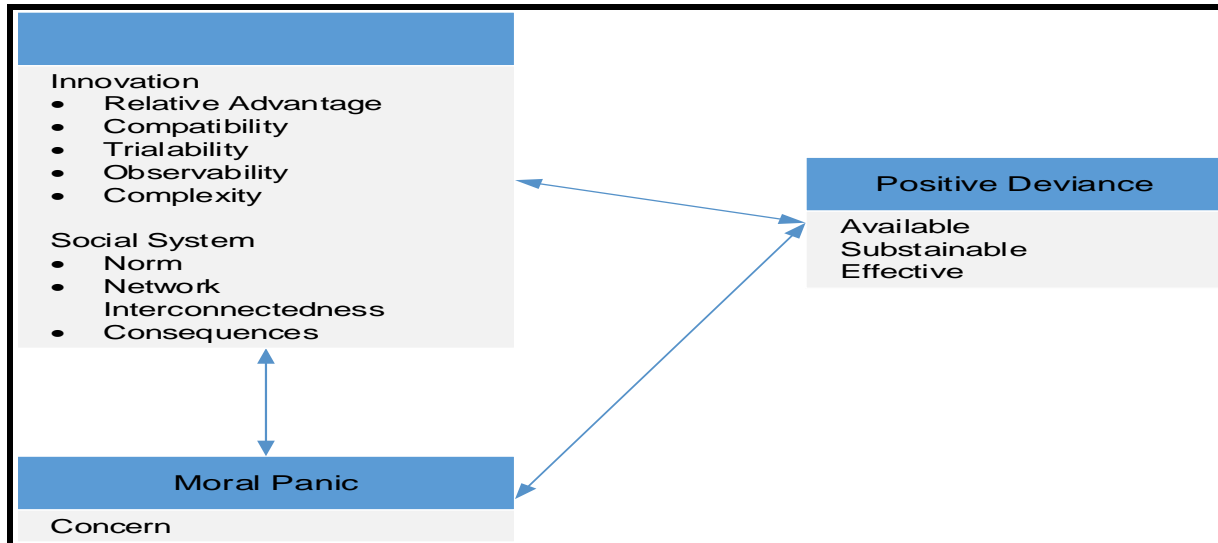


Figure 1: Framework on students' effective use of mobile devices for learning outside the classroom.

Diffusion of innovation is a theory on adoption of technology (Rogers, 2003). In this research, diffusion of innovation means students' adoption of mobile devices for learning outside the classroom. It is a theory on individual decision to adopt a technology and views adoption as a process (Rogers, 1983, 2003; Valente & Rogers, 1995). The theory has four concepts, innovation, social system, communication and time.

Time discusses the period an innovation undergoes during diffusion in a society from initial inception (by innovators) to use by laggards. Rogers (1983) argues on individual rate of adoption. Rate of adoption shows early adopters i.e. innovators, early adopters and early majority, as influenced by communication behaviour, personal variables and socioeconomic status.

The personal variable is related to a mobile device as an innovation and use for learning. A complete discussion on the socioeconomic status deserves an independent study and is out of scope on this research. Communication behaviour related to time, are linked to the concept of communication under the theory.

Communication explains channels that information leading to adoption is dispersed from. Mass media and interpersonal approaches are channels used for communication. Mass media includes, television, radio, journals, newspapers and Internet (Kreutzer, 2009; Rajasingham, 2011).

Interpersonal communication is between and among neighbours, relatives and friends (Rogers, 1983). Communication is the effortless way for adopters to learn of innovative technology. Use of mobile devices for learning outside the classroom has been affected by communication channels. These channels are used to create moral panic.

For this research, two concepts from diffusion of innovation will be applied as they encapsulate reasons for students to adopt mobile devices for learning. The concepts are innovation and social system. Communication is argued within the theory of moral panic. The concept of time is completely discarded as the research does not focus on rate of adopters or innovation to diffusion process.

The theory of moral panic is centred on myth that mobile devices are misused by secondary school students. As such, channels of communication are used to spread fear (Cohen, 1972, 1999, J. Young, 2009, 2011). There is concern brought by parents (and teachers) losing control over children. The theory discusses of key stakeholder in panic created in the society. The theory also explains how misinformation is used to lure those with limited knowledge on what is unfolding. Finally, the theory of positive deviance explains to other secondary school students on peers that succeed in despite sharing same resources (Hughes & Coakley, 1991; Marsh, Schroeder, Dearden, Sternin, & Sternin, 2004). It is assumed that in the same context, individuals are expected to progress at the same rate. It is observed that some individuals, develop more than others and enjoy benefits.

The theory explains to struggling students the need to change behaviours and what needs to be done, to attain development as peers. Socioeconomic status of an individual will not be featured on the research.

### **3.2 The theory of diffusion of Innovation**

The theory of diffusion of innovation was developed by Everett Rogers. Rogers defines diffusion as a “process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 1983:6). Diffusion sees adoption or use of a technology as a new idea. The newness is based on the individual it is discussed from, not when it was created (Rogers, 1983, 2003).

With newness comes uncertainty and perceived risk. Information is required for one to overcome uncertainty and risks and adopt the innovation (Doyle et al., 2014). The information originates

from peers, relatives, or friends. The information comes from mass media and influences the decision, to adopt or reject. The innovation argued for is mobile devices and use for learning.

As a communication theory, diffusion of innovation greatest contribution is viewing innovation as a social process (MacVaugh & Schiavone, 2010). Social on how individual's aid in accepting or rejecting an innovation. Individuals apply ideas, use and experiences of an innovation. Adoption of mobile devices and effective use for learning is contributed by peers, friends, teachers and parents. Each student makes personal decision to adopt mobile devices outside the classroom.

### **3.2.1 Innovation**

Students effective use of mobile devices for learning outside the classroom is a new idea, as such an innovation (Rogers, 1983). Mobile devices are in use for years (Gao, Yan, Wei, Liang, & Mo, 2017; Weiser, 1993). Yet, recently mobile devices have received much attention on use for learning outside the classroom (Hashemi et al., 2011; Roberts et al., 2015).

In South Africa and Tanzania, this is a new idea as use of mobile devices on school premises is prohibited (Kihwele & Bali, 2013; Porter et al., 2016). Enforcing outside the classroom discussion at entry level. Each innovation comes with uncertainty on acceptance or rejection.

Rejection encompasses active rejection or passive rejection (Sahin, 2006). Evidence shows mobile devices are adopted and used for learning (Kafyulilo, 2014; Sharples et al., 2007). Access and use of mobile devices for learning outside the classroom includes several characteristics for acceptance or rejection. Characteristics include, relative advantage, trialability, compatibility, observability and complexity.

#### **3.2.1.1 Relative advantage**

An innovation is adopted and widely used if it offers a relative advantage (Rogers, 1983; Straub, 2009). Relative advantage could be, it provides a better solution to current situation or offers an untapped opportunity. Students adopt mobile devices believing it will simplify communication and collaboration with peers, friends and relatives (Georgiev et al., 2004).

Students' use of mobile devices for learning outside the classroom offers several relative advantages. These are, an opportunity to understand concepts better, equip students with knowledge and assist to overcome shortage of teacher and shortage of teaching and learning materials in schools. Students' use of mobile devices for learning outside the classroom is motivated by need to contact family and social status.

Reduction of cost and introduction of cheap but powerful mobile devices has necessitated students' adoption and use. Students adopt mobile devices to contact family, friends and relatives (Alsalem, 2013; Markett et al., 2006). Mobile devices in early 90's were expensive to purchase and maintain (Minges, Mannisto, & Kelly, 1999).

It was not until early 2000's that studies started emerging purporting students use of mobile devices for learning, even then, from a project point of view (Trifonova & Ronchetti, 2003). Students adopt mobile devices to contact peers on academic issues. Students assist siblings with academic content. Normal conversations are extended to academic discussions on mobile devices.

Purchasing a mobile devices and being able to sustain it is a sign of status (Hsu, Lu, & Hsu, 2007). Students who afford to purchase a mobile device are viewed as economically stable. These students create the impression to peers and become support structure during decision-making stage. Students with mobile devices share details of content found online with peers as means of socialization. Information is shared on social networks and instant messaging applications.

### **3.2.1.2 Trialability**

Before adopting a mobile device and using for learning, students try from peers, friends, sibling, parents or at shops (Doyle et al., 2014; Hsu et al., 2007; Sahin, 2006). The more a mobile device is easy to try, the easier a student adopts it. Students trialability is guided by ease of use and affordances (Wright & Parchoma, 2011).

Students prefer audio, video and graphical information. Using a mobile device with these affordances assists students in making the decision to adopt for learning (Oblinger & Oblinger, 2005). This limited trial, assists a student to decide on whether to adopt or reject the mobile device. If trial goes smooth, result is adopting a mobile device.

During trials, students apply multimedia affordances. Students take pictures or record videos to insist on an argument. Students also record audio for elaboration. Peers contribute by providing feedback on that shared.

Much of the trials happen during implementation stage of innovation to decision process. Trialability offers students unique use of mobile device affordance that will enhance learning. This influences the decision on adoption of mobile devices.

### **3.2.1.3 Compatibility**

As humans, we compare an innovation to current context and argue for applicability. Mobile device use for learning outside the classroom compatibility is in relation curricula. Both,

emphasize on students' ability to acquire books, book chapters, notes and examinations (Mtega et al., 2012; Wright & Parchoma, 2011) creating lifelong learning.

Mobile devices assist students to complete homework and assignments. It goes further by looking at search engines, podcasts, videos, social media and other technologies (Looi et al., 2014). These affordances are used on mobile devices for learning.

When mobile devices meet the needs of potential adopter's students easily develop the attitude that it is compatible to existing values. Effective use of mobile devices for learning is compatible with formal education, both intend on impacting lifelong learning (Dangel & Wang, 2008). The more compatible a mobile device is to be learning outside the classroom, the more it is adopted.

#### **3.2.1.4 Observability**

Trying a mobile device before purchasing assists a student with quickly adopting it. What sparks trying, is observing another student using a mobile device for learning (Mac Callum, 2010). Outside the classroom students use mobile devices for different purposes. Little do students know, peers are observing.

Based on observations, peers inquire and ask to try (Hsu et al., 2007). Observing a peer use a mobile device for learning, assist in shaping students' thoughts towards or against the mobile device. Subconsciously, issues of cost shape students' initial thoughts.

Observability relates to affordance of multitasking. Both allow students to receive information from peers or friends while performing other tasks on mobile devices (Carlson, 2005; Jones et al., 2010). Peers sharing information use mobile device. Peers explain what can be done, how and with what application.

Peers receiving the information, observe what a mobile device affords for learning. This builds belief on mobile devices and the need to continue with physical conversations while using them. Students hold physical and virtual conversations. Virtual conversations are on instant messaging applications and social media.

#### **3.2.1.5 Complexity**

A mobile device that is viewed as complex, deters a student from adopting (Shonola et al., 2016). Students adopt mobile devices that are simple to use and assist in daily activities. Students have several subjects to focus on. Students do not require complex mobile devices that do not align to needs. If a mobile device is difficult to understand and use, this increases complexity and deters students from adopting (Teo, 2015).

Complexity is also visible from teachers' views. Teachers struggle to integrate mobile devices for learning outside the classroom (Sharples et al., 2007). Teachers have multiple issues to handle, understanding syllabus, prepare content for class, mobile devices and how to use them. Teachers are confused on how to integrate these elements outside the classroom (Frohberg et al., 2009).

Students require mobile devices to provide relative advantage in relation to current state, offer ability to try, provide compatibility to traditional education, observable from peers and not complex. These characteristics exist in a context where students interact with peers, teachers, friends and parents. The social system assists in making the decision to adopt or reject use of mobile devices for learning.

### **3.2.2 Social systems (process)**

A social system is defined as “a set of interrelated units engaged in joint problem solving to accomplish a common goal” (Rogers, 1983:24). In South African and Tanzanian schools, the common goal is providing education (Gao et al., 2017). The problems in these contexts are issues emergent in and out of schools that affect students.

The units that exist in these contexts include, curricula, students, peers, friends, teachers, siblings and parents. Mobile device affordance and use for learning is a social process emerging from these units and informing others. The intention of informing peers is to understand mobile devices and benefits for learning. Three characteristics are important, the norm, network interconnectedness and consequences.

#### **3.2.2.1 The norm and its influence on adoption of mobile devices for learning**

The norm in the society plays a vital role in adoption or rejection of an innovation (Cheon et al., 2012; Teo, 2015). Society beliefs, values and assumption create the norm (Chiluwa, 2008). Adoption of mobile devices for learning outside the classroom is meet with challenges. Parents and teachers centre students discipline as the way a student talks to elders, walks and upholds themselves. Students view this as being controlled. Mobile devices have helped students escape control.

The generational gap between teachers or parents and students, has creates a discussion upon which, students want to escape through focusing on mobile devices (Johnston, 2013). Students focus is communication with peers or learning.

To parents, this is bad manners and students must be punished (Mohamad & Woollard, 2012). Coupled with affordance of teachers opposition on students using mobile devices for learning, norms in a society affect adoption (Chigona & Chigona, 2008; Wright & Parchoma, 2011).

The result is parents and teachers suggesting students should not be given mobile devices. The decision affects adoption of mobile devices for learning outside the classroom. Students who have not adopted mobile devices miss the relative advantage.

### **3.2.2.2 Network interconnectedness and how it assists in adoption of mobile devices for learning**

Students have networks assisting daily. Networks include, social network and knowledge network (Domingo & Garganté, 2016, Roodt et al., 2012). The networks relate to affordances of communication and collaboration among students (Ciampa, 2014; Oblinger et al., 2005).

Students use social networks to acquire and distribute information on social aspects (Cloete et al., 2009, Roodt et al., 2012). Knowledge networks allow students to communicate with peers in quest of information assisting with learning new concepts or explanations (Domingo & Garganté, 2016; Traxler, 2010).

To students, these networks exist as one and students use them to acquire and distribute information related to academic issues, while socializing. Social and knowledge networks assist students during the persuasion stage of an innovation to decision process. Using networks, students inform peers of that needed to know in relation to use of mobile devices for learning. Students use networks to provide assistance by explaining how to use, benefits and sustainability (Krutka et al., 2014).

Students inform peers on costs associated with purchasing. Students observe peers and try different mobile devices. Through peers, students are equipped with knowledge of mobile devices, acquisition process and use. Information received assist students during adoption decision making. The Internet further assists students. The Internet gives access to broad networks that span cities, countries and even continents (Kumar et al., 2011). Using Internet, students extend immediate physical networks to those online. With Internet on students' mobile devices, students are not confined to physical networks.

### **3.2.2.3 Consequences of using mobile devices for learning**

Using mobile devices, students face consequences. Students insist using mobile devices for learning outside the classroom. Consequences include, confiscation of mobile devices (both, at

school and home), expulsion from school and labelled as misusing mobile devices (Mohamad & Woollard, 2012).

Students have benefitted from using mobile devices for learning (Shonola et al., 2016). Students reveal that mobile devices help by using affordances such as, calling, texting, search engines, social networks and multimedia to enhance learning. Students relate effective use of mobile device for learning outside the classroom through affordances that teachers supporting for learning (Campbell, 2006; Chiluya, 2008; Ciampa, 2014; Kafyulilo, 2014; Mtega et al., 2012).

Observing consequences assists or hinders a student from deciding to acquire a mobile device and using for learning outside the classroom. Some students state upfront reasons for non-adoption, others hold the information as they do not want to offend peers (Page & Kobsa, 2010). Students do not want to be invalidated and assumed without money to acquire mobile devices.

Students undergo the innovation to decision process before adopting a mobile device. The process shapes thinking on using mobile devices for learning outside the classroom. The process aids in identification of characteristics identified on sections 3.2.1 to 3.2.2.

### **3.2.3 The innovation to decision process**

The innovation to decision process offers five stages each student undergoes while adopting mobile device for learning outside the classroom (Rogers, 1983, 2003, Valente & Rogers, 1995). The stages are, knowledge acquisition, awareness (interest), persuasion (decision), implementation (trial) and confirmation (adoption).

Knowledge stage is when a student receives information via mass media on a mobile device (Sahin, 2006). Students become entertained with the innovation. Students like to know, what it is and why is it important. Students' brains start registering the innovation and affordances. Students thoughts, experiences and senses, and cognition, are intrigued to understand the mobile device and how to use them for learning.

The awareness stage allows students to link mobile devices with other innovations. The intention of linking the innovation to prior knowledge is to find familiarity (Keren-Kolb, 2013). The hope is the innovation does not come with complexities. During the awareness stage, students are intrigued to know, how the mobile device works and how to use for learning outside the classroom. Students adopt mobile devices they have prior knowledge on and use for learning. If students do not have prior knowledge on the mobile devices, mass media assists to inform them. Innovation labelled as misused leads to discontinuation as students lose interest.

During the persuasion stage, students receive information from peers, friends and family. The intention is to reduce uncertainty through acquiring information from individuals than mass media. Individuals providing information have used mobile devices for learning.

Individuals offering advice influence students. If the individual support use of mobile devices for learning students find it easy to adopt the innovation (Ciampa, 2014; Mohamad & Woollard, 2012). The opposite deters students from adopting and using mobile devices for learning. From this stage, the student either decides to adopt or reject a mobile device for learning. If students adopt, they proceed to implementation.

The implementation stage allows students to receive technical assistance on emerging problems. When students struggle to connect to Internet or cannot send SMS peers assist. Peer explain network settings or service centre number is incorrect (Mohamad & Woollard, 2012).

Failure to get technical assistance, leads to rejection as innovation is viewed hard to use. In some cases, re-invention might occur. Re-invention is “the degree at which an innovation is changed or modified by a user in the process of its adoption and implementation” (Rogers, 1983:206). Re-invention leads to faster adoption. Mobile devices have been re-invented to current versions. Current versions receive massive adoption as shown by reports (Kemp & We Are Social, 2016).

Finally, confirmation stage. Students’ attitude is crucial. Attitude denotes intention to proceed with adoption or replacing the innovation with another that seems better. If students receive conflicting messages of the innovation, students find a replacement technology (Alvarez et al., 2011).

The innovation to decision process assists students traversing between stages during adoption of an innovation. If mass media portrays the technology as bad influence on students, parents and teachers discourage students from adopting. The fear hinders adoption.

### **3.2.4 Disadvantages of diffusion of innovation theory**

Diffusion of innovation theory has questionable aspects. The theory assumes the innovation will be adopted by the society where it is termed new (MacVaugh & Schiavone, 2010). The theory assumes adoption will spread and society will use innovative technology. While the theory accounts for individual’s socio-economic status, it does not account for the possibility of an innovation being rejected by the society.

Secondly, diffusion as a process does not reveal information in a society at the time data is collected. Innovations take months or years before adoption in a society. For a researcher collecting

data at such time, the society may be viewed as being on the knowledge stage of adoption (Lyytinen & Damsgaard, 2001).

### **3.3 The theory of moral panic**

Moral panic is defined as “an exaggerate collective fear of a phenomenon” (Chigona & Chigona, 2008,54). Moral panic is a behavioural aspect. Moral panic is displayed by individuals, group or organization depicting a phenomenon as against norms (Cohen, 1972, 1999, Young, 2011). The fear is spread in the society and necessitates segregation of perpetrators.

Perpetrators are individuals or group out of control. Perpetrators perform activities the society is not used to. Perpetrators behaviour is labelled as inappropriate within the society.

Students’ use of mobile devices for learning has met several challenges. Teachers opposing students use of mobile devices for learning outside the classroom is one. Teachers and parents, label students as bad mannered and misuse mobile devices. The outcome is ban of mobile devices in secondary schools in South Africa and Tanzania.

Individuals who create a moral panic and ensure it receives attention are moral entrepreneurs (Buckingham & Jensen, 2012, Young, 2011). Moral entrepreneurs use influence and access to mass media to induce fear. The intention is society to react and view perpetrators as members in need of assistance.

#### **3.3.1 Moral entrepreneurs and their role in creating moral panic on students use of mobile devices**

Moral entrepreneurs are individuals, groups, or organization that selectively, depict a certain behaviour in the society as against the norm. Moral entrepreneurs rally the society for assistance in maintaining the norm. Norms are maintained by labelling individuals showing the behaviour (Buckingham & Jensen, 2012; Forrest-Lawrence, 2011).

The behaviour is labelled as supportive or destroying the norm. Students use of mobile devices has met teachers support (Campbell, 2006; Ciampa, 2014; Oz, 2014) and opposing (Carlson, 2005; Leung, 2004). Teachers opposing students’ use of mobile devices have an upper hand.

Teacher opposing use of mobile devices have received society attention by labelling students as bad mannered and misusing mobile devices (O’Bannon & Thomas, 2015). Using mass media, moral entrepreneurs spread fear in the society. Within moral entrepreneurs, there are rule creators and rule enforcers.

### **3.3.1.1 Rule creators that introduce moral panic in the society**

Several moral entrepreneurs play a role in labelling students as bad mannered. These are people in position of power, upper social strata of society (Ben-Yehuda, 2009). Moral entrepreneurs include, religious leaders, law makers, researchers, ministers and other relevant stakeholders.

Ministers of education have prohibited students use of mobile devices on school premises (Chambo et al., 2013; Ito, 2005; O'Bannon & Thomas, 2015). Ministers have enforced other moral entrepreneurs to prohibit use of mobile devices in different areas (Ito, 2005; Woempner, 2007). The foundation of the decision is research findings showing students misuse mobile devices and leads bad manners (Ito, 2005). The intention is depicting students using mobile devices will fail on academic activities.

Rule creators focus on identifying “bad behaviour” and persuading the society. Rule creators label students using mobile devices for learning as against the norm. The task of questioning and shaming students is left to rule enforcers.

### **3.3.1.2 Rule enforcers and the upholding of norms in the society**

Rule enforcers are individuals or groups of experts assumed to professionally handle students “perpetrators” (Woempner, 2007). Teachers opposing students use of mobile devices for learning (Carlson, 2005; Johnson et al., 2014) identify students referred as bad mannered.

Students are then punished. Mobile devices confiscated. Outside the classroom, parents undertake the duty of punishing children or confiscating misused mobile devices (Ito, 2005).

Rule enforcers focus on upholding norms. Rule enforcers ensure anyone going against norm is accountable. Unfortunately, students using mobile devices for learning are caught in the web and generalized as misusing. Misuse has includes, accessing pornographic material, chatting on sexual issues, cheating, cyber bullying, sexting and wasting time on mobile devices (Campbell, 2006; Ito, 2005; Leung, 2004; O'Bannon & Thomas, 2014). Claims on effective use of mobile devices for learning by students have been ignored (Cavus et al., 2008; Scornavacca, Huff, & Marshall, 2009).

### **3.3.2 Role of communication channels (mass media and elders) as they discuss students use of mobile devices for learning outside the classroom**

Mass media has played a critical role in spreading fear from moral entrepreneurs (Buckingham & Jensen, 2012, Garland, 2008, Young, 2009). Mass media introduce fear in the community by providing examples assisting in the spread. Students are portrayed as perpetrators and use of

mobile devices as immoral and against the norm. Mass media provide cases and justification from research on students' misuse of mobile devices.

As the main source of information during knowledge stage, mass media is expected to provide information on innovation. What the innovation is and why it is important. When mass media directs use of mobile devices as unimportant and misused, it affects adoption of mobile devices. Students are not permitted by parents to use mobile devices. Students struggle to demystify peer's understanding during persuasion stage.

Over the Internet, media such as instant messaging applications, social networks, emails, websites, radio and television spread fear that use of mobile devices is not ideal for students (Karim & Nigar, 2014). Parents and teachers as rule enforcers, use evidence from mass media to deny students access to and use of mobile devices. Students allowed to use mobile devices face controlled use. Controlled use limit hours' on mobile device and of using a mobile devices (Kihwele & Bali, 2013).

Moral panic results from moral entrepreneurs not understanding benefits mobile devices offer and use for learning. Moral entrepreneurs create fear out of unhappiness or assumptions that the innovation will affect the norm. This is done in five stages.

### **3.3.3 Stages of moral panic**

The wide spread of fear does not happen overnight. Spreading of fear is an on-going activity that moral entrepreneurs undertake to ensure norm and control is returned. According to Cohen (1999) and Garland (2008), moral panic undergoes the following stages during manifestation.

The first stage is when an individual or a group is identified depicting behaviours the society is not used to. The behaviour is viewed as threat to society and disruptive of the community interest (Forrest-Lawrence, 2011). Identifiers and initiators are rule creators. On this research, rule creators have picked on students' access and use of mobile devices as a threat to society.

In the second stage, the threat is now portrayed by mass media as something minimal. Mass media portrayal is an introductory stage. Mass media informs the society based on information received from moral entrepreneurs (Hier, 2008). Mass media spread information that students misuse mobile devices and results in bad behaviour.

During the third stage, the society concerns are now aroused and start to support that portrayed by mass media. Mass media continues labelling through providing information amplifying the

situation (Young, 2009). The society particularize the behaviour to their context by labelling specific students.

The fourth stage is when education stakeholders provide response. The response is to ensure norm within and outside schools is maintained. Ministers of education have prohibited mobile devices from school premises and advice parents not to allow children full control of mobile devices. The response is a step towards restoring order in the society.

Finally, the moral panic on students use of mobile devices for learning has created social change (Garland, 2008). Societies not only view mobile devices as innovation students' use for communication, but as something creating moral decay within the community. Over time, moral panic reduces. Mass media reports on the behaviour from time to time as a reminder.

The theory of moral panic is built with five key features, concern, hostility, consensus, disproportionality and volatility (Garland, 2008). Hostility deals with society becoming disinterested on perpetrators and how this creates division between those following norms and against (Buckingham & Jensen, 2012).

Consensus is built on grounds that perpetrators do not get assistance in explaining their story (Young, 2009). This is performed by moral entrepreneurs using mass media in labelling perpetrators and getting community support. Disproportionality shows that actions taken by moral entrepreneurs, including punishment, are beyond the scope of the threat (Hier, 2008).

Moral panic on a phenomenon will appear for a brief period and disappear. Moral panic is volatile as it disappears when the society is tired of receiving same information or mass media moves attention to another behaviour (Hier, 2011).

Features discussed are important in explaining how moral panic is spread and who the role players are. What research misses is emerging concerns. Central to the theory, is identification of fear (concern) moral entrepreneurs have. For this research, concern is the only concept discussed.

### **3.3.4 Fear (concern) on students use of mobile devices for learning outside the classroom**

The concern is that students use mobile devices that create a bad behaviour due to misuse (Chigona & Chigona, 2008; O'Bannon & Thomas, 2014). Misuse leads students to fail on academics. Students spend most of their times on mobile devices instead of reading. Students using mobile devices to access audio, visual and graphical information are viewed as misusing mobile devices.

Students are argued not being able to holding a physical discussion while using a mobile device (Markett et al., 2006). The view is students cannot concentrate on two things (Kibona & Mgaya, 2015). Students collaborating with peers on assignments, homework and projects is viewed as socializing and nothing academic is expected (Shonola et al., 2016).

The concern that teachers and parents as rule enforcers have over students' use of mobile devices has assisted rule creators to respond by setting strict measures in schools. Mass media has pondered on the community for support. Students are using mobile devices for learning in an effective way outside the classroom.

Since it is a behavioural issue, information on students' effective use of mobile devices needs to emerge from students. By providing such explanation, teachers and parents will understand how to assist students and rule creators will understand the severity of the phenomenon to amend rules and remove the ban.

### **3.3.5 Disadvantages of theory of moral panic**

Moral panic contains flows (Buckingham & Jensen, 2012; Garland, 2008; Hier, 2008, 2011). Moral panic first flow is viewing perpetrators as passive. Perpetrators did not perform any activities instigating moral entrepreneurs in creating and distributing fear within the society.

The second disadvantage is the label of moral panic is created by the society. However, not everyone in the society view perpetrators as the theory suggests. Better yet, the label is a sign of on-going negotiations in the society. The assumption is mass media portrays the fear and society supports against the perpetrators. The society has no freedom to decide.

While some students misuse mobile devices, it is not without saying these are isolated individuals. Such cases need to independent reporting instead of generalizing behaviours. One apparent aspect is labels have not deterred students on acquiring mobile devices and using for learning.

### **3.4 The theory of positive deviance**

Positive deviance is a behavioural and social change theory. By definition, positive deviance is "the observation that in most settings, a few at risk individuals follow uncommon, beneficial practices and consequently experience better outcomes than their neighbours who share similar risks" (Marsh, Schroeder, Dearden, Sternin, & Sternin, 2004:1177). The theory explains learning from successful individuals in the community despite exposure to same resources.

Successful individuals have different techniques to overcome what the context offers (Ochieng, 2007). The intention is to observe and learn of the uncommon, beneficial practices from the individuals. The practices have assisted to overcome obstacles and explain to the community techniques to copy.

The theory suggests learning of behaviours that influence behavioural and social change in the society. The behaviour comes from individuals who depict them. Successful individuals account for 1 to 10% in the community (Marsh et al., 2004). The intention of learning from individuals within the community is to ensure sustainability of the new practice. It is argued, this reduces expectancy on grants or donor (Ampofo et al., 2014; Martin & Ertzberger, 2013).

Researchers (Doyle et al., 2014; Marsh et al., 2004; Spreitzer & Sonenshein, 2004) learnt, using positive deviance, members of the community start identifying with the concepts at early stage of explanation. Individuals in the community view techniques as common practices observed. Observation and interviews are approaches used to learn from individuals with uncommon behaviour (Marsh et al., 2004).

The information is analysed and beneficial behaviours explained to the community. Lastly, behaviour change are easily accessible and affordable within the community. Some behaviours take a brief time before adoption, others take longer. Central to the theory are three concepts, practices learnt are available in the community, sustainable and used effectively.

### **3.4.1 Availability of mobile devices that can be used for learning outside the classroom**

As a principle, advice given to the community must be on an innovation available within it (Marsh et al., 2004; Shonola et al., 2016). Mobile devices are the most available innovation in societies (Kemp & We Are Social, 2016). Elders and youth use mobile devices for different purposes. Youth include students using mobile devices as explained in chapter two, section 2.4.

Secondary school students in South Africa and Tanzania have mobile devices (Chambo et al., 2013; Cloete et al., 2009). Students use mobile devices to socialize, for entertainment and refreshment. Students use mobile devices for academic purposes. The only downfall has been prohibition on school premises. Outside the classroom use is hard to observe as students are given controlled access to mobile device to ensure they concentrate on studies.

To overcome shortage of teaching and learning material and shortage of teachers, secondary school students use mobile devices for learning outside the classroom (Kafyulilo, 2014). This provides

access to audio, visual and graphical information. Mobile device use allows collaboration with peers and assistance when struggling to understand concepts.

### **3.4.2 Students ability to sustain mobile devices used for learning outside the classroom**

For the behavioural and social change to last, it must come from individuals in the community who are show uncommon sustainable practices in the community (Ampofo et al., 2014; Shonola et al., 2016). Sustainability is very important in the theory. Uncommon practices are already in the community, sustainability calls for identification of those behaviours for community members to learn (Marsh et al., 2004).

Within the secondary school students who misuse (as argued in section 3.3.4), there are students who use mobile devices for academic purposes. Students use Internet for non-academic activities while peers use to enhance learning (Keren-Kolb, 2013). Students using mobile devices for learning outside the classroom possess uncommon behaviours that peers can learn from.

Despite shortage of teachers and shortage of teaching and learning material, the shift to student centred learning (as argued on section 2.4.4) is creating challenges. The challenge is students shifting focus from expecting teachers “spoon-feed”, to preparing for class (Vavrus, 2009).

Using mobile devices, students access notes, books and examinations. Not only hard copies, but also online. When students don't understand, they can contact peers and teachers for assistance. Students have access to information in multimedia format for better explanation of concepts. These resources are available to students during preparation for class. Using peers, students understand how to adopt the new behaviour.

### **3.4.3 Effective use of mobile devices for learning outside the classroom**

Since the behaviour is available and sustainable in the community, it is explained to community members such that it allows for community to use the uncommon practices effectively (Kumar et al., 2011; Ozdamli & Uzunboylu, 2015; Scornavacca et al., 2009). The essence of effectiveness is ensuring the uncommon practice is applied in getting the community to affect social and behaviour change desirable.

Outside the classroom, effective use (also discussed on section 2.6) of mobile devices by secondary school students requires a goal. The goal of using mobile devices for academic reasons is argued

to enhance academic performance (argued on section 2.5). Effective use of mobile devices for learning assists students understand concepts better while preparing for classroom interaction.

This research thus argues students use mobile devices for learning with intention to attain a certain goal. Uncommon practices from positive deviants are important to understand and explain to secondary school students. This will assist in changing students behaviours and societies views.

#### **3.4.4 Disadvantages of positive deviance theory**

According to Johnson et al (2014) and Marsh et al (2004), positive deviance struggles to identify top 1-10% of secondary school students using mobile device for learning outside the classroom. The approach is not strong in context where relevant services are not available. Scaling up requires assistance from skilled individuals in community mobilization and participatory research.

Limitations are taken as enhancers. Limitations assist in knowing that required before data collection. Identification of secondary school students using mobile devices for learning is either by asking, observing or interviewing.

A secondary school is a community with learning as the goal. This research intends to mobilize schools to appreciate and assist with behavioural and social change towards students' use of mobile devices for learning outside the classroom.

#### **3.5 Limitations of framework for students' use of mobile devices for learning outside the classroom.**

The framework provided contains assumptions. Assumptions lead to boundary conditions for the framework to operate. The framework operates with five assumptions, the first is that it operates outside the classroom environment and is therefore applicable to informal learning. The second assumption is students are not funded by parents to specifically buy mobile devices, airtime (credit), or Internet bundles for learning. Students use same airtime or Internet bundles for academic purposes. The act happens consciously or unconsciously.

Thirdly, students use mobile devices for learning outside the classroom voluntarily and are not coerced by teachers, parents, siblings or school administration. Students are not motivated by any form of direct assessment to use mobile devices for learning. Students use mobile devices willingly.

Fourth, highly academic performing students are not favoured on academic issues compared to peers. Highly academic students strive as self-starters and have the urge of learning. Some highly

academic students have parents (siblings or relatives) enforcing formal learning on them. Lastly, the socio-economic status of parents might play a role in students' academic achievement or effective use of mobile devices for learning.

### 3.6 Conclusion

Using traditional literature review, a comprehensive discussion is provided accounting for limitation of existing adoptions theories. The discussion provides justification for the framework developed. Three theories are combined and used as lens on this study.

The framework is used to understand students' effective use of mobile devices for learning outside the classroom. The framework also assists in explaining effective use and how it influences academic performance. Table 2 provides a summary of the key concepts discussed in chapter 3.

Concept	Argumentation
<b>The theory of diffusion of innovation</b>	
Innovation	The term innovation in this research refers to mobile devices. As such, students have many reasons to adopt mobile devices. Among them are, relative advantage, compatibility, trialability, observability and complexity.
Relative advantage	Students adopt mobile devices as they believe it simplifies communication between them and relatives.
Compatibility	The use of mobile devices for learning outside the classroom is compatible to formal education, both intend on impacting lifelong learning on students.
Trialability	Students prefer to use audio, visual and graphical information. The use of mobile devices for learning offers students a conducive environment to try these affordances and learn at own pace.
Observability	Students observe peers who have adopted mobile devices. Students enquire when necessary. The more observable an innovation is, the less the uncertainty and the higher the adoption.
Complexity	Mobile devices are used to learn simple concepts to gain knowledge.
Social system	Diffusion is a social process. In that the meaning of innovation is socially constructed. Students have enacted their meaning of mobile devices and use to suit their needs.
Norm	The norms in a social system might hinder adoption of some innovations. Teachers' perceptions have resulted in lack of data from South Africa and Tanzania.
Network interconnectedness	Students' impact peers as they are impacted in return. Distinction between students social and knowledge network is blurred as students intermingle and influence peers.
Consequences	Individual and social consequences on students' use of mobile devices have created concerns to teachers. Students traverse the norm to ensure mobile devices are not confiscated. The ban of mobile devices has created limited use reported.
<b>The theory of moral panic</b>	
Concern	Teachers' focus is not on mobile devices, rather on students and results of using mobile devices. There is fear among teachers and parents that students are

	misusing mobile devices. The fear is students' access inappropriate materials and this might affect academic performance.
<b>The theory of positive deviance</b>	
Available	Information that students and teachers receive must be on technology they have and use daily. Mobile devices are the most available technology to students and teachers.
Sustainable	Individual mobile devices available and continuously used by students and teachers are easy to employ for lifelong learning. Students and teachers use mobile devices and sustain using own funds to buy credit (airtime) and Internet bundles.
Effective	There is an opportunity to use the most available technology to assist students in understanding concepts. The intention is to reduce the impact of shortage of teaching and learning materials and teachers. Effective use of mobile devices for learning outside the classroom influences academic performance.

Table 2: Framework for students' effective use of mobile devices for learning outside the classroom.

The framework identified is dependent on philosophical and methodological approaches this research will use. Different philosophical approaches may lead to different findings hence the need to provide justification on philosophy used. The next chapter discusses methodological approaches to data collection and analysis ensuring research is conducted using strict scientific techniques that are justifiable and replicable.

## CHAPTER 4: RESEARCH DESIGN

### 4. Introduction

Research in Information Systems (IS) is not only about mobile devices and social system in which they exist, but also students' effective use of mobile devices as an emerging phenomenon of interest. The research follows an abductive approach to strengthen SEUMD as a framework and induct other concepts as suggested by Dubois & Gibbert (2010) from collected data.

The research then merge emerging concepts during data analysis using an inductive approach (Creswell, 2013; Fereday & Muir-Cochrane, 2006). The framework is used as lens to explain students effective use of mobile devices for learning outside classrooms in secondary schools (Gregor, 2006).

Developing or using a framework is necessary in research (Walsham, 2006). Framework are supported with data that extend, validate or falsify it (Huang, 2009, Okoli, 2012). The framework identified provides a starting point in delving on research. The next step understands underlying assumptions held by researcher.

Researcher assumptions are important as failure to provide explanation and justification results in wrong interpretation (Halaweh, 2012; Klein & Myers, 1999). Different researchers might arrive to different explanations based on ontology and epistemology used.

This chapter provides explanation on the pillars of the research. The chapter argues on presence of relativist ontology. The chapter explains why it is relevant to research from that viewpoint as it shapes reasoning, knowledge, values and language. The chapter proceeds by discussing Interpretivist epistemology. Case study is explained as a methodological approach upon which arguments are provided for conducting research in South Africa and Tanzania.

Distinction is made between independent and dependent variables, education and mobile devices respectively. Explanation is provided on timeframe for data collection. The use of close questionnaires, active observations and semi structured interviews is provided for quantitative and qualitative data collection. Lastly, explanation of descriptive statistics and thematic analysis as techniques for data analysis using Epi Info 7 and Atlas.ti 7 as tools is provided.

In the quest to answer the main research question, *what influence does effective use of mobile devices for learning outside the classroom have on academic performance of secondary school students in Tanzania and South Africa*, which entails an explanatory contribution (Gregor, 2006),

the research employs the relativist ontology and Interpretivist epistemology. Collectively, ontology and epistemology provide justification and explanation of the philosophy being used for this research.

## **4.1 Philosophical approach**

### **4.1.1 Ontological approach used on this research**

Ontology is defined as “the science of ‘what is’ and ‘how it is’” (Becker & Niehaves, 2007:202). Ontology includes a realist and relativist view (Orlikowski & Baroudi, 1991). Both views intend to understand what knowledge is and how knowledge is formed.

The relativist view of the world is centred on human understanding of the phenomenon of interest (Fitzgerald & Howcroft, 1998). The belief is reality is socially constructed and varies based on language, knowledge, culture and values in the society (Gregor, 2006; Halaweh, 2012).

Different societies view the world based on what they understand of it and how it is passed from generation to generation. The evolvement and development of language and how they ascribe values to what the world is, is important. Society assumptions, preconceptions and beliefs shape understanding. This is completely different to the realist view where the world is argued independent of humans (Halaweh, 2012; Sarker, Xiao, & Beaulieu, 2013).

The meaning of the phenomenon of interest is consciously created by humans and affected by the society they have existed (Fitzgerald & Howcroft, 1998; Orlikowski & Baroudi, 1991). This affects knowledge of actions undertaken and meaning ascribed (Creswell, 2013). Multiple realities exist as subjective creation of mind on an individual in relation to phenomenon of interest (Okoli & Schabram, 2010). The researcher influences understandings on respondents that might strengthen or weaken views of the world.

### **4.1.2 Epistemological approach**

The epistemological stance of this research is multiple realities dependent on society that created them are the source of knowledge (Myers & Newman, 2007; Orlikowski & Baroudi, 1991; Semali & Mehta, 2012; Walsham, 2006). This research follows an Interpretivist approach where a single view is not given preference over others based on being “strong”, “higher”, “better”, or explains “it all” (Gregor, 2006; Klein & Myers, 1999). Each view is accounted, presented and shown how different it is.

In Interpretivist research, no universal truth exists. Knowledge is developed by the society and hence creating multiple understandings (Becker & Niehaves, 2007; Fitzgerald & Howcroft, 1998; Walsham, 2006).

Knowledge is acquired and justified by interaction between the researcher and the subject (Gregor, 2006, Klein & Myers, 1999, Walsham, 2006) while understanding lived experiences and history of the society. Lived experiences and history are shaped by language, culture and values. The subject is not just the source of information, but knowledge produced is shared experience and affects interaction with researcher.

Questions asked to respondent's (subjects) shape reflection of their society and things known to exist. While the focus is phenomenon of interest, subjects recollect and relate to questions through thoughts and reflection. Respondent views are impacted by reflection and recollection. Interpretivist research does not assume a "value free data" as data is created by both, subject and researcher (Klein & Myers, 1999; Walsham, 2006).

#### **4.1.3 Conclusion on philosophical approach**

To explain students and teachers access and use of mobile devices for learning outside the classroom for learning the research follows the relativist view where focus is on individuals and their interpretation of the world as argued in previous researches (Jouhki, 2011; Norqvist, 2016). Students use mobile devices for several purposes, learning, entertainment, refreshment and socialization. Students ascribe to above aspects at separate times and in some instances, cannot control which takes precedence. These activities intermingle and shape students view of society and the world.

The researcher did not follow a positivist approach and opted for an Interpretive approach as suggested by Walsham (2006) where research focus is on providing multiple views on the phenomenon of interest. These approaches allow students to use mobile devices for learning in different contexts. Parents and teachers' views on students' use of mobile devices provide another approach. The approach allows arguing for the phenomenon that affects students' use of mobile devices.

Information from students is an interaction between students and researcher (Vainio et al., 2014). Students' views are shaped by questions and interrogation by the researcher. The researchers' understanding of students' use of mobile devices is shaped by their response. Students' culture, values, knowledge and history shapes response which impacts on this research. Students' use of

mobile devices is a complex interaction among students, between students and the researcher and students and their society.

The research was undertaken in a developing country where context is different to developed countries (Davison & Martinsons, 2016). As a research in Information Systems, understanding societies in developing countries (Gurstein, 2003) is important. Difference in context and interpretation based on philosophical underpinning provide clear and rich explanation of the phenomenon of interest. Each society has a unique understanding of the world.

## **4.2 Methodological approach**

This research uses case study as method for data inquiry as it provides for a contemporary phenomenon in secondary (and high) schools in Tanzania and South Africa as identified by Yin (2013). A case study is “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clear” (Yin, 1981, 2013). Interpretive case studies allow the researcher not to view themselves as outsiders or observers but explicitly included in data, concepts and interpretation during interaction with subjects (Fereday & Muir-Cochrane, 2006; Halaweh, 2012; Walsham, 2006).

Case study afford testing or generating a framework (Halaweh, 2012; Yin, 2003). Case study is used to identify, generate and support SEUMD and “draw out specific implications” (Halaweh, 2012:37). Case study requires development of a research protocol. Research protocol is developed based on framework, concepts from literature review and research question resulting in construct validity (Dubois & Gibbert, 2010; Yin, 2003). Construct validity assists the research to focus on data collection (Halaweh, 2012; Yin, 2013). From case study definition, four components are of importance, empirical inquiry, contemporary phenomenon, in real-life and boundary being unclear.

An empirical inquiry involves data collection. Empirical inquiry does not assume importance on experiments or archival data but requires a set of data collected from subjects that explain existence of phenomenon of interest (Gill, 2011; Lee, 1989; Lee & Baskerville, 2003).

A contemporary phenomenon is something that is current. A contemporary phenomenon requires investigating to understand what aspects exist within the phenomenon of interest (Benbasat, Goldstein, & Mead, 1987; Orlikowski & Baroudi, 1991). The phenomenon of interest is continuously evolving and creating a need to understand.

Real-life setting distinguishes case studies from laboratory work by revealing society and on-going activities (Dubois & Gibbert, 2010). Lastly, boundaries between phenomenon of interest and context are not clear (Yin, 2013), as the society does not separate them. They exist and intermingle such that, untangling one, means understanding more than the researcher expected. The researcher only limits scope using a theoretical lens. Failure to use a lens results in using a different methodology.

The phenomenon of interest is students' effective use of mobile devices for learning and how this influences academic performance. The boundary between effective use of mobile devices and learning is hard to identify. Students do not decide of specific time to use mobile devices.

Students use mobile devices randomly. Use of mobile devices can be consciously or unconsciously. Students learn of interesting concepts related to subjects they undertake (Crescente & Lee, 2011). It is hard to separate students' effective use of mobile devices, students learning and what influences students' academic performance. The best fit is questioned from textbook studies, teachers' guidance or effective use of mobile devices.

Students' use of mobile devices is a contemporary phenomenon. Despite government prohibition (ban) of mobile device use in secondary schools (Kafyulilo, 2014; Kreutzer, 2009), students use mobile devices. Data collection was undertaken at the school in a reflective way on students' use of mobile devices for learning outside the school. Data collection allowed for depiction of real-life context.

#### **4.2.1 Preferable conditions for using case study**

Yin (1981, 2013) proceeds by stating three conditions a case study is preferable. The first is when the researcher has a 'how' or 'why' research question. The question relates to intended research contribution. This research poses a what question that offers explanatory contribution. An explanatory contribution provides answers on 'how' and 'why' questions (Gregor, 2006). To answer a what question, the researcher interrogates data to show, why a phenomenon exists and how it has appeared in the society.

The second condition is the research does not control events. As an active observer, the researcher interrogates students on use of mobile devices for learning. The researcher uses research instrument prepared from the framework. The researcher does not control students' use of mobile devices for learning. The researcher does not conduct an experiment on mobile device influence on academic performance. It also accounts to few studies undertaken on effective use of mobile

devices for learning outside the classroom and especially in Tanzania and South Africa (Kafyulilo, 2014; Ng'ambi & Bozalek, 2013; Roberts et al., 2015).

Lastly, case studies are ideal when undertaken in a natural setting (real-life context). The society plays a significant role in students' decision towards or against use of mobile devices for learning outside the classroom. The society includes, teachers, parents, siblings and friends offering a natural setting.

#### **4.2.2 Choice of single vs. multiple case study**

A case studies is approached by using single case or multiple cases (Creswell, 2013; Halaweh, 2012; Lee & Baskerville, 2003; Rivard, 2014; Yin, 2013). A single case study is when the researcher purposely choses to use one context (or location) for data collection. The researcher justifies location chosen and unique (or extreme) characteristics it has (Gill, 2011; Yin, 1981, 2013). A single case study provides in depth understanding of the phenomenon of interests as the researcher immerses on it (Eisenhardt, 1989).

Multiple case studies are used when two or more contexts are used for data collection (Eisenhardt, 1989; Yin, 2013). The researcher intends on either comparing contexts, complementing or both, depending on the purpose of the research (Sharples et al., 2005; Walsham, 2006; Yin, 2013). This research uses multiple case studies for data collection and inquiry.

Multiple case studies are ideal in three scenarios (Gill, 2011). The first is when depicting a widely applicable theory that holds across all cases that are dissimilar (complementary case studies). The second is when establishing boundaries. Similar cases are chosen to show different outcomes (comparative case studies). Lastly, a hybrid approach allows for similar or dissimilar cases application and results either set boundaries or differences.

This research follows complementary multiple case study approach with two cases to provide validity of SEUMD as a theoretical framework trough empirical evidence as supported by Eisenhardt (1989). The cases have almost similar characteristics. The cases are in different contexts and used to provide explanation on the framework which offers empirical evidence (Eisenhardt, 1989).

Eisenhardt (1989) and Huang (2009) argue, multiple case studies offer explanatory power to framework building and affects quality of the framework developed. Multiple cases provide in depth understanding of research question and theoretical elaboration created thereafter (Halaweh,

2012). Theoretically, multiple cases are chosen to depict replication, theory extension, contrary replication and offer power to eliminate alternative explanations (Yin, 1981, 2003).

### **4.2.3 Justification of location for data collection**

Tanzania and South Africa are good representation of developing country context that suffice for data collection. The two countries provide a rich context of students and teachers using mobile devices. Populations in developing countries are marginalized by at least half the population being of infants and some youth (National Bureau of Statistics, 2013) who depend on parents to buy mobile devices and credit (airtime) (Kreutzer, 2009). Youth are aged 15-34 years (Blum, 2007). Of these, 14 to 20 years are secondary school students (UNFPA South Africa, 2014).

Data collection was undertaken in cities of Dar-es-salaam (Tanzania) and Cape Town (South Africa). Data was collected based on four reasons as identified by National bureau of statistics in Tanzania (2013) and statistics South Africa (2012). The first is, these cities have the highest urban population which assists in being able to understand students' use of mobile devices and generalize by city.

The second reason is a mix in culture and economy standards that favour diversity in these cities. As historical cities and having been linked to slave trade, Dar-es-salaam and Cape Town offer rich and diverse cultures. Thirdly, these cities are the highest in ICT's (mobile device penetration) use. In terms of ICT, mobile devices are the most available to secondary school students (Kafyulilo, 2014; Kreutzer, 2009). The fourth reason the cities offer a good representative sample in developing countries where mobile devices are used.

In each city, one secondary school was approached as a case study and used for data collection. In Dar-es-salaam, there are more than 317 secondary schools (Secondary Education Department, 2013). In Cape Town, a total of 180 secondary schools is identified (Department of Basic Education, 2016b; School4SA, 2017). These make up the total population of secondary schools the researcher can use for data collection (Hew & Leong, 2011).

The researcher must identify one secondary school in each city that meets set criteria and use as the unique and reliable source for data. This process is referred to as sampling (Gao et al., 2017). From the population of secondary schools, samples were selected using specific criteria.

The researcher used seven criteria for selecting the schools. The criteria are, first, the school must be a highly academically performing and has been in top 10% schools in the city for 3 years prior

to data collection (2012 to 2014). Academic performance of the secondary school is measured by the relevant authority in terms of national Form IV (or Grade 12) examination.

The second criteria, the school is mixed gender, mixed religion, mixed tribes and mixed ethnicity. This allows for rich information from respondents as underlying assumptions are also analysed. Each secondary school needed to have more than 40 students in Form IV or Grade 12 (also known as matric) as the third criteria.

The fourth criteria, each school offers all basic subjects a student seats for in final examination. The school has a ratio of at least one teacher per subject as the fifth criteria. A good filtering technique for students moving from one Form or Grade to another was the sixth criteria. Both school require an average pass of 40% of all subjects to progress to next Form or Grade. Lastly, students must pay fees or the school belongs to a quintile 4 category.

Quintile 4 secondary schools are school that students must pay fees. In South Africa, school are divided into quintile 1 to 5 (Lewin, 2009; Mestry & Berry, 2016; Ndlovu, 2011; Sayed & Motala, 2012). Quintile 1 are the poorest schools and quintile 5 the least poor.

The ranking for this are identified based on the poverty of the community where the school is situated (Badat & Sayed, 2014; Lewin, 2009; Mestry & Berry, 2016). Quintile 1 to 3 schools are schools that principals get subsidies from government for operation. Students do not pay fees. Students in government schools in Tanzania pay fees equivalent to \$20 for an academic year.

Quintile 4 and 5 secondary schools require students to pay fees. Quintile 5 secondary schools are expensive and for high income earners. Quintile 4 schools cater mostly to middle class citizens. By paying fees, students in quintile 4 have access to highly qualified teachers.

These teachers might be undertaking Masters or PhD. Teachers assist the school as teachers and consultants. Teachers are employed as full time or part timers while completing university studies. Teachers are highly motivated as the school is taken care, well equipped and offers opportunities with technology and support structure.

Based on criteria identified, moving from secondary school's population in Dar-es-salaam and Cape Town to sample schools applied quota sampling. Quota sampling requires identification of different criteria setting the sample apart from population (Roodt, 2013). The intention is to acquire rich, unique and informative information from respondents. To approach these respondents, the researcher needs to identify data collection methods used.

### **4.3 Research methods**

This research uses mixed method approach during data collection to complement shortages using a single method can present as argued by Creswell (2013). A mixed method involves collecting, analysing and interpreting quantitative and qualitative data in a study or in multiple studies providing an understanding of the phenomenon of interest (Becker & Niehaves, 2007; Creswell, 2013; Krutka et al., 2014). Creswell (2013) argues, mixed methods are used as a technique on neutralizing biases inherent in methods.

Not only does mixed method approach offer triangulation, but also provides for rich data collection and analysis. Thus, one method (either quantitative or qualitative) is used to inform (or embed) on another. The intention is providing different perspectives on phenomenon of interest.

#### **4.3.1 Different approaches to mixed methods**

Mixed method affords application of more than one approach for data collection based on a planned structure. The planned structure is organized in one of the following designs, sequential exploratory, concurrent, sequential explanatory and embedded (Bryman, 2006; Creswell, 2013; Walsham, 2006). These techniques allow the researcher to acquire rich information on the phenomenon of interest from respondents that inform the framework especially when learning happens outside the classroom.

A sequential exploratory mixed method organize data collection such that qualitative data collection start, followed by the quantitative with intention of aiding on generalization (Creswell, 2013; Seixas et al., 2016). Qualitative data searches for information where variables of the phenomenon of interest are not known. While qualitative approach explores relationships, merger with quantitative data aid with collection of large data. Quantitative data aids with refining and (or) testing qualitative data findings to provide justification for an emerging theory and generalizing to a population.

A concurrent mixed method allows for both approaches, quantitative and qualitative, use for data collection at the same time. No consideration for scanning or analysis of one approach prior to starting the other (Creswell, 2013). While concurrent mixed method enriches on collected data, aspects missing from one approaches might not be captured on the other as both operate at the same time.

Each data is analysed separate from the other and the results combined during interpretation or reporting. Results are used to triangulate and confirm, collaborate or cross-validate findings.

A sequential explanatory mixed method starts by collecting quantitative data with the intention of testing concepts or theories. Data is analysed (partially or fully) to understand unfolding information. Upon completion of the analysis, qualitative data is used to explain findings (Creswell, 2013; Santos & Ali, 2012).

Qualitative data collected is on fewer individuals. The intention of collecting qualitative data is enriching on quantitative data. The researcher acquires information on missing aspects that quantitative data did not account for. It assists when generalizing findings from qualitative data.

Lastly, embedded mixed method includes attaching a database collected using one approach (either qualitative or quantitative) onto a larger study using a different technique with intention of understanding levels, groups, or structures (Creswell, 2013). Embedded mixed method is used to understand a segment of data that aids in explaining from large data.

This research employs sequential explanatory mixed method for data collection and analysis to address the research question which affords explaining on each methods shortfall as argued by Creswell (2013). Quantitative data is collected, scanned and analysed for general trend. Then, qualitative data is collected to explain emerging issues. By completing quantitative data collection and analysis, then starting qualitative data collection, the research reaps the advantage of using multiple approaches and outcome enriches the study (Creswell, 2013).

Interpretation of quantitative data leads to correction of qualitative protocol and identification of respondents during qualitative data collection. Quantitative data depicts behaviours inherent (Yin, 2013) in secondary school students and teachers. Qualitative data involves fewer individuals as respondents until saturation (Halaweh, 2012; Sokolovsky, 1996). Data triangulation is applied through use of quantitative and qualitative data collection and analysis.

Triangulation is using more than one source for data collection and analysis and is meant to increase validity (Benbasat et al., 1987; Eisenhardt, 1989; Krutka et al., 2014). Other types of triangulation include, investigator triangulation, where more than one researcher participates in data collection or analysis.

Respondent's triangulation, data is collected from multiple units of observation. Theoretical triangulation, several frameworks are used. Methodological triangulation, data is gathered using

different methods (Benbasat et al., 1987; Bryman, 2006; Creswell, 2013; Eisenhardt, 1989; Osakwe, Dlodlo, & Jere, 2017; Santos & Ali, 2012; Sokolovsky, 1996; Yin, 2003).

This research employs data triangulation, respondent's triangulation where students and teachers are used as sources of information. The use of three theories to form SEUMD is a theoretical triangulation. Use of mixed methods offers methodological triangulation and explanation (Bryman, 2006). Research priority is on qualitative data (Bryman, 2006; Yin, 2013).

### **4.3.2 Independent and dependent variables**

Whether data triangulation or respondent triangulation, the researcher must identify central variables necessary to the phenomenon of interest. The variables are independent and dependent (Alrasheedi, Capretz, & Raza, 2016; Lai, 2015). The independent variable is the education systems (Ngwenyama et al., 2006). Independent variables do not change. The curriculum may be altered, but new students register to start school and complete. Education continues despite advancement in technology.

Innovation and as such mobile devices are dependent variable. A dependent variable cannot exist without presence of another (Alrasheedi et al., 2016). Mobile devices are the centre of attention in students learning outside the classroom (Lai, 2015).

Before mobile devices, television, radio and computers were advocated for learning (Shudong & Higgins, 2006). For technological tools to be used, learning must exist. Tools support the education system. Outside the classroom effective use of mobile devices is a dependent variable to learning. One can argue this learning is not structured or expected to produce specific output (Domingo & Garganté, 2016). At the same token, one realizes students relate what they learn through mobile devices to what is taught in class. The direct link of learning using mobile devices and content learnt might be missing, but the reflective elements are present. Through reflection students learn and relate content from mobile devices to classrooms.

### **4.3.3 Unit of observation and unit of analysis**

During data collection, unit of observation must be identified. The unit of observation relates to that the researcher focuses on during data collection (Boell & Cecez-Kecmanovic, 2014). Unit of observation can be respondents as individuals, a group or an organization. The researcher identifies level of engagement with respondents and how to organize data collection sessions.

During data analysis, the researcher must explicitly state what and how analyse of data is undertaken (Boell & Cecez-Kecmanovic, 2014; Lyytinen & Damsgaard, 2001). Unit of analysis may be individuals, a group or an organization. Unit of analysis is dependent on the researcher's intention and research question posed. The framework used also guides in such decisions on unit of analysis.

This researcher uses students and teachers as units of observation and unit of analysis as individuals to aid with explaining the phenomenon of interest. Students and teachers' response provide explanation on the phenomenon of interest. The researcher thus splits cases and explains findings of the study based on case and further based on method as suggested by Yin (2013). Eisenhardt (1989) proceeds by demanding a chapter that merges and complements multiple views of previously explained cases.

Understanding of independent and dependent variables in conjunction with units of observation and analysis, allows one to delve into data collection approaches with a good picture of what is expected.

#### **4.3.4 Quantitative approach**

Quantitative data is used in theory development and testing where hypothesis are identified and research purpose is shown using statistical means of presentation (Creswell, 2013; Dubois & Gibbert, 2010; Lee & Baskerville, 2003). Quantitative data are associated with deductive approach. A theory or framework is identified prior to data collection. The framework is used to develop questions given to respondents during data collection depicting construct validity (Hew & Leong, 2011; Sarker et al., 2013).

Quantitative data uses larger samples to justify findings and create base to generalize from. An objective process is followed where collected data is subjected to statistical inferences for analysis and reporting (Hew & Leong, 2011; Lee, 1989). Qualitative data collection techniques include, questionnaire and survey.

Questionnaires may be open or close ended (Ndlovu, 2011). An open-ended questionnaire allows respondents to include comments in. A close ended questionnaire requires the respondent to select from options available per question.

The researcher used SEUMD to develop questions included on research protocol. The protocol included an introduction, explaining the purpose of research, how data that will be collected, confidentiality and reporting format.

Thereafter, questions from the framework were presented. Questions were structured in a closed questionnaire format. Respondents would only select answers from the list. The unit of observation was Form IV and Grade 12, students and teachers as individuals. Sample questionnaires for students and teachers are attached as appendix one and two.

All Form IV and Grade 12 students and teachers were given questionnaires by the researcher. Questionnaires were collected after 20 minutes (or as respondent completed). The questionnaires were given in classrooms for students and in offices for teachers. Respondents were informed of ethical issues. No names were included on questionnaires.

Data analysis used descriptive statistics (Kafyulilo, 2014; O'Bannon & Thomas, 2014). Descriptive statistics depicts frequency distribution as a technique for statistical analysis. Results allow the researcher to describe what the data states and draw conclusions. Collected data was analysed for each unit as individuals. Results are provided by showing frequencies.

The tool that used for data analysis on quantitative data is Epi-Info 7. A simple, yet powerful tool that allows the researcher to create a database of questions and responses. Thereafter, the researcher queries to depict responses for each question. Data is presented in table or plotted as a graph. The tool exports data to excel and SPSS and Statistica.

#### **4.3.4 Qualitative approach**

Qualitative approach focuses on data collection based on context (Marvasti, 2014; Myers & Newman, 2007; Sarker et al., 2013). The intention of qualitative approach is to understand the phenomenon in each context. Qualitative approach affords individuals to ascribe meaning to concepts and behaviours such that one needs to understand based on their explanation. Qualitative approach also create an avenue for developing or refining a framework (Miles & Huberman, 1984). Qualitative approach either starts with a framework or collect data from field without a framework. Starting with a framework is a deductive approach to data collection (Fereday & Muir-Cochrane, 2006). The researcher started with a research question leading to a framework and develops research protocol of it.

Starting with data collection is an inductive approach (Fereday & Muir-Cochrane, 2006; Halaweh, 2012; Sarker et al., 2013). In inductive approach, the researcher starts with a research question with no framework. The researcher collects data without prior knowledge of what concepts to focus on. During data collection, each data is analysed to identify emerging concepts. Data collection and analysis proceeds until completion with a framework or model.

Both approaches used, deductive or inductive, the researcher would ensure unit of observation and analysis are identified prior to starting data collection. Qualitative data collection includes, interviews and observations (Bryman, 2006; Sarker et al., 2013; Schultze & Avital, 2011).

Interviews are divided to structure, semi-structured and unstructured (Bryman, 2006; Myers & Newman, 2007). Structured interviews are those requiring the researcher to ask questions as visible on protocol without alteration.

Semi-structured interview allows the researcher to edit, add or remove questions on the protocol. Great care is taken in ensuring questions do not diverge from framework. Lastly, an unstructured interview requires an open mind in understanding the phenomenon of interest without a complete protocol for data collection. The researcher thus has few questions to start with. The research will expand to include questions emergent from interviews.

Observations happen when visiting data collection site and document as much of that observed to explain phenomenon of interest (Baskerville & Myers, 2015; Marvasti, 2014). Observations are divided into direct and participant (Marvasti, 2014). Direct observations manifest as researcher visits site for data collection and documents that observed. Mostly, without informal discussions. This is also referred as peripheral observation. The problem with peripheral observation is the observer does not have access to detailed information. Respondents provide answers that are not detailed. Peripheral observer is assumed to be an outsider.

Second type of direct observation is active observation. An active observer is introduced to the site for data collection and the society identify the observer. Respondents reply to observer's questions with rich information and relate to active observer. Active observation is prevalent in case study research (Marvasti, 2014).

Finally, a participant observer has accessed the site for data collection and immersed themselves that the society identifies as one of theirs. Participant observers are prevalent in ethnographic and case study researches (Baskerville & Myers, 2015).

This research uses semi-structured interviews and active observation as sources for data collection. Sample interview questions are attached as appendix 3. These techniques are used in qualitative data collection (Bryman, 2006; Seixas et al., 2016) and applied in Information Systems (Myers & Newman, 2007). The semi structured interviews were done using face to face for a period of 25 to 40 minutes per each student.

A different protocol was used for qualitative data collection compared to quantitative data. The intention of collecting qualitative data was to explain emergent aspects from quantitative data. Qualitative data collection was undertaken upon completion of collection and analysis of quantitative data.

The protocol communicated objectives, issues and research interests investigated and shared to subjects before the interview started. Respondents review research protocol and upon clarification of unclear terms, the interview begins. The intention was to increase reliability (Halaweh, 2012).

The researcher observed and interacted with teachers, students and admin staff at each school. Qualitative data provides deeper understanding of the phenomenon of interest used to inform other settings (Orlikowski & Baroudi, 1991).

Data collected from students and teachers was analysed as individual data for unit of analysis. Qualitative data analysis is conducted using discourse analysis, interpretative phenomenological analysis, content analysis and thematic analysis to name a few.

Thematic analysis is flexible to apply on any epistemology or theoretical approach making it a useful data analysis approach (Braun & Clarke, 2006). The 6-step thematic analysis by Braun and Clarke (2006) is used to analyse qualitative data. All interviews and field notes were edited transcribed (Kvale, 1988) and loaded on a qualitative analysis tool known as Atlas.ti 7.

Thematic analysis searches for themes emergent from data in relation to the phenomenon of interest (Braun & Clarke, 2006, Fereday & Muir-Cochrane, 2006, Okoli, 2012). Thematic analysis enforces constant (but careful) reading and re-reading data as a form of pattern recognition in qualitative data (Clarke & Braun, 2013, Fereday & Muir-Cochrane, 2006).

#### **4.3.5 Validity and reliability**

Research involving data collection follows scientific procedures by showing how instruments were developed, data was collected, analysed and discussion allows for replication. Collectively referred to as rigor (Dubois & Gibbert, 2010). Interpretivist research shows rigor through credibility, accuracy, transferability, confirmability (Kopcha, 2012; Venkatesh, Brown, & Bala, 2013) and other principles as identified by Klein and Myers (1999). Positivist research requires validity and reliability to show trustworthiness of data and offer rich details of the case description to allow for replication (Sarker et al., 2013; Venkatesh et al., 2013).

Interpretivist are urged to apply validity and reliability in research as positivist to depict rigor (Becker & Niehaves, 2007; Dubois & Gibbert, 2010). Four aspects are important, construct

validity, internal validity, external validity and reliability (Benbasat et al., 1987; Creswell, 2013; Davison & Martinsons, 2016; Dubois & Gibbert, 2010; Eisenhardt, 1989; Flyvbjerg, 2006; Lee & Baskerville, 2003; Okoli & Schabram, 2010; Ozdamli & Uzunboylu, 2015; Yin, 2003).

Construct validity denotes relations existing from research question to discussion of findings. Main research question is broken to sub-questions in chapter one (Dubois & Gibbert, 2010, Roodt, 2013). A detailed literature review is undertaken relating to each sub question leading to main question. Literature review was extended by developing a conceptual framework, SEUMD and is detailed in chapter three.

Using concepts (themes) from the framework, two research protocols were developed. Research protocols were for quantitative data and qualitative data. Quantitative protocol intended to understand students' widespread use of mobile devices for learning outside the classroom. Qualitative protocol to provide explanation on quantitative data.

In total, use of 301 questionnaires and 35 semi-structured interviews shows data triangulation. Respondent triangulation is represented by collecting quantitative data from students and teachers. Teachers' quantitative data was aimed at acquiring a general perspective on teachers' use of mobile devices and views on students' use of mobile devices for learning.

Internal validity is shown during data analysis through relationship of collected data and conceptual framework. Quantitative and qualitative data are analysed in relation to SEUMD. Data analysis provides richness through explaining the framework and findings to depict absence of systematic error (Dubois & Gibbert, 2010; Eisenhardt, 1989). Findings were linked to theoretical framework and previous research.

Discussions linking data analysis and previous research are in chapter nine. Data extracts are provided on chapters six and eight as direct quotes of respondent statements from semi-structured interviews. Chapter ten demonstrates researcher reflection in response to Klein and Myers (1999) review of interpretive field research.

External validity (generalizability) relates to two elements, generalizing data in relation to framework and generalizing framework to a population (Davison & Martinsons, 2016). Generalizing data in relation to framework is conducted in chapters five, six, seven and eight. At the beginning of each chapter, a case description is provided. Rationale is provided for selection of cases in section 4.2.3.

Generalization to population is done using multiple cases, one in Dar-es-salaam and another in Cape Town. Complementing case studies is used and offers richness of data and appreciation of cities while depicting external validity. Qualitative data is used to complement on quantitative data. Complementing research methods involves “seeking elaboration, enhancement, illustration, clarification of the results from one method with the results from another” (Bryman, 2006:105). Discussions are also linked to research findings in the field.

Reliability requires reporting research that does not include random errors and researchers can follow steps used in a systematic manner (Benbasat et al., 1987; Dubois & Gibbert, 2010; Kopcha, 2012; Lee & Baskerville, 2003; Okoli & Schabram, 2010; Ozdamli & Uzunboylu, 2015).

Reliability in research is shown using transparency and allowing for replication. Research depicts transparency by providing accurate account of events through documentation. The appendix includes research protocol for quantitative and qualitative data collection. Due to ethical concerns, case study database is not included. Replication is achieved by following documented explanation of case description, justification of case selection, data collection and data analysis procedures and using research protocol.

#### **4.3.6 Timeframe**

Research is bound by time taken for data collection. Data collection is undertaken as cross-sectional or longitudinal (Gill, 2011). A cross sectional timeframe allows the researcher to collect data once at the site, analyse and report (Nyahende, 2013; Rogers, 1983).

Longitudinal data collection requires returning to data collection site at a later planned period (Gregor, 2006; Vainio et al., 2014). Longitudinal timeframe involves a fixed period after first data collection, 3 months, 6 months or a year. In a longitudinal research, the researcher maintains the protocol for data collection and use previous findings to complement or compare with current data. This research used cross-sectional timeframe, data was collected once.

#### **4.4 Ethics**

Consent was overt (Taua, Neville, & Hepworth, 2014). The researcher received ethics clearance from university of Cape Town, Western Cape department of education and principals of each school. Students were informed of the study before questionnaire distribution. The researcher was accompanied by teachers at each school when meeting students.

Students were given control to choose the location and room for interviews. Students assisted the researcher to organize seating arrangement. The teacher would stay outside the room and not impede on interview. The teacher will check on progress by stepping in the interview room to show presence.

To give students a sense of security, windows and door were left open, lights on and no music was played. The researcher and students would seat where anyone entering the room can see, middle or front of the class or office. Students interviewed in sequence were given liberty to stay in the room or wait outside. Students stayed in the room and selected another side to seat. Students would discuss own issues with peers. This allowed interviewed student not to feel alone or overwhelmed. Student leaders were also informed of the researcher presence and venue used for data collection. Student leaders provided consent and were willing to offer an office for interviews. On discussion with interviewees, the researcher identified interviewees did not want to share offices with their leaders. Interviewees believed any views provided will be shared with teachers. The decision was made to allow students (interviewees) to find a neutral room. Students were in control of the venue for data collection.

Students were asked for permission to collect data through questionnaires and later interviews. Students that accepted interviews, were informed they may terminate the interview at any time if not comfortable, supposed to attend tuition or meeting. Students were also informed they may choose not to answer a specific question or set of questions. All relevant ethics forms are attached as appendix six to appendix eleven.

In terms of power relations, students were interested in understanding how does a person get to a level of doing a PhD. Students viewed the researcher not only as a brother, but a fellow they can acquire details from. Teachers on the other hand viewed the researcher as a person who they can manipulate by requesting laptops, chocolates and monetary compensation before completing questionnaires. While in the first instance power dynamics were an act of shock to the researcher, preparation and expectation of such events assisted in manipulating events to the researcher's advantage. One such approach was to explain that the research is not funded. The other approach was to explain to interested students the path they should follow before enrolling for a PhD.

## **4.5 Expected research outcomes**

The research has contributed in three fundamental areas, theoretical, to literature and methodology. The framework for students' use of mobile devices for learning outside the classroom (SEUMD) offers explanation on students' adoption and effective use of mobile devices. The framework addresses concerns raised by teachers, parents and cultural aspects as narrated by students. Application of the framework in multiple cases aids in generalizing to academically performing secondary schools that pay school fees.

The research contributes to literature in mobile learning. Particularly outside the classroom effective use of mobile devices. Empirical evidence from two secondary schools is used to support students' effective use of mobile devices. Previous held assumptions and myth on students' misuse of mobile devices are clearly explained. Counter arguments are provided for clarification. The discussion aid in showing mobile devices are used as a supplementary source of information for learning.

Contribution to methodology is provided by using SEUMD in multiple case studies. The research applies sequential explanatory mixed method on multiple case studies. The research uses questionnaire, active observation and semi-structured interview uniquely to explain students' effective use of mobile devices for learning outside the classroom. Thus, the research provides contribution to methodology through stated applications on SEUMD.

## 4.6 Conclusion

Error! Reference source not found.

	Title	Explanation
Philosophy	Ontological approach	Relativist
	Epistemological assumption	Interpretivist
Contribution		Explanatory
Research purposes		Abductive
Methodology		Case study
	Type of case study	Multiple case study
	Method for data collection	Mixed method
	Type of mixed method	Sequential explanatory
Quantitative		Questionnaire
	Type of questionnaire	Close ended
Qualitative		Interviews and observations
	Type of interviews	Semi-structured
	Type of observation	Active observation
Method for data analysis		
Quantitative data		Descriptive statistics
	Type of descriptive statistics	Frequency distribution
	Tool used	Epi-Info
Qualitative data		Thematic analysis
	Thematic analysis approach by	Braun and Clarke (2006)
	Transcription	Edited transcription
	Tool used	Atlas.ti 7
Variable		
	Independent	Education
	Dependent	Innovation (mobile devices)
Unit of		
	Observation	Students and teachers as individuals
	Analysis	Students and teachers as individuals
Triangulation approaches		Data triangulation
		Respondent triangulation
		Methodological triangulation
Timeframe		Cross-sectional
Validity		Construct validity
		Internal validity
		External validity
Reliability		Transparency
		Replication

summarises the discussion of chapter 4. This research employs a relativist ontology and an

Interpretivist epistemology. The researcher explains findings in chapter 5 with aims to depict students' effective use of mobile devices for learning outside the classroom.

Title		Explanation
Philosophy	Ontological approach	Relativist
	Epistemological assumption	Interpretivist
Contribution		Explanatory
Research purposes		Abductive
Methodology		Case study
	Type of case study	Multiple case study
	Method for data collection	Mixed method
	Type of mixed method	Sequential explanatory
Quantitative		Questionnaire
	Type of questionnaire	Close ended
Qualitative		Interviews and observations
	Type of interviews	Semi-structured
	Type of observation	Active observation
Method for data analysis		
Quantitative data		Descriptive statistics
	Type of descriptive statistics	Frequency distribution
	Tool used	Epi-Info
Qualitative data		Thematic analysis
	Thematic analysis approach by	Braun and Clarke (2006)
	Transcription	Edited transcription
	Tool used	Atlas.ti 7
Variable		
	Independent	Education
	Dependent	Innovation (mobile devices)
Unit of		
	Observation	Students and teachers as individuals
	Analysis	Students and teachers as individuals
Triangulation approaches		Data triangulation
		Respondent triangulation
		Methodological triangulation
Timeframe		Cross-sectional
Validity		Construct validity
		Internal validity
		External validity
Reliability		Transparency
		Replication

Table 3: Philosophical and methodological approach.

## CHAPTER 5: QUANTITATIVE DATA ANALYSIS AND FINDINGS OF SCHOOL A IN DAR-ES-SALAAM

Previous chapter identified different research aspects applied, philosophy, methodology, timeframe, unit of observation and unit of analysis. It justified data collection in Tanzania and South Africa, including explanation on quota sampling. Multiple case studies were argued. This chapter begins discussion of findings from one of the cases, a secondary school in Dar-es-salaam, Tanzania. Explanation of the case is provided to depict external validity (Dubois & Gibbert, 2010).

### 5.1 Case description

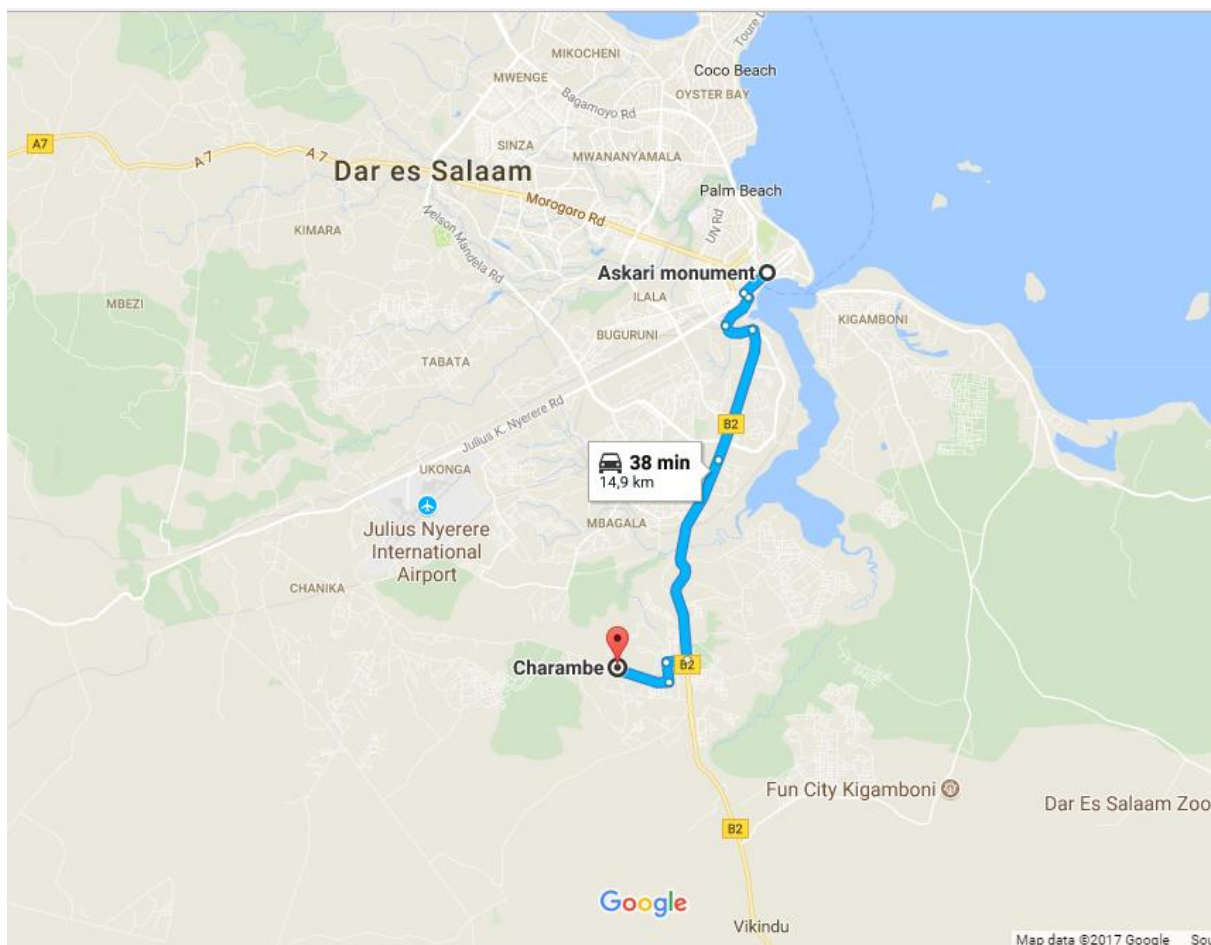


Figure 2: Map of Charambe

The secondary school in Dar-es-salaam is a highly academically performing schools in the city (hereafter referred as School A). The district where the school is situation is called Charambe. Figure 2 demonstrates borders of the district. Charambe has a surface area of 7.36 km<sup>2</sup>. The total

population as of last census was 101, 933 (Brinkhoff, 2012). Charambe is an area predominantly residential for low-income citizens.

Data was collected from students and teachers. The school is situated 15km from Dar-es-salaam city centre (Google, n.d.). The school is owned by the Roman Catholic Church and contains all essential facilities.

Facilities include a library with recommended and supplementary textbooks, journals, audio and television set. Audio and television set assist students learn of contemporary events in the country and over the world. The school has sports facilities, basketball, volleyball, netball courts and a football pitch.

The school is brick walled and this assists in security. The school has security guards. The school bus takes students to sporting events and academic competitions such as debates and sight-seeing tours. The schools' boarding facilities is open for students from outside Dar-es-salaam and Form IV students. Form IV students use boarding facilities to prepare for national examination and reduce community from home. The school offers French and computer courses that few schools in Tanzania have.

Teachers and students are using mobile devices for learning outside the classroom and as such, provide for a contemporary phenomenon in this society. Apart from being an academically performing secondary school, the school was also chosen as it is mixed gender, mix religion, offers all seven subjects for national examination and students pass by having 40% average in an academic year before proceeding to next Form.

Getting below 40% means repeating the Form or a student moves school. The school has a ratio of at least one teacher per subject for Form IV subjects. Some of the teachers at the school have high qualification, Master's. The school accepts in-training teachers and acquires academically highly qualified teachers.

Students pay school fees of Tshs. 1,910,000 (\$ 855) for day scholars and Tshs. 3,030,000 (\$ 1,356) for boarding students for an academic year. Academic year starts in January and ends in November in Tanzania. Failure to complete fees means the student does not seat for term examination. Prior to said exclusion, students return home.

The student is given a letter showing outstanding amount and either a parent should pay or explain to the school (in person) when the balance will be completed. Parents negotiate on completion date

with the deputy headmaster of administration and write a letter to commit. Children are then allowed to attend class. The cycle starts every mid-term.

A day at the school starts at 7:30AM when students meet at assembly grounds. Students sing the national anthem and school song. Upon completion, students receive updates from headmaster or teacher on duty on activities performed or forthcoming. Student representative leaders inform peers of school or sporting events.

At 8:00AM (or when assembly completes) students head to class. Classes finish at 3PM with two breaks, tea break from 10AM to 10:20AM and lunch break from 12:20PM to 1PM. Form IV and VI students take half an hour break at 3PM and return for remedial classes. Remedial classes operate from 3:30PM to 5PM. Excluding Friday when students finish at 4:30PM.

Secondary school in Tanzania starts at Form I with average age of 14 and progresses to Form IV where students write national examination (Kalolo, 2015). Passing the national examination provides opportunity to continue with Form V or join technical colleges for a certificate course. Form V students are examined two years later, in Form VI, and pass means joining university. Failing Form IV provides a chance for repeating or technical colleges for non-certified courses.

Form IV at the school has six classes. Classes are identified by combinations. One class is for arts combination students. Arts students' seat for compulsory seven subjects during national examination. The seven subjects are civics, biology, mathematics, geography, Swahili, English and history.

Two combination classes are for business subjects. Business students undertake arts subjects adding commerce and book-keeping. Two classes are for science subjects. Science subjects include arts and physics and chemistry. The sixth combination is pure science. Pure science students include science and additional mathematics.

Students are requested to leave mobile devices at home. If any mobile device is found within school premises, it is confiscated. Security guards search students known as trouble makers. Guards ensure no student enters school gates after assembly without signing late arrival book. Late arrivals are punishment by teacher on duty. Punishments include physical activities, running between administrative block and the gate (distance of 20 meters) and back, cleaning corridors and toilets.

## 5.2 Data collection

Data collection at the school started by appointment with the principal. Intention of research was explained and ethics approval letter from the University of Cape Town and research protocol shared. The researcher was referred to deputy principal academics. The school has two deputy principals, academics and administration.

Contents of the research protocol was explained to deputy principal academics and reference given to school research representative. The research representative is a biology teacher as is the deputy principal academics.

The research representative requested an appointment on the day quantitative data collection commences. A date was selected and time organized for 2PM. The researcher arrived at 1PM on said date. Intention of arriving early is to ensure research protocol is reviewed and students are informed to wait in classrooms. Early arrival also included requesting permission from teachers. Teachers informed students to wait after class. Data collection took at least 20 minutes per classroom.

On the date and time agreed upon, the research representative was handling academic issues and did not review research protocol. For 45 minutes the research representative was loitering in the corridors and would constantly inform the researcher that she is completing administrative duties. At 2:45PM, the research representative introduced the researcher to the school patron. She stated, "I will not have enough time to assist in this matter". The school patron is a biology teacher. A brief discussion followed and the patron set a new date to start data collection.

On the new date, the researcher arrived at the school at 2PM and the patron was awaiting. The patron requested the researcher to wait until 2:40PM as data collection begins after class. At 2:35PM, the patron went to Form IV classes and started asking teachers for last 10 minutes towards data collection.

Teachers in two classes agreed. In one class, the physics teacher stated, "Once I am done with class, only then can he [the researcher] come in". Three of the classes did not have teachers. Upon acquiring permission from patron, quantitative data collection commenced.

The patron would inform students the researcher is from university of Cape Town (UCT). The researcher would introduce himself to students and explain the aim of the research. Students were asked if they have questions. Students would then be requested to fill a printed questionnaire and with students' permission, they were distributed.

Students were given 20 to 30 minutes for completion. The questionnaire is self-administered. Questions required respondents to select a yes or no answer. In few sections, hours on mobile device and hours on Internet, students would input numbers. Questionnaire closed ended. Students completed questionnaires in 10 minutes. When questionnaires were returned, the patron would move to the next class and start the process until all six classes in Form IV were included.

Each classroom is required to have 35 to 45 students. In total, 259 Form IV students. During quantitative data collection, 203 students returned questionnaires. Quantitative data was collected in April 2015, two weeks before students write mid-term tests. Some of the students were not at the school due to fees. Some students took the questionnaire with promise to complete and return via the patron. Only one student remembered to submit. Some students were not at school due to illness.

Form IV teachers were given questionnaires with the intention of understanding use of mobile devices and if any academic application is included. The other intention was to acquire teachers view on students' use of mobile devices. Teachers have been identified in chapter two and three as concerned on students' use of mobile devices.

23 Form IV teachers were given questionnaires and 19 were completed and returned. Teachers were given questionnaires from 1PM to 2PM on the same date students completed theirs. Some of the teachers requested monetary compensation believing the research is funded. Teachers were informed the research is not funded and referred to purpose of the research on the protocol.

### **5.2.1 Assessment of completed questionnaires from students and teachers**

Each questionnaire was assessed for completion. Out of 204 students that responded, 2 respondents filled only demographic information. Demographic data was not the main reason for data collection. The two questionnaires were discarded. Two female teachers did not complete age on the questionnaire. Teachers' ages were acquired patron.

Student and teacher questionnaire are included in appendix one and two respectively.

Questionnaires were meant to respond to sub questions one, two and five of the main question,

1. To what extent are secondary school students in Tanzania using mobile devices for learning outside the classroom?
2. What mobile device affordances do secondary school students use outside the classroom for learning?

5. What are teachers' perceptions on students' use of mobile devices for learning outside the classroom?

These questions were linked to the concepts of innovation, social system, concern and availability from the framework. For each concept, the working explanation is provided on Table 2.

### **5.2.2 Data omission during data collection**

In the first two classes, students were asked to submit completed questionnaires in front of class. Some students felt shy and intimidated response will be read by researcher. Students started collecting peers completed questionnaires and submit as a pile. This became the approach in remaining four classes.

One student recorded his age as 12 years old. A female student identified the misinformation. She confronted the peer, "Why did you write your age as 12 years?" He was shy to respond. The female student explained the male student is 17 years old. One male student in commerce combination wrote age as 12 years old. The researcher edited to 17 years old.

Two female teachers in the commerce department did not include age. Teachers were told information is confidential. The two teachers chose not to complete the section. Yet, asking each other "why does he need to know our age?" It became evident that, teachers were worried of exposing their age. When the situation was narrated to patron, he identified their age as between 30 and 35 years old.

### **5.2.3 Creation of unique numbers on questionnaires**

Completed questionnaires were given unique numbers. The intention is assist during data entry. It is easy to revert to a questionnaire for verification if data entered is incorrect or incomplete. Upon completion of the exercise, all data was entered on Epi Info 7.

The researcher scanned all submitted questionnaires as identified on section 5.2.1. During scanning, completed questionnaires were counted. The intention of counting was to identify range of unique identifiers for each questionnaire. Students' data was provided with unique numbers separately to teachers.

Each questionnaire then was coded by a unique number. Students were assigned a three-digit number from 001 to 204. Teachers were assigned a two-digit number from 01 to 19.

### **5.3 Preparation of quantitative data entry and analysis tool**

In preparation for data entry, Epi Info 7 was programmed. Programming was done by creating forms, attaching labels (for titles), radio buttons (for single selection of option, gender and study combination), drop down menus (yes or no questions), textboxes and grouping.

Textboxes comprised, age, questionnaire number, number of hours on device and hours a student uses social media on mobile device in a day. Grouping comprised of activities done on mobile device and for email address company selection. All these were created on a form and a database (equivalent to MS Access) would store data.

In the process of creating forms, conditions were created to assist in error capturing. Data entered with numbers higher than range were rounded off to the highest number. Data entered with numbers lower than the range were allocated to lowest number on the range. Conditions set were:

- Questionnaire numbers are 3 digits for students, 100 and 2 digits for teachers, 01.
- Age was limited to 2 digits and was ranged for students (12 to 25) and teachers (25 to 70).
- The number of hours a student spends in a day on a mobile device was within the range of 0 to 18 hours.
- The number of hours a student spends in a day using Internet on a mobile device was within the range of 0 to 18 hours.

Several errors were noticed during data entry. Errors based on range and interpretation. The following range errors were noticed:

- 14 students entered using mobile devices 24 hours a day and 3 students stated using mobile devices for 20 hours in a day,
- 8 students use Internet on mobile devices for more than 18 hours in a day.
- 1 student uses a mobile device for 30 minutes in a day and 15 minutes on Internet and
- Another student uses mobile device for 45 minutes in a day and 10 minutes on Internet.

Upper identified times, 20 to 24 hours on mobile devices and more than 18 hours on Internet were rounded off to 18 hours each. Lower time, 30 to 45 minutes on devices and 10 to 15 minutes on Internet were rounded off to 0 hour each.

The prominent interpretation error was on email. Students and teachers were asked to select companies email addresses they use belong to. The list contained Yahoo, Hotmail and Google.

The email question was open and other option was included. Teachers and students, wrote Gmail. This would mean students and teachers don't know what company owns Gmail, Google.

Two students wrote Live score, 2 Rocket mail, 5 Facebook, 2 Twitter and 1 WhatsApp. WhatsApp is an instant messaging application that can be accessed using a mobile device or a web browser. Live score is a website offering update sporting results. Facebook and Rocket mail have closed email addresses. Twitter does not offer email address. Twitter uses other company email addresses to register an account.

The least expected interpretation error came was completion of sections by writing text instead of numbers or ticking appropriate option. One question required teachers to tick what students use mobile devices for. The options given were recreational, social, entertainment and academic. Examples were given for each to illuminate the theme.

One teacher underlined examples to mean how he uses his mobile device. These were audio for recreation and calculator for academic matters. On the same question, some students wrote "a little" on their academic use of mobile devices. In response to hours using a mobile device for learning, one student wrote "it depends on the program I need".

#### **5.4 Descriptive Analysis**

Descriptive statistics was used to summarize survey data. Descriptive statistics can be performed on quantitative data with an intention of identifying frequencies, percentages, mean, median, mode and standard deviation (Domingo & Garganté, 2016; O'Bannon & Thomas, 2014; Orlikowski & Baroudi, 1991; Ozdamli & Uzunboyu, 2015).

As identified by Orlikowski & Baroudi (1991) and Oz (2014), frequencies were used. Questions asked emerged from SEUMD and hence the analysis depicts students' and teachers' response to concepts.

For each question, a frequency table was created. Frequency table generation continued until all 25 questions for students and teachers were illustrated on tables. Tables were used for basic understanding on the extent of mobile devices use, affordances that students and teachers use mobile devices outside the classroom for learning and teachers views on students' use of mobile devices.

## 5.5 Students data analysis and findings

This section explains quantitative data analysis and findings per concept. The tables provide summaries followed by explanations.

Demographics and general information			
No.	Concept	Characteristics and aspects	Frequency
1	Gender	Female	72
		Male	127
		Missing	3
		Total	202
2	Learning combination	Arts	19
		Commerce	60
		Science	96
		Pure Science	26
		Missing	1
		Total	202
3	Age	12 to 14	2
		15 to 17	156
		18 to 20	40
		21 to 23	1
		Missing	3
		Total	202
4	Mobile device	Personal ownership	
		Yes	171
		No	29
		Missing	2
		Total	202
		If NO, sharing with uncle, aunt, brother, sister, or parents?	
		Yes	27
		No	2
		Total	29
		Internet on mobile device	
		Yes	187
		No	12
		Missing	3
		Total	202
5	Email address	Ownership	
		Yes	137
		No	62
		Missing	3

		Total	202
		Email address company	
		Yahoo	55
		Gmail	121
		Hotmail/Live	19
		Other	5

Table 4: Students demographics and general information.

Table 4 demonstrates demographic and general information based on analysed questionnaires. There are more male students. Science students completed more questionnaires. It should be noted, arts and pure science have only one class each with maximum of 40 students. Commerce has two classes, as is science.

In 2015, science classes had 50 students each hence the high number on completed questionnaires. Students age range from 12 to 21 years old. The data hides details. The age range 15 to 17 has 97 students aged 17 years old.

### 5.5.1 Availability of mobile devices

Data demonstrates 171 students own mobile devices. Students ownership is despite the ban, fear and control at the school and by ministry of education. The twenty-seven students who do not have personal ownership of mobile devices, share with a relative or sibling.

Two students do not own mobile devices. It was identified in qualitative data collection, one of the students lost the mobile device. The other mobile device was confiscated by mother to allow the student to focus on studies. Form IV students are preparing for final examinations.

Mobile devices that students own have Internet access as 187 students identified. Internet on mobile devices affords students communication with peers and friends alike. Internet access allows students to access emails and 137 students illustrate owning at least one email address. The email address companies include Yahoo, Gmail, Hotmail (or Live), Rocket mail and Facebook email.

Hours on mobile device (range)	0 to 2	3 to 5	6 to 8	9 to 11	12 to 14	15 to 17	18 and above	Missing	Total
How many hours in a day do you use your mobile device?	43	52	33	4	29	2	28	11	202
How many hours in a day do you use social media (Facebook, Twitter and Instagram)?	114	33	18	7	11	1	8	10	202

Table 5: Hours students spend on mobile devices and using Internet

Table 5 shows students spend up to 18 hours on mobile devices. On a regular day, students spend 3 to 5 hours on mobile devices. The data is dispersed but ideal to identify students spending 18 hours and above on mobile devices. 28 students describing spending such time is not a coincidence and shows students are on mobile devices for long hours.

Using Internet on mobile devices, students depict spending up to 18 hours. Eight students spend above 18 hours on Internet. On average, students spent between 0 to 2 hours. The range of 0 to 2 hours using Internet holds vital details. 24 students depicted spending 0 hours which is 15 minutes to 45 minutes on Internet.

51 students use 1 hours on Internet and 39 spend 2 hours on Internet on mobile devices. The significance of this data is that on a regular day, students are glued on mobile devices communicating with peers and friends alike. Students use the Internet on mobile devices based on funds acquired from parents and other means.

### 5.5.2 Innovation

Students have access to mobile devices and use Internet. Students have adopted mobile devices for several reasons. Mobile devices are used as shown on Table 6.

No.	Concept	Characteristics and aspects	Frequency			
			Yes	No	Missing	Total
1	General use					
		Socializing	144	58	0	202
		Searching for information	124	78	0	202
		Recreation	151	51	0	202
		Academic	131	71	0	202
2	Innovation					
		Relative advantage	192	6	4	202
		Compatibility	171	25	6	202
		Trialability				
		Camera/Video	63	135	4	202
		Google search	148	50	4	202
		YouTube	88	111	3	202
		Map	65	133	4	202
		Observability	161	31	10	202
		Complexity	115	82	5	202

Table 6: Students and use of mobile devices.

Generally, students interact with peers, friends and relatives by socializing as depicted by 144 students. Socializing is students using Facebook, Twitter, WhatsApp and Instagram to

communicate. The intention of communication is interacting with peers to acquire or distribute information.

Students use blogs, websites, news portals and sports websites to acquire information. 124 students stated using mobile devices to search for information. Information searched on mobile devices becomes knowledge and applied during conversations or in class. Students do not acquire information passively.

Listening to music and audio files, watching videos online and playing games are recreational activities students engage on mobile devices. 151 students responded by stating undertake these activities. The activities relate to use of multimedia and illustrate students' preference of audio, video and graphical information. Students acquire information that is explained and elaborated which enhances learning.

Reading, studying and performing calculations on mobile devices describes academic activities. 131 students responded undertaken these activities. Identifying that students relate use of mobile activities to academic matters was important as it shows searching for information accounts for learning.

Students access various sources that afford learning on mobile devices. The Internet provides students access to more academic material. It suffices to argue, irrespective of how long students are using mobile devices and on the Internet, students are active learners while outside the classroom.

General information demonstrates good response from students on use of mobile devices. Not only do students have access to mobile devices, but students use to socialize, search for information, recreational purposes and academic. This information is further enhanced by depicting views on the innovation.

#### **5.5.2.1 Relative advantage offered by mobile devices.**

Mobile devices provide relative advantage to students by affording communication to peers, friends and relatives. 192 students stated acquiring advantage by having a mobile device. Students use mobile devices to socialize, distribute information, or receive information. Mobile devices on students' hands are not just a tool for communication, but source of information.

Students contact peers in search of solutions on assignments or homework. Students with mobile devices acquire assistance from peers with mobile devices. Without a mobile device, a student

would have to travel to peers' residence. With mobile devices, students can organize for a meeting using Facebook or WhatsApp and inform one another of progress.

### **5.5.2.2 Compatibility of mobile devices with textbooks as supplementary sources**

The intention of students attaining education is to equip with knowledge and skills employed for the rest of their lives. Attainment of education is a lifelong learning experience. At school, students use textbooks to acquire knowledge. Teachers use recommended textbooks to guide students learning. Outside the classroom, students access audio, video and graphical information on mobile devices. Students read information in text using mobile devices.

Mobile devices give students access to material on Internet. By accessing varied materials on mobile devices, students learn of concepts related to school work. Mobile devices provide lifelong experience to supplement recommended textbooks. Mobile devices supplement learning outside the classroom by providing enhanced learning. 171 students demonstrate learning using mobile devices as a supplementary source of material is compatible to recommended textbooks.

### **5.5.2.3 Trialability using Google search, YouTube, camera and maps**

Students try several techniques to acquire information that enrich learning. Recommended textbooks are in black and white. Students lose richness of information in colour. If recommended textbooks are produced in colour, due to price, students make copies in black and white. Key details are missed in pictures.

At secondary school level, recommended textbooks do not include CD's that provide audio or video explanation to enhance students learning. If recommended textbooks come with CD's, there is a need to identify students with computers. Viewing of pictures, listening to audio and learning from video files is made easier with mobile devices.

Mobile devices afford students use of camera to take pictures or videos shared with peers. The pictures can be based on social events, but also academic events. Pictures taken assist peers and friends to understand concepts covered in class. Peers relate that seen on picture to knowledge of the concept. 63 students use camera to take a picture or video and shared to peers that is related to academic matters.

Student perform searches not only as a general source of information, but also to acquire academic information. Students identified Google as the leading search engine. 148 students depicted using Google search engine to acquire academic content. Searches could be for definitions or searching for solutions on assignments. Students access websites and blogs.

Previous national examination questions are available on websites and blogs with solutions. Refined questions are updated by blog owners with students shared solutions and viewpoints on why a certain solution is not valid. Students access websites and blogs through searches on Google. When in need of further understanding concepts, students require the service of videos. Argued in chapter 2, science subjects have been affected by lack of laboratory facilities for Physics, Chemistry and Biology. Students access videos online to understand how practical are done, what equipment's are required and how the measuring occurs.

By accessing such videos online, students are equipping themselves with knowledge of not only how the practically are carried, but also how to acquire information from video websites. Different subjects entice students to use video for explanation. Videos accessed are from YouTube, a well-known video sharing platform. 88 students attest using YouTube for school work.

Geography is one of the subject's students are required to write examination on. Students access notes from Google searches and use YouTube to understand. Students require maps or atlases not at their disposal in classrooms. Using mobile devices, students access different map programs that assist learning of countries, calculation on distance and different vegetation information. 65 students used maps for academic purposes.

Trialability assists in settling the question of what do students do on mobile devices. Students take pictures and videos, use search engines and video websites and lastly maps to enrich understanding of different concepts.

#### **5.5.2.4 Observability from peers**

Students observe peers using mobile devices. Students become inquisitive on how mobile devices are used and which mobile device meets their demands. When in doubt, students enquire from peers observed. 161 students responded having observed a peer using a mobile device.

Students observe peers using Google to search for information, access video websites, take pictures and record videos and navigation using maps. The easier students observe peers, the better it allows for ease of adoption. Students are also inquisitive of the amount of Internet bundle they require to access services.

#### **5.5.2.5 Complexity of using mobile devices for learning**

Students view using mobile devices for learning as a complex process. 115 students attest. The complexity emerges from several issues out of students' control. Students' use of mobile devices for learning is an exploratory study.

Lack of guidance could account for a reason on viewing use of mobile devices for learning complex. Coupled with language used and content being above students' level, students struggle to understand some of the content on the Internet hence viewing it as complex.

### 5.5.3 Social system

The norm in the society has labelled students use of mobile devices as misuse. Upon grasping students' adoption of mobile devices, it was important to identify students' communication to peers in relation to academic issues.

Concept	Characteristics and aspects	Frequency			
		Yes	No	Missing	Total
Social system					
	Network interconnectedness				
	Using calls				
	Call a peer to ask for solution	141	58	3	202
	Received a call requesting for solution	132	67	3	202
	Using SMS				
	Sent text to a peer requesting for a solution	131	69	2	202
	Received text asking for a solution	134	66	2	202
	Using instant messaging				
	Sent instant message asking for a solution	87	112	2	201
	Received instant text requesting for a solution	87	112	3	202

Table 7 depicts such information.

Concept	Characteristics and aspects	Frequency			
		Yes	No	Missing	Total
Social system					
	Network interconnectedness				
	Using calls				
	Call a peer to ask for solution	141	58	3	202
	Received a call requesting for solution	132	67	3	202
	Using SMS				
	Sent text to a peer requesting for a solution	131	69	2	202
	Received text asking for a solution	134	66	2	202
	Using instant messaging				
	Sent instant message asking for a solution	87	112	2	201
	Received instant text requesting for a solution	87	112	3	202

Table 7: Students use of networks on academic issues.

Secondary school students use knowledge and social networks on academic matters. 132 students have received calls in relation to academic matters e.g. homework, assignment, or project and provided a solution(s) to the caller. Meanwhile, 141 students called a peer or friend to enquire on academic matters.

Students use SMS to enquire from peers. 131 students sent text to peers requesting for assistance with academic matters. 134 students received texts and responded. Peers provided solutions or helped peers in need. Sending an SMS is the convenient way of reaching a peer as it allows the receiver reflection time before responding.

In relation to instant messaging, WhatsApp, Viber, IMO and Skype, students have used these facilities for academic purposes. The distinction of a basic mobile device from a smart mobile device is visible. 112 students stated not having used instant messaging and it can be accounted to ownership of a basic mobile device. Those with smart mobile devices depict using instant messaging.

Both, sending messages and receiving messages, 87 students stated using instant messaging to enquire on academic issue and receiving a response. Instant messaging allows students to share pictures, audio clips (including a voice note), videos and contacts. Instant messaging application use Internet on the mobile device to send and receive messages and files.

When a peer request for a solution to any academic activity, the student receiving a request may take a picture of the solution and send as the response. If the requesting student does not understand, the sender may record audio providing a solution. The picture and audio file will be sent to the student requesting, or it may be sent to a group where every member in the group benefits.

What elders observe, is students using mobile devices, and assume misuse. Linking misuses to sharing inappropriate material. Students' use calls, SMS, or instant messages to enquire or provide solutions on academic matters.

## **5.6 Teachers data analysis and findings**

A total of 19 Form IV teachers responded to the questionnaire from 23 teachers. Teachers completed questionnaires in offices. Provided in this section is explanation of teachers' response to questionnaire.

Based on table 5.5, from the population of teacher respondents, six are female and thirteen males. Arts combination provide more respondents. Only one teacher is available from pure science. Pure science shares teachers with all combination with surplus of only one teacher for additional mathematics.

Demographics and general information
--------------------------------------

No.	Concept	Characteristics and aspects	Frequency
1	Gender	Female	6
		Male	13
		Missing	0
		Total	19
2	Teaching combination	Arts	8
		Commerce	6
		Science	4
		Pure Science	1
		Missing	0
		Total	19
3	Age	30 to 39	10
		40 to 49	4
		50 to 59	3
		60 to 69	1
		Missing	1
		Total	19
4	Internet on mobile device	Yes	16
		No	3
		Missing	0
		Total	19
5	Email address	Ownership	
		Yes	17
		No	2
		Missing	0
		Total	19
		Email address company	
		Yahoo	9
Google	12		
Hotmail/Live	2		
Other	0		

Table 8: Teachers demographic and access to mobile devices.

Science teachers are for biology, physics and chemistry. Science teachers educate 3 classes each on a topic rotational basis. Usually, each of the science subjects has two teachers. Accounting for four teachers that did not return questionnaires, two are from science combination. Teachers' age range of 30 to 39 includes ten teachers, two of these discussed on section 5.2.2. Within this age group, three teachers are 33 years old.

### 5.6.1 Availability of mobile devices

All teachers own mobile devices. Mobile devices teachers own have Internet access excluding three teachers. With Internet access on mobile devices, teachers communicate with relatives and friends. Teachers also communicate with students using instant messaging.

17 teachers have email address, 12 using Gmail. Teachers access to mobile devices and Internet affords ease of communication and response to students' queries outside the classroom.

Hours on mobile device (range)	0 to 2	3 to 5	6 to 8	9 to 11	12 to 14	Missing	Total
How many hours in a day do you use your mobile device?	5	6	2	1	3	2	19
How many hours in a day do you use social media (Facebook, Twitter and Instagram)?	14	3	0	0	0	2	19

Table 9: Time spent by a teacher on a mobile device in a day.

Table 9 illustrates teachers spend up to 14 hours on mobile devices in a day outside the classroom. Some teachers were observed wearing wedding bands and may explain need for constant communication with spouse and possibly children. Teachers communicate to peers, friends, relatives and children using mobile devices. Time responding to students' queries may be included. Time on Internet for teachers is depicted as maximum five hours as revealed on Table 9. 14 teachers responded to spending up to two hours a day on the Internet outside the classroom. From this Internet use, eight of the teachers spend 1 hour a day.

### 5.6.2 Innovation

Mobile devices afford teachers ability to perform several activities as shown in Table 10. Teachers use mobile devices to communicate to peers, friends and relatives on social matters. 14 teachers attested showing they communicate using Facebook, Twitter, Instagram and instant messaging applications.

No	Concept	Characteristics and aspects	Frequency			
			Yes	No	Missing	Total
1	General use	Socializing	14	5	0	19
		Searching for information	15	4	0	19
		Recreation	12	7	0	19
		Academic	14	5	0	19
		Innovation				
2	Innovation	Relative advantage	19	0	0	19
		Compatibility	19	0	0	19

		Trialability				
		Google search	17	2	0	19
		YouTube	5	14	0	19
		Camera/Video	9	9	1	19
		Map	3	16	0	19
		Observability	17	2	0	19
		Complexity	7	11	1	19

Table 10: Teachers and their use of mobile devices.

Mobile devices are used by teachers to search for information. 15 teachers use mobile devices to search for information. The information could be on politics, economic issues, family and health matters, sports or academic.

Using mobile devices, teachers listen to audio files, music, videos and radio. These activities account for recreational and 12 teachers responded to performing them on mobile devices. Instant messages and content searched from websites may account for source of recreation teachers' use. Lastly, teachers read novel, study required and supplementary textbooks and use mobile devices to perform calculations. 14 teachers have used mobile devices for learning outside the classroom.

#### **5.6.2.1 Relative advantage offered by mobile devices**

Teachers view mobile devices as a tool that simplifies communication to relatives and friends. All teachers agreed as shown on Table 10. Mobile devices provide a relative advantage to teachers as they communicate to peers, friends and relatives.

Mobile devices assist teachers to communicate to students and provide support. Teachers send SMS, call students and interact with students on instant messaging and emails.

Queries that students have and not solved by peers, are forward to teachers for clarification, insight and elaboration. Students interact with teachers and receive response to questions. Mobile device in the hands of teachers, provide a relative advantage not only to them, but to students communicated.

#### **5.6.2.2 Compatibility of mobile devices with textbooks as supplementary sources**

Teachers view using mobile devices for learning as a supplementary source of information compatible to lifelong learning. All 19 teachers responded using mobile devices to support recommended textbooks. Teachers enhance knowledge over time. New topics are added on the syllabus and teachers should have knowledge.

Compatibility of mobile devices in supplementing recommended textbooks affords teachers access to websites and blogs. Access to these services, allows teachers to listen, watch and view different

content available on the Internet. Content acquired on the Internet either explains of concepts teachers want to learn or further knowledge.

### **5.6.2.3 Trialability using Google search, YouTube, camera and maps**

From peers and friends, teachers tried several devices before settling for mobile devices bought. Teachers' mobile devices afforded access to Internet that provides a host of content. Content teachers use for class preparation or to offer better explanation to students after class. Outside the classroom, teachers have made use of services such as search engines, video searches, camera for picture and video recording and access to maps.

Teachers use search engines to enhance knowledge. Teachers use search engines to look for definition, spelling, pronunciation or reading a topic from an expert. Search engines such as Google provide these services on mobile devices. Table 10 represents 17 teachers use Google search to acquire knowledge on academic content.

Videos provide greater insight when one has not understood content from text. Websites providing video services such as YouTube are a source of such knowledge. Millions of videos are available explaining different topics. Only 5 teachers have used YouTube to acquire insight on academic material. To the researcher, this was not expected.

Teachers are inclined to use recommended textbooks for preparation and teaching. Identify a teacher using YouTube as supplementary source of material on mobile devices is a positive aspect. It informs of possibility more teachers use mobile device to access video sharing websites that provide and enhance knowledge.

Teachers were split on the use of camera to take pictures and record video for learning. Nine teachers agreed, while nine disagreed. Teachers take pictures or videos of different events or objects that are used to explain in class. Pictures taken from mobile devices include richness of colour recommended textbooks lack.

Map applications are used by teachers specializing in Geography or History. Teachers use maps to identify cities, town, country borders, water bodies, directions and distances between places. It was not a surprise then that only three teachers responded using maps on mobile devices. Knowledge acquired on mapping applications, is shared in class with students.

### **5.6.2.4 Observability from peers**

Teachers observe colleagues, friends and relative using mobile devices. Observations done lead teachers to shortlisting mobile devices of interest. 17 teachers have observed a colleague using a

mobile device and become interested in owning it. As is with any innovation, observing a colleague using a mobile device assist in reducing uncertainty. Reduction in uncertainty motivates a teacher to acquire a mobile device.

Teachers observe colleagues and friends using mobile devices to access search engines, video websites and mapping applications. Teachers also observe pictures and videos captured using a mobile device camera and ascertain quality of interest in adoption.

### 5.6.2.5 Complexity of using mobile devices for learning

Using a mobile device for learning can be complex depending on specific tasks the user intends to accomplish. Mobile devices when used as the primary source of academic information are complex. Especially when a recommended book is read from a mobile device as the screen size, light, incoming messages and calls may be a source of disruption.

On the other hand, mobile devices are used to supplement learning. As supplementary source of information, mobile devices simplify life. Teachers do not view using mobile devices to supplement learning as a complex activity. 11 teachers do not view using a mobile device for learning as a complex process.

### 5.6.3 Social system

Teachers academically assist colleagues using social and knowledge networks. Where a teacher does not understand, they reach out to a colleague who explains the concept or refer to a knowledgeable person.

Table 11 displays teacher using networks to communicate on academic matters. Teachers' affordances such as calling, SMS and instant messaging.

Concept	Characteristics and aspects	Frequency			
		Yes	No	Missing	Total
	Network interconnectedness				
	Sent/received a call on academic matters	11	8	0	19
	Sent/received text on academic matters	11	8	0	19
	Sent/received an instant message on academic matters	11	8	0	19

Table 11: Teachers use of networks for academic purpose.

For each category, eleven teachers responded communicating with a colleague in search for academic assistance. Teachers inform colleagues of updates in the curricula. Teachers contact knowledgeable colleagues in a topic for assistance.

### 5.6.4 Teachers' concerns

Teachers have concerns on students' use of mobile device. Teachers are moral enforcers. The role requires teachers to be vigilant of students' behaviour and social change affect studies. Unfortunately, teachers hold views and argue students misuse mobile devices. To acquire teachers' views on students, the questionnaire included four questions gauging teachers' perception on students' use of mobile devices. Details are described on Table 12.

Concept	Characteristics and aspects	Frequency			
		Yes	No	Missing	Total
Concern	Outside the classroom, do you think				
	Students use mobile devices to search for information?	12	7	0	19
	Students use mobile devices to socialize?	19	0	0	19
	Students use mobile devices to recreation?	19	0	0	19
	Students use mobile devices for academic purposes?	6	13	0	19

Table 12: Teachers views on students' use of mobile devices.

Table 12 depicts teachers' views on students' use of mobile devices. Twelve teachers stated students use mobile devices to search for information. It explains belief in students. It creates allowance for teachers to instruct students on searching for information using mobile devices in an effective way.

19 teachers believe students use mobile devices for socialization and recreation. Teachers provide evidence on belief that students are misusing mobile devices by acknowledging to socialization and recreation. Socialization includes use of Facebook, Twitter and Instagram. Recreation comprises listening to radio, audio files and watching video are assumed to be activities that waste students' time.

On the most important aspect, teachers identify students' use of mobile devices as not for academic purposes. Only six teachers recognized students' use of mobile devices linked to academic activities. As was the case on the first question, teachers show indications of belief on students. These few teachers are willing to contact students and offer academic assistance.

### 5.7 Conclusion

Chapter 5 started by providing explanation of the Dar-es-salaam case. It depicted quantitative data collection technique by engaging with the process, problems and solutions applied. The chapter preceded by discussing preparation of data analysis tool, data entry and descriptive analysis.

Secondary school students in Dar-es-salaam aged 12 to 21 own mobile devices and with Internet access.

Teachers describe using mobile devices for socialization, recreation, searching for information and academic purposes. Teachers own mobile devices, with Internet and use emails. Teachers' data analysis depict misbelief on students' use of mobile devices. Teachers' fears might be developed due to role, moral enforcers. Further explanation on students' use of mobile device is provided in chapter 6. Teachers' views are also assessed based on students' response.

## CHAPTER 6: QUALITATIVE DATA ANALYSIS AND FINDINGS FROM SCHOOL A IN DAR-ES-SALAAM, TANZANIA

Quantitative data analysis from the secondary school in Dar-es-salaam is provided in chapter 5. The chapter is accompanied by description of the secondary school. Using descriptive statistics, findings are discussed. Chapter 6 delves into thematic analysis by Braun & Clarke (2006), illustrates steps followed in explaining findings from data and linking to SEUMD.

### 6.1 Introduction

Chapter 6 provides analysis of qualitative data. Qualitative data for this research includes semi-structured interviews and active observation. Semi-structured interviews were undertaken using a research protocol developed from SEUMD.

Concepts identified on the framework were developed to questions and included on interview protocol. Concepts (themes) included in the framework are innovation, social system, concern, available, sustainable and effective.

In certain themes, innovation and social system, further breakdown is provided to include relative advantage, compatibility, trialability, observability, complexity, norm, network interconnectedness and consequences. Each sub-theme was developed to a question and included on the research protocol.

To ensure research protocol relates to research question, themes were linked to specific questions. The main research question is *What influence does effective use of mobile devices for learning outside the classroom have on academic performance of secondary school students in Tanzania and South Africa?* The research question is expanded to include sub-questions as,

- a. To what extent are secondary school students in Tanzania and South Africa using mobile devices for learning outside the classroom?
- b. What mobile device affordances do secondary school students use outside the classroom for learning?
- c. What influences secondary school students use of mobile devices for learning outside the classroom?
- d. What does effective use of mobile devices for learning outside the classroom infer in the context of secondary school students' in Tanzania and South Africa and how does it influence academic performance?

The four research sub questions are linked to framework and to research protocol. The research protocol is attached as appendix three.

## **6.2 Data collection**

Active observation started at the school gate. Information concerning the school was documents on a 72 paged A5 notebook. Details about school operations, security, class format, interaction among teachers, students, academic staff, parents, prospective students and support staff was documented.

Permission at the school was acquired as explained in chapter 4 and 5. Students volunteered for interviews. Four students from each class were included for interview. 20 students volunteered for interviews. Of which, four students are academically performing based on academic report. The researcher was informed by school patron of academic performing students. Students were asked to identify dates of availability and venue to conduct interviews.

During first set of interviews, students came in groups with peers who will be interviewed. By attending individual interviews with peers, students assumed control and were empowered by selecting venue for interviews.

After moving between dormitories and sports field, decision was made to use teachers' staff room for interviews. Dormitories are gender sensitive. Sports field are isolated. On this day, nine students were interviewed, four being females and five males.

The second set of interviewees were held in a class. It is not mandatory for teachers to go to school on Saturday. Unless it is teacher on duty. On Saturday's, the staff room is locked. All Form I classes were used for entry examinations by prospective Form V students. Other classrooms were locked.

The classroom is for Form V, PGM (physics, geography and pure mathematics) students. The classroom is opposite school hall where events like welcome Form I and V and graduations for Form IV and VI occurs. Form VI seat for national examinations in May.

Qualitative data collection was undertaken by end of April. A religious (Christian) graduation was taking place during second set of interviews. During interviews, writing field notes is important. Music from school hall interfered recorded sounds. Fortunately, using multiple mobile devices for recording interviews paid off as the audio recordings are clear. Unfortunately, the Dictaphone is not clear.

The Saturday was a rainy day and interschool sporting activities taking place. The rain delayed one of the interviewees, a day scholar that had to travel to school. Though interviews were scheduled to start with him, he had to recover as it rained on him. He was interviewed last.

Students informed a peer is sick and could not attend interviews. One student had gone to another school for interschool netball match. In both cases, a reschedule was discussed with peers. Two students did not come to school and were never interviewed as information on availability and rescheduling was not possible. Four students were interviewed from the second set of respondents. The third set of data collection occurred on a Thursday. Students had finished monthly tests and had a prayer session for Form VI before beginning examinations (5 days later). The staff room was undergoing maintenance and students selected computer labs location to hold interviews.

Unbeknown, some students use the opportunity to play computer games in the lab. Interviews were entry ticket to computer labs. Games students played included FIFA 07 and Grand Theft Auto (GTA). Both games were old models.

Dar-es-salaam is a hot city with temperatures averaging 27 degrees and humid. The school has two computer laboratories (labs). Computer labs have Dell OptiPlex 755. Neither lab has air condition unit (AC) or a fan. One of the students stated, “the school is planning to install air conditions in the computer labs”.

For cross ventilation, windows were opened and dust could be seen on computers. Computer teachers’ office has an AC unit that was turned off. The room was hot. Electricity (power) was off and the school generator was applied. Saving oil might explain AC being off in computer teachers’ office.

The computer lab was used for two interviews. The next interviews were scheduled two hours later. Fortunately, students came earlier. Due to little air circulation and both computer labs fully occupied, interviewees suggested seating outside computer labs.

It was a rainy day and students delayed getting to computer labs. School buildings are not connected. Seven students were interviewed during the third and final set of interviews at the school.

To ensure no data is lost, a digital recorder, a tablet and a smartphone were used to document and record interviews. Using a Samsung Galaxy Tab 2 (tablet) and Sony Xperia LT30p (smartphone) audio recording application known as Smart Voice Recorder was used on each. The digital

recorder was a uCorder digital audio recorder (Dictaphone). These tools were used simultaneously to capture interviews.

The uCorder digital audio recorder was used to supplement mobile devices. Both smartphones have good audio quality and suppress background noise. The Sony Xperia saves the audio recording with a small file size. The Samsung Galaxy Tab file size is 500% higher. The Dictaphone file size is average of the two, lacking background noise suppression.

The notepad was used to write summaries on that respondents answered during interviews. While writing summaries, a preliminary analysis was undertaken. The analysis allowed processing of responses and ask supporting questions for clarity. Semi-structured interviews allow clarification of questions, addition or reduction of questions during interviews.

The interview protocol was shared to interviewees before starting. Students reviewed the protocol and ask questions. After clarification of unclear terms, the interviews began. Students requested to use Swahili to respond to questions or ask questions. Students request was granted. Students showed remembrance when asked about projects undertaken a year prior to data collection. Respondents recollection of facts depicts data does not only reside on respondent's memory, but re-enacted when questioned by interviewer.

### **6.3 Preparation of qualitative data analysis tool**

Atlas.ti version 7 was the tool used for data entry, transcription and storage of interview data. Prior to loading interviews and active observation (field notes) data to Atlas.ti, necessary preparations were undertaken.

A new hermeneutic unit was created and given the name of the school. The hermeneutic unit was saved on a laptop that is password protected. Audio recordings for each interview were assessed to identify audible interviews. The process required listening to interviews recorded using Samsung Galaxy Tab, then Sony Xperia and lastly Dictaphone. One interview was selected for each student that will be loaded on Atlas.ti based on voice clarity.

Audio interviews and field notes were given unique identifiers. Audio interviews were given letter S, referring to student, followed by number of interviewee and lastly gender as male or female. The number of interviewee was increased sequentially as students were interviewed. Students were thus organized as S1M to S20M. Field notes identifier included date and time.

Interview recordings were imported to Atlas.ti. A new text document was created for each transcription. A new text document was also created for field notes. The hermeneutic unit was saved on laptop and a copy on a secured external hard drive. The process of thematic analysis began.

#### **6.4 Thematic Analysis**

Thematic analysis offers flexibility in identification or development of a (Braun & Clarke, 2006). Thematic analysis offers ease of application of steps in analysis leading to theme explanation. The process of thematic analysis begins at transcription and is completed with writing final report.

Thematic analysis is a recursive process (Braun & Clarke, 2006) and took two years from data collection in Dar-es-salaam, to completion of writing qualitative data analysis chapter. Qualitative data analysis takes time in identifying, refining and developing themes and should not to be rushed (Braun & Clarke, 2006; Yin, 2003).

Thematic analysis is conducted using a deductive approach or inductive approach (Braun & Clarke, 2006; Clarke & Braun, 2013; Fereday & Muir-Cochrane, 2006; Norqvist, 2016). Deductive approach to thematic analysis involves analysing data based on theoretical framework. Inductive approach requires analysis of data and development of themes as data entails.

An abductive approach (Dubois & Gibbert, 2010; Norqvist, 2016) merges deductive and inductive approach. This research follows abductive approach by linking data extracts to framework, followed by identifying themes or sub-themes not included on framework.

Thematic analysis begins with data familiarization and completes with a written report. Multiple approaches exist on conducting thematic analysis (Braun & Clarke, 2006; Fereday & Muir-Cochrane, 2006), this research follows Braun & Clarke (2006) thematic analysis approach. Table 13 summaries phases in thematic analysis.

Name of phase	Activities
Phase 1: Familiarization with data	<p>During phase 1, field notes and written interview summaries are read to gain initial understanding of data. Recorded interviews transcribed and initial analysis of interviews is actively conducted.</p> <p>A period for reflexivity is important to aid fresh understanding. Transcribed data is read alongside recorded interviews for accuracy. Initial codes are developed based on first impression of data. Initial codes are written on notebook.</p>
Phase 2: Generating initial codes	<p>At phase 2, each word, sentence, or paragraph is coded on Atlas.ti. Codes are produced in respect to respondent views (data extracts) and phenomenon of interest. The process is referred to as initial coding.</p> <p>During initial coding, researcher intended to acquire initial impression of data. For each code, comparison was performed with respondent's views to ensure respondent meaning is captured.</p>
Phase 3: Searching for themes	<p>Initial codes are grouped based on meaning. Combined codes are given an overarching name.</p> <p>Phase 3 enforces application of analytical. Meaning is attached to each initial code and overarching representation labelled theme.</p>
Phase 4: Review themes	<p>Themes identified in phase 3 are reviewed and distinction between themes is developed. Themes may be dissolved, merged or edited.</p> <p>Importance is on coherence of respondent views included on each theme and sub-theme. Internal homogeneity and external heterogeneity are enforced.</p>
Phase 5: Defining and naming themes	<p>Each theme is assessed to ensure sub-themes assist in telling the story. If sub-theme does not depict coherence, it is moved to miscellaneous.</p> <p>Themes are then defined to show scope and content. A table is developed to summarize definition of all themes.</p>
Phase 6: Producing the report	<p>A narrative story is developed explaining each theme and sub-theme. During writing of the report, focus is using respondent views to support each sub-theme.</p> <p>Rival explanations are included in findings. Quantitative data is used to support arguments in findings.</p>

Table 13: Phases in thematic analysis.

### 6.4.1 Familiarization with data

Familiarization with data requires listening to audio recordings, reading field notes and recollecting relevant information acquired during data collection. Familiarization with data necessitates active participation in assessing collected data. Documents are read and re-read. During reading of documents, meanings are established, relationships between different segments of data are acknowledged. Patterns are also recognized leading to initial codes written as side notes. Field notes were collected from first day of data collection until final day. Field notes provide understanding of school context. During interviews, notes were written on A5 notebook. Interview notes were read with field notes. Initial codes were expanded from field notes and interview notes. Research protocol was revisited. For each interview question, a code was allocated on expected content linking to SEUMD. Each interview question had a 1 to 1 (1:1) relationship to concepts.

Interviews were carefully listened. Transcription performed by writing on Atlas.ti what the audio recording revealed. Edited transcription (Kvale, 1988) was applied. The method includes all information relevant for research and leaving out sighs (mhhhh, ahhhh, ohhh). The method insists on finishing sentences.

Ensuring transcript is suitable for analysis is important (Braun & Clarke, 2006) than transcribing every sound. Interview transcription was performed as question and answer based on audio records. Transcription was done on each student interview. The intention was to allow for visibility of richness of data.

Two interviews were transcribed per day. Each interview took minimum of 4 hours and maximum of 6 hours. Interviews were conducted in Swahili and translated to English during transcription. Transcription requires playing recorded interviews at a slow speed and typing on Atlas.ti.

Transcription became tedious and boring, when students' voice was low, background noise was clear or students would answer without explanation. While boring, it is an important phase of data analysis (Braun & Clarke, 2006). After completing transcribing interview protocol, observations were transcribed as written on a notepad.

A week off transcription was taken by the researcher from reading transcripts. Intention for week break was to allow for relaxation and reflection (Walsham, 2006). Reflection deals with recollection of that supposed to be done (linking research question to framework and research protocol), what was done (collected data) and what the data is informing (findings).

Upon completion of the week, verification on accuracy of transcribed data was undertaken. Transcribed data was compared to interviews and field notes to ensure content is not altered and where necessary editing was performed. Transcripts were edited because of, not hearing a word correctly or translating the word incorrectly. Verifying transcribed data increases data accuracy (Braun & Clarke, 2006; Lai, 2015).

Transcription is an important phase in data analysis, it creates familiarity with data (Kvale, 1988). Transcription allows linking initial data to SEUMD as depicted in

Construct	Respondent identification	What influences your decision to use your device for learning?
Innovation	S2F	For example, I have a sibling in another secondary school. They are usually given homework to do during school holidays. So, if my sibling doesn't know what to answer, he contacts me and asks for solutions. I end up recording myself (inferring to voice note) and send to him. Or I could be searching for something.
	S3F	First, I will understand more. Sometimes you will find that in a textbook they have summarized or using complicated language and I don't understand. So, I decide to Google and I get an understanding from that.
	S15M	Because when you use your device you get more information. So instead of using books I might use my device to search for more information.

Table 14.

During transcription, meanings are created from data. Initial side notes and codes are refined after transcript verification. The process is iterative, reading transcripts, research protocol, listening to recordings and revisiting field notes. Reflecting on school premises, interactions with students, teachers, academic staff and supporting staff, ensures transcribed data is not fabricated but grounded on that stated by respondent. Providing details of case study is fundamentals to 'goodness' (Tobin & Begley, 2004).

Construct	Respondent identification	What influences your decision to use your device for learning?
Innovation	S2F	For example, I have a sibling in another secondary school. They are usually given homework to do during school holidays. So, if my sibling doesn't know what to answer, he contacts me and asks for solutions. I end up recording myself (inferring to voice note) and send to him. Or I could be searching for something.
	S3F	First, I will understand more. Sometimes you will find that in a textbook they have summarized or using complicated language and I don't understand. So, I decide to Google and I get an understanding from that.
	S15M	Because when you use your device you get more information. So instead of using books I might use my device to search for more information.

Table 14: Organizing of data into data table.

Construct	Respondent identification	What influences your decision to use your device for learning?
Innovation	S2F	For example, I have a sibling in another secondary school. They are usually given homework to do during school holidays. So, if my sibling doesn't know what to answer, he contacts me and asks for solutions. I end up recording myself (inferring to voice note) and send to him. Or I could be searching for something.
	S3F	First, I will understand more. Sometimes you will find that in a textbook they have summarized or using complicated language and I don't understand. So, I decide to Google and I get an understanding from that.
	S15M	Because when you use your device you get more information. So instead of using books I might use my device to search for more information.

Table 14 shows data related to innovation as a construct. Column two shows respondents' code and column three shows question and students' responses. Multiple explanations are provided with some captured on

Construct	Respondent identification	What influences your decision to use your device for learning?
Innovation	S2F	For example, I have a sibling in another secondary school. They are usually given homework to do during school holidays. So, if my sibling doesn't know what to answer, he contacts me and asks for solutions. I end up recording myself (inferring to voice note) and send to him. Or I could be searching for something.
	S3F	First, I will understand more. Sometimes you will find that in a textbook they have summarized or using complicated language and I don't understand. So, I decide to Google and I get an understanding from that.
	S15M	Because when you use your device you get more information. So instead of using books I might use my device to search for more information.

Table 14. The question intended to appreciate reasons for students using mobile devices for learning. Students responses include assisting siblings and use of voice note as enacted by respondent S2F and understanding content as explained by S15M, to mention a few.

#### 6.4.2 Generating initial codes

Coding involves active participation in reading and re-reading of data and labelling data (a word, sentence, or paragraph) per phenomenon of interest (Basit, 2003; Kvale, 1988; Tong, Sainsbury, & Craig, 2007). Phenomenon of interest would include an action, an event, concept, theme, cultural practice, language, belief, or relationship (Basit, 2003; Clarke & Braun, 2013; Coffey, Holbrook, & Atkinson, 1996; Walsham, 2006). Good coding is “one that captures the qualitative richness of the phenomenon” (Fereday & Muir-Cochrane, 2006, p. 4).

Revised initial codes from phase one were analysed and related to protocol questions, to ensure the framework is included. Side notes were updated with contradictory initial codes analysed during transcription. Initial codes from side notes were applied to software, Atlas.ti, for actual coding. Manual coding was applied as opposed to automatic coding (Miranda, Kim, & Summers, 2015).

Manual software coding involves selecting a paragraph or sentence in a transcript and assigning a name (code) from phase one or as a free code (Basit, 2003; Gonzalez, 2016). A free code (also known as initial code) is a name given to a sentence or paragraph not on side notes or code book. Automatic software coding requires identification of key terms in a pattern and assigning a code (Coffey et al., 1996). Key terms and codes would have been identified in phase one. Automatic coding hinders deeper or hidden meanings to emerge if analysts has not spent time with transcripts (Pringle, Drummond, McLafferty, & Hendry, 2011).

Codes were developed based on that interesting on raw data. Interesting aspects assist in understanding students effective use of mobile devices for learning outside the classroom (Burton-Jones & Grange, 2013; Fereday & Muir-Cochrane, 2006; Ifenthaler & Schweinbenz, 2013; Kvale, 1988; Sarker et al., 2013). Coding during generation of initial codes has sole purpose of breaking raw data to categories (Braun & Clarke, 2006).

Each transcript was assessed and initial codes applied to student responses. Free codes were added on alternative explanations. Free coding was applied to a sentence with a verb, noun or adjective.

The intention is identifying students' response to any of the W or H questions: -

- What are students doing with mobile devices?
- Why are students using mobile devices for learning?
- How are students effectively using mobile devices?
- Who are students asking for assistance, assisting, or communicating to?
- Which affordances of mobile devices do students use for learning?
- When do, students use mobile devices for learning?

Questions identified, while guiding coding process, reflected on main research question. Careful consideration was given for each question per transcript. Once the first transcript was coded, codes were populated, printed and assessed. The intention of assessing was to ensure no code duplication occurs. After assessment, coding proceeded to remaining transcripts. Each transcript was given special attention.

Transcription was performed on different days. Certain days meant returning to phase one. Leading to creation of new free codes related to previous codes showing what raw data is communicating. Using free codes and prior identified codes, code book ballooned to 122 codes (see appendix 4). Moreover, using free codes, allowed for induction during pattern matching creating themes. After completing first round of coding, coded transcripts were read and related student responses to a given code. When a mismatch was identified, assigned code was replaced with correct code. Furthermore, a free code was added if a new meaning is identified. Using the question on influence, from phase one, raw data from all interview respondents were segmented to different initial codes as shown on Table 15. Students use mobile devices for learning as influenced by presence of search engines or websites, Internet and subjects requiring clarification or preparations.

Construct	Initial code	Respondent identification	Respondents views
Innovation	Search engine/website	S3F	I will understand more. Sometimes you find that in a textbook they have summarized or using complicated language and I don't understand. So, I decide to Google and I get an understanding from that.
		S10M	For example, a textbook summarizes some information, on the Internet example, Wikipedia, I could get pictures or videos.
	Internet	S8M	You can find a lot of material on the Internet.
		S10M	For example, a textbook summarizes some information, on the Internet example, Wikipedia, I could get pictures or videos.
	Subject student uses device for learning	S13M	... let's say its mathematics or biology and the teacher is teaching evolution and let's say the teacher announces that our next topic will be digestive system, we are revising.

Table 15: Identification of initial codes.

Search engines afford students use of mobile devices to access definitions and understanding of content, as narrated by a female student that was third respondent (S3F). Google and Wikipedia are search engine and website influencing students' use of mobile devices for learning.

Internet was initial code influencing students' use of mobile devices. Specifically, Internet is one-stop-shop for finding new material and refreshing understanding on prior content as enacted by S10M. Lastly, students were influenced to use mobile devices for learning by subjects such as mathematics and biology as explained by S13M.

### 6.4.3 Searching for themes

Third phase of thematic analysis requires close examination of codes to identify broader patterns. 122 codes were printed, read and assessed to make sense of codes in relation to respondent's views. Related codes but using different names were linked e.g. use mobile device for planning and use device to plan. While using different codes, both statements mean a mobile device is used to plan daily activities. Related and repeated codes were linked on Atlas.ti, using "is associated with". By linking codes, initial code table was reduced.

Related codes explaining same theme with multiple understandings were identified and grouped. Possible codes depicting rival explanations for each theme were also identified. Intention of presenting rival explanations is to allow rich data to depict contradictions in respondent's explanations.

Codes not in a theme, were grouped based on logical sense. Other data analysts could name outlying codes as miscellaneous theme.

Examination of question on influence (argued on section 6.4.2) when applied to respondent population (all transcripts) reveals reasons for students use of mobile devices for learning and using mobile devices as tools to support learning.

Theme	Description	Sub-theme	Respondents views (Respondents identification)
reasons to use mobile device for learning	Use of mobile device for learning (as a supplementary source) is influenced by language, life-long learning and time.	language	Sometimes you will find that in a textbook they have summarized or using complicated language and I don't understand. (S3F)
		life-long learning (Internet)	There are ideas that I get, that usually on text books or teachers notes they are not available. So, it increases my knowledge. (S9M)
			... Then, I will take it as initiative to use my device so that I know a lot about the topic announced. (S13M)
		Time	It is easier to search for material using my phone and it takes little time than going to the library. (S5F)
tool to support learning	Use of mobile device for learning is influenced by subjects and Search engine.	Subjects student uses device for learning	... let's say its mathematics or biology and the teacher is teaching evolution and let's say the teacher announces that our next topic will be digestive system, we are revising. (S13M)
		Search engine/website	I will understand more. Sometimes you find that in a textbook they have summarized or using complicated language and I don't understand. So, I decide to Google and I get an understanding from that. (S3F)

Table 16 provides illustration.

Theme	Description	Sub-theme	Respondents views (Respondents identification)
reasons to use mobile device for learning	Use of mobile device for learning (as a supplementary source) is influenced by language, life-long learning and time.	language	Sometimes you will find that in a textbook they have summarized or using complicated language and I don't understand. (S3F)
		life-long learning (Internet)	There are ideas that I get, that usually on text books or teachers notes they are not available. So, it increases my knowledge. (S9M)
			... Then, I will take it as initiative to use my device so that I know a lot about the topic announced. (S13M)
		Time	It is easier to search for material using my phone and it takes little time than going to the library. (S5F)
tool to support learning	Use of mobile device for learning is influenced by subjects and Search engine.	Subjects student uses device for learning	... let's say its mathematics or biology and the teacher is teaching evolution and let's say the teacher announces that our next topic will be digestive system, we are revising. (S13M)
		Search engine/website	I will understand more. Sometimes you find that in a textbook they have summarized or using complicated language and I don't understand. So, I decide to Google and I get an understanding from that. (S3F)

Table 16: Searching for themes on what influences students use of mobile device for learning.

Reasons for students to use mobile devices for learning include language, need for life-long learning and time. Students depict language used in recommended textbooks is complicated to understand at Form IV level or in some cases students view content is simplified making it hard to understand as depicted by S3F.

Using Internet on mobile devices is argued by S9M to aid in life-long learning. Mobile devices afford students acquiring content and knowledge not in recommended textbooks or covered in class by teachers. Knowledge student can employ for the rest of their lives. On the other hand, S13M takes the initiative of using mobile device to learn of a topic before class.

Intention of learning a topic before class could include, getting clarity of content not understood from a mobile device, being able to depict understanding of content in class or being able to acquire pictures or videos that textbooks are missing.

On issue of time, students view using mobile devices easier in terms of searching for content on the Internet. Mobile devices save time compared to going to library or using books as enacted by S5F.

As a tool, mobile devices assist students to acquire material based on subjects of interest and presence of search engines. Students mentioned subjects such as mathematics, biology (as portrayed by S13M), history, geography, English and chemistry.

Students use mobile devices to aid in projects, assignments and class preparation. Search engine that students use for learning is mainly Google. Phrases such as “I Googled it” became common. Students mean use of search engine as described by S3F.

#### **6.4.4 Reviewing themes**

Internal homogeneity and external heterogeneity important when reviewing themes (Braun & Clarke, 2006; Eisenhardt, 1989; Miranda et al., 2015; Sokolovsky, 1996; Venkatesh et al., 2013). Internal homogeneity refers to ensuring all related themes are grouped together, while external heterogeneity seeks to depict differences between themes during categorizing. Both concepts relate to consistence between respondent’s views and codes leading to themes and sub-themes (Bagozzi, 2011; Miranda et al., 2015; Tobin & Begley, 2004).

Careful consideration and understanding was applied to codes from phase 3. The researcher applied a priori analytical knowledge to grouping related respondent views. Each theme reviewed and respondent views assessed. Related themes were grouped. Internal homogeneity was attained through pattern recognition on respondent views. Unrelated themes were placed on miscellaneous category.

Transcripts were assessed to understand themes researcher deem relevant and re-assess miscellaneous themes. Attention was given to respondents’ views to ensure external heterogeneity. In developing external heterogeneity, the researcher brought knowledge on SEUMD. Logical and relationship flow to overarching themes emerging from respondents’ views was assessed.

Re-coding was performed when certain segments or sentences of respondents’ views depicted aspects not previously thought or coded. Re-coding ensures respondents’ views are captured as accurately as possible. Re-coding returned the researcher to phase two, generating initial codes. Two rounds of re-coding were performed before recognizing no relevant codes developed (Braun & Clarke, 2006).

Transcripts were assessed and overarching themes organized to include sub-themes (mostly from phase three) and respondents’ views. Internal homogeneity and external heterogeneity were assessed to ensure themes explain overall story of respondents’ views. Table 17 was developed with two overarching themes, compatibility and observability.

Compatibility encapsulate reasons to use mobile devices and tools students use to support learning. Students depicted using mobile devices for learning as a supplementary source assists in

understanding concepts. Language used is simple and mobile devices offer convenience. Google as a search engine is argued by students to aid learning.

Observability was shown by students through explanation of advice from peers and shop attendants. Technical support through peers and parents during the process of assessing a mobile device intended to adopt. Despite advice received, a rival explanation from students was use of emotional decisions in acquiring mobile devices. Emotional decisions are on budget or durability. Students acquire mobile devices based on what is believed of 'quality' as enacted on Table 17.

Reviewed Theme	Theme	Description	Subtheme	Respondents views
Compatibility	reasons to use a mobile device for learning	Use of mobile device for learning is influenced by need for life-long learning, language and as a means of convenience.	language	Sometimes you will find that in a textbook they have summarized or using complicated language and I don't understand. (S3F)
			life-long learning	There are ideas that I get, that usually on text books or teachers notes they are not available. So, it increases my knowledge. (S9M)
				... Then, I will take it as initiative to use my device so that I know a lot about the topic announced. (S13M)
			time (convenience)	It is easier to search for material using my phone and it takes little time than going to the library. (S5F)
	tool to support learning	Tools used to support learning include search engines and websites and are subject specific.	subject's students use devices for learning	... let's say its mathematics or biology and the teacher is teaching evolution and let's say the teacher announces that our next topic will be digestive system, we are revising. (S13M)
			search engine/website	I will understand more. Sometimes you find that in a textbook they have summarized or using complicated language and I don't understand. So, I decide to Google and I get an understanding from that. (S3F)
Observability	Advice	Students receive and might follow advice provided by peers or shop attendants before purchasing a mobile device	peer advice	I do listen to them. I might not know much details about the device I want to acquire, there are times when your friend knows more about the device and hence I listen to my friend's advice. If the advice is good I shall listen, if it is not contributory advice, I might not follow it. (S2F)
			shop attendant advice	The shop attendant gave me a lot of options to choose from but also gave me advice on the phone to buy (S7M).
	technical support	Students depend on parents and peer support when in need of technical assistance with mobile device.	peer support	The friend had a Samsung duos but it has an android operating system. That gave me an idea of what to focus on, what android version it should have. Student was migrating from Nokia 5000D (using Symbian OS) (S10M).
			parent support	I had a relative that had it and I asked her if I could use it for few minutes and I learnt from that (S5F).
	emotional decision (durability of device)	Students make emotional decisions on mobile	budget	Some students joke a lot, someone might tell you that the phone is expensive, but if I have planned to

		devices to buy based on budget or durability		acquire it and I have enough money, I will buy it (S2F)
			durability	For example, I know what I want and the advice I will take is which phone has the quality which I want. I won't focus on their advice of which phone is an original and which is a replication, I will focus on which phone is good (S17M).

Table 17: Reviewed themes.

### 6.4.5 Defining and naming themes

Respondent's views were assessed in relation to phase four. Themes were refined for internal homogeneity and external heterogeneity. Each theme was assessed to ensure sub-themes encapsulate 'the story'. Respondent views were used to explain arguments. Consideration was placed on each theme to ensure unique stories are explained.

Respondent's views were not just paraphrased. Attention was given to story explained. Each respondent discussion as supporting or rival explanation to the story. Where necessary, rival explanations were included for each sub-theme. Finally, theme names were assessed and retention of current names was decided as depicted in Table 18. Table 18 shows themes emergent from data.

Theme		Description
Innovation	Relative advantage	Students use mobile devices as it affords contacting friends, family and relatives and provides a platform for socialization.
	Compatibility	As a supplementary source of information, students adopt and use mobile devices due to affordance in simplifying language, taking short time when searching and life-long learning. Students use search engines and websites.
	Observability	Students acquire advice from peers on what features to consider and mobile devices to buy. Students receive technical support from peers and parents. Some students make emotional decision during adoption.
	Trialability	Students share multimedia and text on mobile devices for social purposes and learning.
	Complexity	Information overload and not understanding affordances on a mobile device deter students from adopting or using a mobile device for learning.
Social systems	Norm	Parents, teachers and elder sibling's perceptions coupled with cultures have affected students' use of mobile devices for learning.
	Network Interconnectedness	Students interact with peers and friends using groups created on social networks and instant messaging platforms.
	Consequence	Confiscation of mobile devices has affected students.
Concern	Moral enforcers	Announcements of 'no mobile devices' on school premises and ban by ministry of education have deterred students from using mobile devices within school environment.
	Moral creators	Government ban of mobile devices on school premises and teachers' perceptions on students' use of mobile devices plays a significant role in limited views on students' use of mobile devices for learning.

	Availability	Mobile devices on students' hands are a resource that when well organized, fosters learning based on affordances.
Sustainability	Self determination	Ownership and control of mobile devices is on students. Students buy credit (airtime) for phone calls, short messages services and Internet bundles. When buying Internet bundles, focus is on how long it will last.
	Willingness	Students save pocket money to buy airtime depicting willingness to communicate. Students initiate conversations and sharing of educational content to peers and friends.
Effectiveness	better explanation	Students view effective use as using mobile devices for better explanation by assisting with time management during studying and using mobile devices for research.
	use mobile device to plan	Using alarm, calculator and calendar on mobile devices, students plan academic activities.

Table 18: Influence of effective use of mobile devices outside the classroom by secondary school students.

Each theme is presented with sub-themes and descriptions. Descriptions provided are specific to sub-theme. Availability was identified as a theme that encapsulate an innovation. While availability will be discussed in findings, it will be omitted from the final framework.

#### 6.4.6 Producing the report

The report is provided in succeeding section as findings. Findings are discussed per theme and within each theme, sub-themes provide rich explanations. Explanations provided are linked with respondents' views. Mixed method approach requires arguments in findings must include quantitative data (Creswell, 2013). Discussions of findings is provided in chapter 9. Findings are generalized from respondents' views for the single secondary school in Dar-es-salaam (Lee & Baskerville, 2003; Walsham, 2006).

### 6.5 Findings

#### 6.5.1 Innovation

As an innovation, mobile devices have penetrated Tanzanian secondary schools. Mobile devices afford communication outside the classroom. This is supported by Table 4 and Table 8 showing 200 students and 19 teachers owning mobile devices.

Table 6 accounts for, 144 students using mobile devices to socialize. Respondent S3F explains of socializing and chatting to peers. 151 students used mobile devices for recreational purposes and S6M explains how. The student refreshes through music and sporting information.

124 students used mobile device to search for information. To keep abreast with current affairs in politics, S11M uses a mobile device. Specifically, the student searches for newspapers. Lastly, 131

students used mobile devices for academic purposes. S8M clarifies on academic use of mobile devices to acquire base competence. The data shows mobile devices have been adopted by Form IV students.

“I use the Internet. There are many things, like for my studies when we are given a homework. May be in refreshing mind by chatting with people”. S3F

“Actually, I search for information about sports. It’s about football. Sometimes music for refreshing”. S6M

“When I am tired, I like to refresh my mind by watching music videos and reading sports news”. S15M

“It was about news. The news was related to sports and politics, from newspapers”. S11M

“When you use your device for learning, there is something they call base competence. Your ability to learn thing by using your device will assist you in your life. As we progress for example, at university, there is no teacher that will come and teach you how to learn using your devices. Ever since we were kids, we depend on ourselves for learning and we find a lot of materials on the Internet”. S8M

By adopting mobile devices, students show several important characteristics of an innovation. These characteristics include relative advantage, observability, trialability, compatibility and complexity.

#### **6.5.1.1 Relative advantage**

Students depict relative advantage received by using mobile device through its affordances. Students without mobile devices struggle to contact peers, family and teachers. In a modern world, a student without a mobile device in a city, feels empty. Ability to socialize is impaired as socialization happens on mobile devices.

Respondent S2F depicts a relative advantage received by a private secondary school student with a mobile device. Students with mobile devices learn of different techniques to access technologies as expanded by S4F.

“I could say, compared to other schools, government schools, as we know they have few teachers and hence they don't get enough learning material as we do. E.g. our History teacher gives us challenging and complicated questions, we usually struggle with them. Hence after struggling for

some time, I end up googling for answers and gain something compared to a student from a Government school”. S2F

“A person that is not using their mobile device for learning will struggle to get solutions to any problem while for me it will be easier to find the information I need”. S4F

Students use mobile devices to socialize, for recreational purposes, searching for information and for academic purposes. Quantitative data for these four uses was argued in previous chapter. Chapter 5 also shows 192 students (out of 202) responded having a relative advantage when using mobile devices. Relative advantage is depicted by students socializing, contacting family, friends and peers and contacting teachers.

#### *6.5.1.1.1 Socializing*

144 students represented in Table 6 using mobile devices to socialize. Socializing using mobile devices for students included using Facebook, Twitter, Instagram and YouTube. Socializing is application of Web 2.0 platforms to create, acquire and share content. Students download social networks and use on mobile devices as described by S13M.

“I have downloaded social networks on it [Techno mobile phone] such as Facebook”. S13M

Students share and respond to information shared by peers on social networks. Response is by support or addition of content. Content acquired on social networks is shared to peers to aid understanding and engagement. Respondent S8M explains of sharing content from social networks on an instant messaging application, WhatsApp. S14M explains of how pictures taken during a school trip were shared with peers using Bluetooth, Gmail and Facebook.

“I have shared a video that I found on YouTube with my friends on WhatsApp”. S8M

“I took pictures. It was in relation to school trips, Geography studies to be specific and we went to Arusha (Ngorongoro national park, Tarangire and Manyara). I shared these pictures to other students who were present by using Bluetooth, for others I used Gmail and Facebook”.

Academic content on social networks is shared on multiple platforms. The power of a video or link, from YouTube on students is massive. Content shared by peers is assumed trustworthy. Students open videos shared and move the discussion to social media.

#### *6.5.1.1.2 Contacting family, relatives, friends and peers*

Students use mobile devices to contact family, friends, peers and relatives. Contacting family and relatives is given priority by some students as explained by S2F. S13M clarifies reasons for

contacting parents. Another student, S16M, provides explanation on using mobile devices to enquire from his aunt of medication to relieve stomach pains.

“While school is important, there is a need to contact my relatives”. S2F

“When I have a problem then I use my device to contact my parents”. S13M

“I needed information about certain medication from my Aunt as I had serious stomach pain”.  
S16M

Using mobile devices, students use phone calls, SMS, social network, instant messaging and other Internet resources to communicate. Communication using mobile devices is summarized by students as chatting as enacted by S2F.

“As you know us, young people, chatting will be associated”. S2F

Academic use of mobile devices in contacting family includes sharing academic knowledge with sibling attending different school as clarified by S2F. The student was assisting a sibling from a different secondary school with homework. Students use mobile devices to contact peers and exchange ideas on school related matters as presented by S3F.

“I have a sibling in another secondary school. They are usually given homework to do during school holidays. So, if my sibling doesn’t know what to answer, he contacts me and asks for solutions. I end up recording myself [inferring to voice note] and send to him”. S2F

“Because, sometimes we communicate and exchange ideas may be about a certain work that you are given at school and one has an idea about that work so we exchange ideas”. S3F

The only problem that emerges when students contact peers, is when the communication happens late at night. Students spend hours on mobile devices as presented on Table 5. 59 students stated spending between 12 hours and 24 hours in a day on a mobile device. Of these, 20 on social networks.

Hour’s students spend on mobile devices include late night. Even though it might be during school holidays, students are expected to have 8 hours’ sleep. 156 students were between the ages of 15 to 17. Required to spend considerable time sleeping for growth. S5F shows the time she was contacting peers.

“There have been times that I chat to my friends till 0100 and mom found me doing that, she decided to confiscate my phone for some time. I was chatting to a friend in relation to project work and this was during holiday time”. S5F

Students report disruption from messages by peers at times when concentration is on studying. Students sending messages to peers on instant messaging application, WhatsApp, do not consider time or content sent. When a student receives a message (s) from peers, focus is on reading and responding quickly.

“Usually it’s the time when I have things in my mind that will get me off the mood for reading. Example someone is trying to communicate to you about things that are not relevant to my studies. Sometimes I get these disruptions when they [peers sending message] use Internet e.g. WhatsApp”. S14M

#### 6.5.1.1.3 *Contacting teachers*

Students contact teachers on school related matters. Students call, send SMS, use instant messaging or social networks to contact teachers as described by S2F. School matters include administrative and classroom content. Administrative communication with teachers include enquiring on marks, fees, date school opens or closes and student absenteeism.

“I do contact my teachers regarding school work. I use call, text and social networks”. S2F

Marks enquire comprises tasks students were given and graded. Marks include, assignments, homework, tests and projects. Students enquire on marks upon receiving term report as argued by S4F.

“It was about my academic report. There were some incorrect calculations on my report and I contact my teacher. He said I should come to school and he will rectify that. It was by calling and I called the teacher”. S4F

Students contacting teachers have generous intentions. Some students contact teachers to wish them well during festive seasons. S10M clarifies communication to teachers wishing best of festive season.

“I contact them to wish them well during festive seasons and holidays”. S10M

Teachers in administrative positions prefer students to inform of absenteeism. Administrative positions are project coordinator, matron, patron, academic master, deputy principal and principal. Students call, send SMS or send email to matron or patron and inform of when they won’t attend

school and reasons. Reasons provided by students include health condition, hospital visits and funerals. Respondent S2F explains of how students acquired coordinator's phone number. S3F explains reaction from coordinator if not contacted on absenteeism.

“He gave it to the class. He wrote it on the board as he is the coordinator for Form III and IV students. So, if you won't be at school, you will be required to contact him and inform him that you won't be at school on a given day and reasons behind”. S2F

“There was a point in time I was sick and I could not come to school. So, our coordinator requires you to inform him, if you don't, he panics. You might come to school and explain the situation to him and he won't understand. So, the straightforward way is to inform him of your situation on time”. S3F

“Not at all. May be my mom would contact my teachers. I just don't feel like talking to my teachers”. S19F

While some students leverage contacting teachers for administrative and academic purposes, other students do not exercise contacting teachers. As previously stated by S2F, teachers have given phone number to students by writing on the board. S19F doesn't have any teachers' phone number and the responsibility is left to parents.

### **6.5.1.2 Observability**

Students observe peer's using a mobile device before, during and after adoption. Quantitative data from Table 6 represents 161 students observed a peer. During adoption, students receive advice and assistance. However, students make emotional decisions.

Students listen to advice from peers and shop attendants. Peer advice is based on that owned. Shop attendants explain to students how a mobile device of interest operates, affordances and comparison to other mobile devices. Respondent S1M explains on observation and how it assisted during adoption. The student observed a friend using a Samsung Duos and assisted decision making.

“I saw a friend and I was interested on it. ...but it [Samsung Duos] is less expensive on Internet charges compared to the blackberry bold I had”. S1M

Students receive technical support from parents (or relatives) or peers. Parent's advice includes problems on using mobile device. Students contact peers that offer technical assistance. Technical

assistance is used to assist parents in using mobile device. The student learns of working affordances, applications and problems.

Respondent S3F identify observing a relative using a mobile device. Respondent relate how observation lead to trial. The student owns a Techno P5. In the process of observing and trying mobile devices, technical support is offered on complex issues.

“I saw my sister having it. I tried the phone for some time before I bought it”. SF3

“I just take their advice but I also add my own experience and information I have. When I go to a shop to buy a mobile device, I look at if it has the following features: does it have a battery life, may be 2000mhA”. S10M

Despite advice received and technical support, a student has ultimate decision. Emotional decisions are when a student adopts a mobile device despite advice from peers. Students make emotional decisions when budget does not match cost of mobile device, focus is on durability or quality of mobile device. Respondent S10M discusses of durability

#### *6.5.1.2.1 Advice received from peers and shop attendant*

Students receive assistance from peers on mobile device to acquire. Students observe peers using mobile devices and are interested. Students try peer’s mobile device which assists with familiarity. The more familiar a student is to a mobile device, the higher chances of adopting. S2F provides an account of friends knowledgeable on mobile devices.

“I might not know much details about the device I want to acquire. There are times when your friend knows more about the device and hence I listen to my friend’s advice”. S2F

Students receive advice on applications a mobile device should have. Peers consider several applications on a mobile device. Applications comprise, YouTube, WhatsApp, Opera mini and Gmail to name a few. S6M discuss applications peers refer students.

“Yes. Some of their advices are good. They are just advising me to look for some features on the device. Many of my classmate’s state those features, the phone should have good Internet that is fast. It should not be expensive as I cannot manage to buy. It should support some features as Google, YouTube and other apps”. S6M

Students receive advice from shop attendants. When a student is in a shop, shop attendant may influence adoption decision. Shop attendants are familiar with mobile device features.

“I tried it at the shop. The shop attendant gave me a lot of options to choose from but also gave me advice on the phone to buy”. S7M

The advice a shop attendant gives to a student affects decision making. A student might walk into a shop with intention of buying a specific mobile device, but a shop attendant advice could change it. S7M accounts for this.

#### 6.5.1.2.2 *Technical support*

Technical support from peers consist of, details on storage capacity, Internet speed, camera quality and operating system. S8M describes technical support received from peers. Focus was on mobile device storage capacity and Internet speed.

“The advice I follow the most is usually about it should be good on the Internet and its capacity so that I don’t search for other external storage devices”. S8M

“I used another device. It was another product from another company that a friend had. The friend had a Samsung duos but it has an android operating system. That gave me an idea of what to focus on, what android version it should have”. S10M

Respondent S10M accounts for technical support by observing and using Android operating system. The student explains how viewing a different operating system and knowing of version, affects his decision.

Parents (or relatives) provide technical support. Students observe relatives and parents using mobile devices and are interested. Mobile devices owned by parents, relatives, or siblings affords students ability to try. A student that tries a mobile device, has a higher chance of understanding it before adoption.

“I had a relative that had it and I asked her if I could use it for few minutes and I learnt from that”. S5F

“The Techno a relative had it and that is where I fell in love with it. At that point I bought a new one and sold my ITEL so that I would buy it”. S17M

Respondent S5F describes learning of a Techno mobile device before adopting. S17M sold a mobile device to top-up and buy a Techno P5. The student had observed a relative. Based on explanation, the student must have tried the mobile device and liked features.

#### 6.5.1.2.3 *Emotional decisions in the process of acquiring a mobile device*

Students make emotional decisions on mobile devices to acquire. Emotional decisions depict not following peer advice. Cost of mobile device and durability account for students' emotional decisions. Students decide on price and quality of mobile device regardless of peer advice.

Students want a mobile device that lasts with charge. Tanzania has unstable electricity supply. Acquiring a mobile device requiring charging numerous times during the day defeats the purposes.

“I just take their advice but I also add my own experience and information I have. When I go to a shop to buy a mobile device, I look at if it has the following features: does it have a battery life, may be 2000mAh...”. S10M

“I focus mostly on the price of the device, its durability and it's Internet”. S16M

Power failure reduces communication from student to relatives, peers or teachers. S10M shows need for a good battery. S16M describe features a mobile device has including good battery life.

Students consider originality or quality of mobile device. However, some students do not want replicated phones (clones) due to mediocre quality of mobile device.

“They advise me to buy an original phone and not a replication and that it won't be damaged easily”. S18F

Respondent S18F explains of need for original phone. Replicated phones are easily damaged and parts hard to find.

#### **6.5.1.3 Trialability**

Students try mobile devices before adopting. Mobile devices observed from peers, parents, relatives or at the shop affords students ability to engage with. When engaging with mobile device, students learn of features, applications and operating system. Students struggling with any mobile device affordance receive assistance from owners. Students engaging with mobile devices assists with reducing uncertainty leading to adoption.

Students use audio, picture, video and visual during adoption. Students also use text on a mobile device. As students engage with a mobile device, easy to use features are identified. Students also identify applications that simplify use and efficiency. Multimedia and text on mobile devices afford students learning.

“A student friend had it and so I used to play around with it”. S2F

“Yes, I tried it. It was from a friend that owned it”. S13M

Students adopt mobile devices after observing and trying from peers. S2F who owns a Samsung Note 3 and S13M, owner of a Techno smartphone, explain of how they were influenced after observing. Both students went to buy phones tried.

Other students have tried mobile devices that a family member or relative owned. Family members include mother, father, brother and sister.

“I saw my sister having it. I tried the phone for some time before I bought it”. S3F

“I tried and I received some advice from someone who used it before. It was my father who had it before”. S6M

Students who tried mobile devices owned by a family member or relative are S3F who owns a Techno P5 and S6M owner of a Nokia Asha 301.

Mobile devices students adopt afford multimedia and text. With multimedia, a student can view pictures, watch videos, listen to audio or engage with other visuals. Students are content creators. Students take pictures, record audio and videos and create visual using mobile devices.

“I have taken pictures and videos. They were related to places I have visited and who I am with that graduated at this school years before. Some friends have not seen this person for long. It’s for memory.

Audio that I recorded were not related to school work. In relations to school work, it was pictures that came from the industry project we undertook. The video we did not share anywhere. The pictures we scanned them and attached them on our portfolio to show what type of machines they use. The audio we recorded as a group our words and included it but we did not submit”. S10m

Multimedia is accompanied by text to clarify content observed. Respondent S10M gives an account of using multimedia and text.

After interviews, the researcher applied principle of suspicion. The researcher conducted a search on mobile devices students mentioned. Three companies were new, Yxtel, Ditel and Amoled. The researcher learnt Yxtel and Ditel are mobile device manufacturers. Amoled is a type of screen display used on Samsung mobile device, specifically tablets.

#### *6.5.1.3.1 Student use of multimedia*

Students use multimedia, pictures, audio, video and visual format. Textbooks provided in secondary schools and sold in bookstores are predominantly in black and white format.

Pictures assist students to understand content. Pictures taken include general purpose and for academic purposes. Students take pictures on momentous events. S13M took pictures during a school visit to a historical site.

“I took pictures at the national museum and in Bagamoyo. Pictures at national museum were of old cars on display. Pictures in Bagamoyo were to show old building and surroundings. My intention was to inform others that when you go to Bagamoyo, these are the possible things you might find”. S13M

Pictures were used as proof of visiting site and sharing with peers on areas of interest. Pictures increase students understanding of phenomenon and are point of reference.

Students undertake a project in Form III. Projects are done during June vacation. Projects are completed in groups of maximum 10 students. Students chose a topic from a subject of interest.

“It was in relation to History and we were doing it as part of our project. Our topic was on historical sites. We took pictures and we sent to one another by using WhatsApp and Facebook”. S15M

Students visit any location related to the project, take pictures or videos. Students write a report and include pictures on a manila paper to showcase project development. S15M explains of channels used to disseminate pictures.

Illustrated on Table 6, 63 students used camera and video for academic purposes. While the number might be less than half the students, interviews provide details. Students take pictures assisting in elaborating an argument.

“I took a picture of 2 questions while solving book keeping and I sent to my friend”. S1M

“Some textbooks don’t display all the information or lack pictures but on the Internet, I can find the material”. S11M

Respondent S1M describes how peers acquire assistance on academic content. The student took pictures of questions and shared with peers. S11M advocates for using a mobile device for learning. He asserts, content is available on the Internet.

Using videos for learning provides students with clarity of content. 88 students identified on Table 6 using YouTube. YouTube is a website where users create content and share videos. Content shared on YouTube is accessed by students and used for learning.

Combining pictures, videos and audio recordings is not for project only, but also class content. Students want to understanding content covered in class. Students employ the Internet and watch videos to capture details aiding in understanding.

“For example, a teacher would summarize some information in class. When you use the Internet, you will gain knowledge by looking at pictures and videos. Let’s take Biology, the teacher has drawn a picture of a cell, I would go to the Internet and check on a video to understand its reality. So, I go online to search for videos that assist me to understand more”. S10M

“If I am in a hurry, a video does it especially one with quick explanations or if I want to record something that will take long to explain then I use videos”. S17M

Respondent S10M explains learning through video sharing platforms to further classroom content. Students use YouTube as video sharing platform. S17M explains content creation using video. The student records videos to explain concepts unclear to peers.

Instant messaging applications affords audio recording. WhatsApp is one such instant messaging application. Apart from affording students’ ability to make or receive Internet calls, students can record audio files. Recorded audio files, also known as voice note, are shared to peers, friends or relatives.

“I have a sibling in another secondary school. They are usually given homework to do during school holidays. So, if my sibling doesn’t know what to answer, he contacts me and asks for solutions. I end up recording myself [inferring to voice note] and send to him”. S2F

Students assist peers or siblings by recording explanations to a question. Recorded explanations are then shared on WhatsApp as explained by S2F.

#### 6.5.1.3.2 *Preference on text*

The classical approach of communication is through text. Students use text on mobile devices. Students send and receive SMS and instant messages through mobile devices. Some students prefer text messages over multimedia as described by S1M.

“Text works better for me”. S1M

As identified in previous section, texts are mixed with multimedia. Multimedia is used to enhance text. Multimedia when combined with text, assist in clarifying concepts to students.

“I would say all of them. It’s subjective to what we are looking for. There are times you would send text and someone would say they need more evidence. Then you send them a picture and they say this was edited, then you are forced to send them a video. Hence all of them”. S10M

Respondent S10M provides a discussion on transition from text to multimedia. Throughout the process, the student shows different multimedia are used to clarify unclear concepts.

#### **6.5.1.4 Compatibility**

An innovation is easily adopted if compatible to current norms. Mobile devices show similarity to norms and are adopted by secondary school students. Outside the classroom students socialize by chatting as explained in section 6.5.1.1.

“I use my dictionary found on opera mini for learning unfamiliar words and their meaning instead of opening pages on a physical dictionary. I use calculator for handling fast calculations, I also use my device to write notes, for example I have something that I need to remember and I have no place to write it on so I set an alarm so that when I get home I should remember to write it down”. S17M

Compatibility between a mobile device and objects that are a norm in education is illustrated by S17M. The student asserts having a dictionary, calculator, note pad and alarm on a single mobile device.

Mobile devices afford students ability to access textbooks, view pictures and videos and listen to audio on topic of interest. Table 6 shows 171 students view mobile devices compatible to textbooks for learning. On mobile devices, students use coloured pictures.

“For example, someone is explaining about something that is so scientific, so they know for someone to understand better, they need to go on the Internet, they can download videos or use pictures. When they teach about atomic bomb, for you to know how it creates catastrophes, you need to watch a video on how they are sent and how they create eruption on the surface”. S20M

“In relation to studies, the importance is for us to search for materials knowing that we are candidates [soon to seat for national examination]. We cannot heavily rely on what we are being taught and hence we need to search for more materials for ourselves. Thus, Internet is the most important thing”. S2F

Videos afforded enhancement of students understanding as narrated by S20M. Students use videos to clarify understanding and gain knowledge. Students are in final year of Ordinary level and

attention is on examination preparation. Students use mobile devices as supplementary source of information. S2F extrapolates.

Mobile devices are compatible to many objects that are a norm at school. Students have reasons to use mobile devices for learning and tools that assist. Reasons include affordance of life-long learning, assisting with language and convenience. Tools that students use for learning are search engines and websites as applied to several subjects.

“For example, a textbook summarizes some information. On the Internet example, Wikipedia, I could get pictures about that aspect, or videos.

There are times you are at home and you have your mathematics textbook and you want to solve a question. Once you are done, you want to share this with your school mates. You could submit the question and explain to others how you completed the question.

The people I am sharing these questions with are not necessarily on my class. They could be from any other school or anywhere in the world.

There was a time I was using my device and I found Microsoft Math. It has a Tanzanian syllabus for O-level and A-level mathematics. You can even create friendship with the people you share your solutions with”. S10M

Respondent S10M summarizes mobile device compatibility through extending traditional discussion to include online collaboration. Collaboration with students in various parts of the world is possible using mobile devices on Microsoft Math.

#### *6.5.1.4.1 Reasons to use mobile devices for learning*

Students depict mobile device affordance for life-long learning through challenges from teachers, extending content on textbooks, understanding questions given by teachers, exchanging ideas with peers and having an inquisitive mind. Life-long learning is one of the reasons student use mobile devices for learning.

When students complete Form IV, mobile devices assist with application to school, colleges and universities. Students learn of concepts with mobile devices. Mobile devices are used by students to enhance life.

Teachers give students assignments, homework and projects. Despite these, teachers challenge students in classroom. Teachers provide students with problem solving questions and expect submission within few days.

“Sometimes they give us questions and we should go and find out, they give us problem solving questions and hence I use it [mobile device] to find solutions”. S1M

“I use my device to search for material. For example, a teacher might give a certain area from a certain topic, that he/she will teach but you must go and search for materials, then discuss with your friend. When we meet for the next class, we will go through it but I have an idea in advance”. S2F

S1M discusses how teachers challenge students. The student uses mobile device to search for useful information that answers questions from class. S2F does not only use mobile device to find solutions on teachers’ challenge. The student also uses to prepare for discussion and next class. Students use mobile devices to search for material unavailable on textbooks. Coloured pictures, videos and audio files available on the Internet are accessed through mobile devices.

“There are a lot of recommended books, but on these books not all the school materials are available, things are summarized. So, if you use, illegal ways [mobile devices] you will find more materials than those on textbooks. He [teacher] even tells us, go and search on the Internet and hence we use our devices”. S2F

Students leverage mobile devices for learning and access content either not covered in class or detailed on the Internet. S2F confers mobile device affordance on search for content on the Internet.

Students use mobile devices to understand questions. Questions posed by teachers are typed on search engines. Searching for solutions is an outcome of not understanding the question as explicated by S2F.

“I searched for solutions and found the points on the Internet, they were not that hard but it’s just because we didn’t understand the question to that level”. S2F

“I feel good as the teachers explains better to me, I understand and I get ideas. Even when I continue searching on my own, I get more information”. S9M

S9M shows dependency on teachers. While searching on the Internet, he contacts teachers. Teachers’ feedback aid further searches using mobile devices.

Mobile devices afford students ability to exchange ideas. Students, whether on individual capacity or group, communicate with peers on content discussed in class. Students who understood content during class, become conveners outside the classroom.

“Because, sometimes we communicate and exchange ideas may be about a certain work that you are given at school. When one has an idea about that work, we exchange ideas. It’s not only between me and the person I am chatting to, it also includes other members in the group”. S3F

Discussions are thus not in a physical room but virtual using mobile devices. S3F elaborates on exchanging ideas using mobile devices.

Inquisitive minds lead student to use mobile devices for learning. S14M depicts accessing Cambridge website and completing questions using a mobile device.

“Some information features in communication like Gmail and other applications like those used for eLearning. The eLearning apps are like the ones I use to solve mathematics questions. I answer questions from Cambridge website. It has questions and solutions and I found it by googling. It was not on Xbox. It has questions for O-level and A-level students, in such for all levels. It has questions and answers”. S14M

By accessing content on mobile device, the student did not incur printing costs. The student uses other technologies at disposal. Email and Xbox are a common phenomenon. The student searched for academic content on Xbox.

Secondary schools in Tanzania use English as the medium of communication. All subjects, excluding Swahili, are taught in English. Students argue, some books language used is complicated. At such times, students use mobile devices to search for content.

“Sometimes you will find that on a textbook they have summarized or by using complicated language and I don’t understand, so I decide to Google and I get an understanding from that”. S3F

“Sometimes when you use the web, mostly you learn by using English. We are Tanzanians, so our English is not so good. Hence the English they use becomes complex to me. So, I decide to use my books as the English is simple”. S19F

Respondent S3F provides explanation on how textbooks are hard to understand. S19F provides counter explanation. She argues, content on the Internet uses complex language. For a Tanzanian student, she views this as a point of departure and focus on textbooks.

Mobile devices on students’ hands offer convenience. Students spend less time searching for information using mobile devices.

“It is easier to search for material using my phone and it takes little time than going to the library”. S5F

“It does not take a lot of time as it takes brief time. Also, it is easier than going on the book searching and getting answers.

Sometimes in book you can read something but the way you interpret it is somehow hard and on the Internet, the explanations are already interpreted”. 6M

S5F argues, going to the library as an activity taking time. Time the student could have focused on other activities. S6M expands on previous argument. The student argues, even when one has a book, time is lost opening pages.

#### 6.5.1.4.2 *Tools used to support learning*

Tools used to support learning include search engines and websites. These tools are used on several subject’s students are preparing for examination. Examination preparation to students means collaboration. Teachers assist by clarifying arguments.

Mobile devices are used to assist in projects, assignments, class preparation and homework. Students use mobile devices for different subjects. Subjects include book keeping, commerce, physics, chemistry, biology, English, civics and mathematics.

Students use search engines on mobile devices to search for information. All mobile devices that access the Internet are preloaded with a search browser. For example, an Apple device will come with Safari, a Windows with Internet explorer, an Android with Chrome.

It is no surprise to hear students stating, “I Googled it” or “I will Google”. These terms refer to using a search engine to access information. Predominantly, Google is used by students as explained by S3F.

“Because when you are given a question by a certain teacher to search for solutions and in the book, there are no answers, you go and search for it on Google”. S3F

Apart from search engines. Students access websites for learning. Students use website such as YouTube and Wikipedia to access academic content. On YouTube, students watch videos. On Wikipedia, students access text and pictures. Wikipedia includes links to sources. Students access links and engage with content.

“I was searching on Wikipedia about South Africa history, it was not related to school work and I found that Portuguese, Jan van Riebeeck, settled in South Africa”. S10M

Respondent S10M explains using Wikipedia to learn South Africa history. The student used initiative of accessing content on the Internet. He explains learning of a settler of Portuguese descending.

#### **6.5.1.5 Complexity**

Complexity is brought by an innovation viewed as hard to understand and use. Complexity reduces the rate a technology is adopted. If students view mobile devices as a complex technology, adoption will be low. If students view mobile devices as complex for learning, they will not apply them.

However, learning is viewed in diverse ways. It is not the ultimate opening of a book on a mobile device. Calling, texting and sending instant messages relating to academic content accounts for learning.

Table 6 represents 115 students stating mobile devices for learning is complex. When interviewed, students argued for mobile devices simplifying work. S3F depicts a mobile device as an innovation that simplify work.

“It is good because most of the time it simplifies the work. The work could be searching for information that you cannot find in a recommended textbook”. S3F

“On these devices, my dad prefers to read news on his device. He has an application that simplifies my work and having access to newspapers. When I use that application, I know what is going on around the world better and when I am on sports, I could check on results and watch live games compared to someone without access to a phone”. S17M

Respondent S17M explains of an application that aggregates news. Secondary school students are required to keep abreast of current phenomenon. Subjects like civics and general studies test students’ knowledge on current affairs.

Complexity on mobile devices may be brought by device incompatibility. Devices using same operating system, afford sharing files including audio and video. iPhone devices are not compatible with Android devices on Bluetooth file sharing.

“I base more on the devices internal capacity; RAM and it should be able to socialize with other devices [inferring to pairing]. For example, when you own an Apple phone, it only links with other apple devices and in such a way if one of my friend wants to send me something from a Nokia phone, then the two devices cannot connect”. S8M

The compatibility problem forces students to view an iPhone complex. S8M explains on his experience.

Another complexity brought by using mobile device is information overload. Students require guidance on the Internet. Purpose is to ensure students do not get confused and overloaded.

“Some ideas that I find on the Internet using my device are beyond my level. Beyond what I am being taught. Hence, they might get me confused”. S9M

“For example, when I am at home during holidays and I find something on the Internet, I send the link to my teacher and ask if it’s related and how to our school work”. S10M

Students depict multiple views on information overload, others offering solutions. S9M explains of content found on the Internet being beyond his level. S10M responds to S9M concerns. He receives guidance from teachers while searching for information.

### **6.5.2 Social systems**

Societies have labelled students and argue for misuse of mobile devices. The norm in the society has suppressed students. Students are secretive to parents. S4F supports this argument.

“On my side, neither my mom nor my dad knows that I own a phone. The only people who know that I own a phone are my sisters. My first sister [elder sibling] is the one who gave me the device. So, the problems I encounter are like, when I am using it during my studies and I use it to search for material, when my mom comes, I have to hide it and hence I am not free”. S4F

The students’ siblings know she has a mobile device. The elder sibling gave her one. Parents do not know their child owns a mobile device. The student hides mobile device when her mother gets to study area. The student uses the mobile device for learning.

Parents have judged students use of mobile device. S5F uses networks for academic purposes. Unfortunately, it was late and her mother confiscated mobile device. The norm has set aside sleeping hours for students.

“There have been times that I chat to my friends till 0100 and mom found me doing that, she decided to confiscate my phone for some time. I was chatting to a friend in relation to project work and this was during holiday time”. S5F

For students to wake up healthy and energized, they must sleep considerable hours. Using a mobile device at midnight is misuse. The student should be asleep. The main consequence students' encounter is confiscation of mobile devices.

### **6.5.2.1 Norm**

The norm affects students' ownership and use of mobile devices. Perceptions from peers, parents and teacher hinder adoption of mobile devices. Coupled with culture, students are adopting mobile devices while being careful. Use of mobile devices for learning is not given priority. Rather, assumptions on misuse

#### *6.5.2.1.1 Perceptions*

Students argue peers should use mobile devices to search for information. Students want peers to use time outside the classroom wisely by concentrating on academic purposes.

"Positive effects, it helps a student to get more information about their studies, or if you don't have any information it may be helpful for you to learn something.

Negative effects, it would mean you go out of the norms expected of a student. For example, if a student is watching pictures that are not good like pornographic and other which are not good for your age and you are a teenager". S14M

Respondent S14M illustrates. Students should use mobile devices for learning. Students should not focus on inappropriate content available on the Internet or shared by peers.

Parents assume students use mobile devices to chat. The perception is created based on hours a student is on a mobile device, Table 5. S8M explains of his mothers' perception. Spending considerable hours on a mobile device is equated to chatting.

"It was at home. I might be studying but my mom does not believe that I am using it for my studies. She thinks I am just chatting with my friends". S8M

Teachers collaborate with parents. A student using a mobile device for long is assumed to misuse the mobile device. Misuse refer to accessing music, videos, movies and websites with non-academic content.

"They spoke in the meeting [parents meeting]. They told our parents that we should not use our phones. They don't know why we are using it. Some teachers say we are full on WhatsApp or other connections". S1M

During parent’s meetings, teachers discuss with parent’s reasons not to ban use of mobile devices. S1M provide explanation. As students chat on WhatsApp, it is assumed misuse.

**6.5.2.1.2 Culture**

The culture in secondary schools in Tanzania gives control to teachers at school. Because student use of mobile devices is viewed as against the norm, teachers have punished students.

“They decided that, we boarding students are so favoured than day scholars. When a day scholar is caught with a phone, they can be paraded during morning assembly or expelled from school. But for boarding students we are told when we finish form IV, we shall be given our phones”. S2F

“Others get their phones confiscated and destroyed. I am yet to know if those caught, what were they using the devices for at that point in time. That is based on school rules”. S17M

Punishments consist of, students get paraded during school morning assembly. Students may also be expelled if caught and explanation is not valid. Teachers decide validity of students defence. Such harsh punishments are meant to deter students from getting to school with mobile devices as explained by S2F. S17M refers to school rules.

**6.5.2.2 Network interconnectedness**

Despite the norm, students use mobile devices for academic purposes. Students use groups on instant messaging and social media to share resources. Students create online friends and share solutions to academic work.

**6.5.2.2.1 Group work**

Students have created groups where subjects, projects, assignments, practical and examination resources are shared. Quantitative data on

Concept	Characteristics and aspects	Frequency			
		Yes	No	Missing	Total
Social system					
	Network interconnectedness				
	Using calls				
	Call a peer to ask for solution	141	58	3	202
	Received a call requesting for solution	132	67	3	202
	Using SMS				
	Sent text to a peer requesting for a solution	131	69	2	202
	Received text asking for a solution	134	66	2	202
	Using instant messaging				
	Sent instant message asking for a solution	87	112	2	201
	Received instant text requesting for a solution	87	112	3	202

Table 7 shows students using mobile devices to call, SMS and instant message peers for solutions.

“Because sometimes we communicate and exchange ideas may be about a certain work that you are given at school and one has an idea about that work so we exchange ideas. It’s not only between me and the person I am chatting to, it also includes other members in the group.

“The group could be about a subject i.e. book-keepers, or the school, i.e. X school, or based on the class i.e. Form 3C”. S3F

Students interact on instant messaging applications. S3F explains of interactions within a group. She further elaborates interaction for subject, Form or school. The communication is undertaken on social networks and instant messaging applications.

#### *6.5.2.2.2 Online friendship*

Students have created online friends. Online friends assist students with sharing resources. One of the resources shared is solution to questions. S10 describes using Microsoft Math to share solutions.

“The people I am sharing these questions with are not necessarily on my class. They could be from any other school or anywhere in the world. There was a time I was using my device and I found Microsoft Math. It has a Tanzanian syllabus for O-level and A-level mathematics. You can even create friendship with the people you share your solutions with”. S10M

### **6.5.2.3 Consequences**

Students are punished for using mobile devices. Punishment includes complain of misuse and confiscation of mobile devices. Despite consequences, students have adopted mobile devices and use for learning.

#### *6.5.2.3.1 Complain of misuse of device*

Peers have complained of students misusing mobile devices. A single student misuse of a mobile device has affected other.

“Some students, obviously not all students will have the same behaviour, so there are others when they have their devices with them they spend doing other things than focusing on their studies and hence teachers judge that all students have the same behaviour but it’s not true”. S20M

Respondent S20M explains of differences in behaviour that students have and how it affects perceptions teachers and parents have. A single students’ mistake is judged upon all students irrespective of background, use and other factors influencing use.

Students have suffered mistrust from family members. S19F explains of her sister not trusting her use of a device.

“It was like, I was googling about literature review for the project. I ended spending a lot of time on my device searching for information on literature review. But my sister thought all that time I was chatting to friends and not reading. What unfolded is that she confiscated my phone for a brief time and returned it”. S19F

Despite searching for academic content, her sister confiscated her mobile device. Elder siblings have questioned sister’s access of mobile devices. The mistrust creates rift between siblings. These siblings should be assisting each other.

#### 6.5.2.3.2 *Device confiscation*

Due to misuse and mistrust, mobile devices are confiscated. Confiscation of mobile devices occurs at school and at home. S2F elaborates on her experiences. She is not allowed to own a mobile device at home. The student cannot go to school with a mobile device too.

“I have faced some problems. As it is now, at home, I am not allowed to own a phone. Earlier on when I had my previous phone [inferring to Nokia Lumia], I had no one to leave my device with. I am a boarding student. So, I had to come with it to school.

As I stayed at hostel, a friend asked to use my phone. I gave it to her and as she was using it, she was caught. She had to say it was my device. I had to explain to my teachers of the reasons I own the device. It was confiscated by the matron. So, I had to save some money to buy another device.

One day while at home, I forgot and I was caught by Mom as I was charging it. The devices wallpaper had my picture. When mom asked whose device, my sibling responded it’s my sisters [inferring to her]. So, I had to tell my mom the truth. My mom confiscated the second device and until now I don’t have any device”. S2F

The student first mobile device was confiscated at school. The student save money to buy a second device. The second device was confiscated at home. Not only did the student get affected financially, she is emotionally distorted as she concludes.

### **6.5.3 Concern**

Students’ use of mobile devices has created fear. The fear comes from behaviours observed from students’ use of mobile devices. Students spend hours on mobile devices. Parents, teachers and society members deem the use inappropriate.

“They discourage us. They say, as we use our devices, we are increasing our chances of underperforming during our examinations”. S16M

This has led to concern on misuse of mobile devices. S16M depicts how teachers related use of mobile devices to examination failure.

Unfortunately, the society does not know that students use mobile devices for academic purposes. S2F asserts, dependency on teachers must reduce as students' approach examinations.

“In relation to studies, the importance is for us to search for materials knowing that we are candidates [soon to seat for national examination], we cannot heavily rely on what we are being taught and hence we need to search for more materials for ourselves. Thus, Internet is the most important thing”. S2F

Concerns the society has are reduced by teachers supporting use of mobile devices. School policies and teachers opposing use of mobile devices insist on misuse and punish students.

### **6.5.3.1 Moral enforcers**

Moral enforcers are individuals who ensure society norms are observed. In the secondary school, teachers are divided. Teachers supporting and those opposing students' use of mobile devices.

Teachers supporting students' use of mobile devices have provided mobile phone numbers to students. Students call, send SMS and instant messages on administrative issues, concept clarification, guidance on academic work and received challenges from teachers.

Teachers opposing students' use of mobile devices have been identified as digital immigrants. Teachers deny students use of mobile devices due to responsibilities they have and fear of misuse. In the 21<sup>st</sup> century, the nation's education policies require review.

#### *6.5.3.1.1 Teachers supporting students use of mobile devices*

Teachers supporting students' use of mobile devices have assisted students through several approaches. Teachers have provided phone numbers to students for administrative and academic use. Students have communicated with teachers to inform on absence, enquire on reports and wishing teachers well in festive seasons.

Students use mobile devices to prepare for classroom interaction. Students use teachers for clarification of concepts from the Internet.

“It's good, because you get ideas that when you go to class you could ask your teacher how s/he views the idea and the teacher could explain better and you get another idea (clarification)”. S9M

Using mobile devices, students access the Internet to acquire content. S9M explains how he uses classroom interaction as an area to clarify concepts from Internet.

During holidays, S10M communicates with teachers to clarify and ensure content read, is not beyond scope.

“I take them to be people that assist me and advise me on how to do things and how those things work. For example, when I am at home during holidays and I find something on the Internet, I send the link to my teacher and ask if it’s related and how to our school work”. S10M

Teachers provide guidance to students. Teachers inform students’ content to read from the Internet. S8M explains physics teacher explaining a topic. After receiving guidance, the student uses the Internet for enhancement of concepts.

“I contacted my physics teacher by calling him. Before I used the Internet, I called the teacher. He explained to me. He started with introduction and I was copying all that he explained to me. Then I used the Internet”. S8M

Teachers are challenging students to use mobile devices. Teachers provide students with questions requiring critical thinking. The challenge is received by students who access search engines for solutions.

“He said go and search even on Google but you won’t find anything. You have to use your critical mind”. S1M

If students do not find answers, they use networks for assistance. S1M describes how history teacher challenges. The teacher is instilling need for critical skills at a youthful age. Students search for information on Google and apply critical skills when completing assignment.

#### 6.5.3.1.2 *Teachers opposing students use of mobile devices*

Teachers opposing students’ use of mobile devices are influenced by role at school. A discipline masters must ensure students follow school rules. S9M highlights one teacher that discourages use of mobile devices. He describes the teacher as discipline master.

“The teacher that discourages us the most is the commerce teacher. He is the discipline master”. S9M

Teachers in administrative position ensure school rules are observed. Discipline master, patron, matron, deputy principal and principal ensure students do not use mobile devices at school Teacher opposing students’ use of mobile devices are digital immigrants. S7M shows the commerce teacher, discipline master, is above 50 years.

“Some of the teacher, here at school, have stated that we are spending most of our time on the Internet and we forget to study which leads to our failure. Our commerce teacher has been the leader in this. He is about 50 years old”. S7M

Teachers fear students spend considerable time on mobile devices outside the classroom. Teachers have no control on that students do on mobile devices. Teacher assume students spending time on unnecessary content. S15M elaborates on students accessing pictures and videos that are inappropriate.

“My teachers discourage. They think that when a student uses their device, as most students use their devices in an inappropriate way, but others use them to find information. They watch pictures and videos that are not helpful to them”. S15M

Teachers communicate with parents. Parents are urged to ensure children do not use mobile devices. Let alone for learning. S4F explains teachers’ use of parents meeting as a platform to disseminate such information.

“They discourage us. They say that we should not use mobile devices as we have studies and they told our parents”. S4F

Secondary school students are not allowed to use calculators. Subjects like mathematics, physics and geography require calculations. Students are forced to use analytical skills to solve questions requiring calculations.

“Discouragement comes from our mathematics teachers. He says we should not use the calculator on our devices and even formulae we should understand them better and not focus on using calculator as formulas are different”. S17M

Respondent S17M elaborates on a teacher discouraging use of mobile devices for calculations. The teachers’ intention is students understand formulas and application. Understanding formulas is a separate argument, the need for using calculators in national examination is important in the 21<sup>st</sup> century of science and technology.

### **6.5.3.2 Moral creators**

Moral creators make laws aiding to maintenance of norm. Moral creators assist by creating concern. The ministry of education has maintained no mobile device policy in secondary schools. The policy is adopted by schools and amended as school rules.

“They [teachers] spoke in the meeting [parents meeting]. They told our parents that we should not use our phones. They don’t know why we are using it. Some teachers say we are full on WhatsApp or other connections”. S1M

Students are informed of school rules during assembly, parents meeting and on notice boards. S1M describes teachers passing information to parents on school rules.

Use of mobile devices on school premises is a serious offense leading to expulsion. Meanwhile, outside the classroom, students require guidance, assistance and support from teacher on how and where to access information.

#### **6.5.4 Availability of mobile devices**

Secondary school students own mobile devices. Mobile devices owned include phones and tablets. Students own phones from several companies, Nokia, Samsung, Blackberry, ITEL, iPhone and Techno.

Students own Nokia Asha, Samsung galaxy core, Samsung galaxy note, iPhone 5 and Blackberry curve to name a few. Tablets owned by students include Techno tablet and Samsung galaxy tab. Students take risk in adopting mobile.

One interesting aspect identified by the researcher is students do not know all mobile device affordances. Samsung mobile devices are preloaded with Android Operating System (OS). Android OS is owned by Google. Google ensures every mobile device using Android OS and has Internet includes the following applications, Gmail, Hangout, Google search, Drive, Calculator, Recorder, Photos, Chrome, Google+ and YouTube.

“I had a Samsung. It had Internet but it did not have YouTube”. S12F

Ironically, respondent S12F depicts the mobile device she has, lacks YouTube. The student might not have explored applications on mobile device. The researcher applied principle of suspicion (Braun & Clarke, 2006; Klein & Myers, 1999; Sarker et al., 2013; Sokolovsky, 1996) to explain contradictory argument by the student.

##### **6.5.4.1 Mobile device affordances**

Students use mobile devices to communicate. Communication includes phone calls and sending SMS as described by S15M. Students prefer use of Internet on mobile devices.

“Texting [SMS] and calling”. S15M

“I own a Samsung galaxy core. It has good storage capacity and its good on Internet surfing”. S8M  
Students identified Internet as an affordance a mobile device must have. S8M supports the argument and identifies mobile device storage capacity. With the storage capacity, students download audio files, pictures and videos.

Apart from taking pictures students records voice notes and share with peers. Students record video and use for different subjects and in assignments.

“Pictures yes. I have also recorded videos and sent to friends. On pictures, I have taken pictures and moved them to a computer using USB and I placed them on a paper and shared with friends on a group. It was about a project and we focused on survey. I did something as part of it and once I had completed I placed them on paper and we could read from that. We send videos to each other about how to develop a webpage and what is needed”. S17M

Pictures taken aid explanation in projects. S17M explains taking pictures submitted on the project. He also mentions sharing videos with peers on website development.

Applications using the Internet contain social network, websites and instant messaging. Social networks recognized by students are, Facebook, Instagram and Twitter. Websites comprised of YouTube, Google and Wikipedia. Instant messaging applications involved WhatsApp, Viber and Skype.

#### **6.5.4.2 Risks students take by using mobile devices**

Students use mobile devices at a considerable risk. When mobile devices are confiscated, some get returned by end of the year and other damaged. When devices get confiscated, students incur extra cost to acquire a new mobile device as enacted by S2F.

“It was confiscated by the matron.

... My mom confiscated the second device and until now I don't have any device”. S2F

“I had an iPhone 5 and an ITEL. The iPhone 5 was damaged, then I sold the ITEL to get more money to buy the Huawei P5”. S17M

Respondent S17M identifies a mobile device being damaged. The student had to sell second device and aggregate funds for a new mobile device. Cost of acquiring a new mobile device or repairing a damaged mobile device is on students and not parents.

## **6.5.5 Students ability to sustain mobile devices (sustainability)**

Students sustain mobile devices through self-determination and self-motivation. Students save pocket money to acquire mobile devices. Once owning a mobile device, students save to buy airtime (credit) and Internet bundles.

### **6.5.5.1 Self-determination**

Students save pocket money to buy Internet bundles. Pocket money is limited and students find alternative solutions. Students switch between mobile service providers or acquiring different mobile devices.

“It was costing on the Internet. It was expensive to buy an Internet bundle using Tigo. For a day, it would cost Tshs 4500 on the blackberry Internet plan”. S1M

Students buy Internet bundles suiting needs. Expensive Internet bundles force students to rethink. S1M depicts purchasing a new mobile device. He argues, previous mobile device, a Blackberry, Internet plan is costly. The student spends \$2 on Internet bundle daily. The service provider was not helpful too.

Respondent S7M describe changes in Internet bundles. Mobile phone operators reviewed prices between January and April 2015.

“These days’ mobile networks have reduced the megabytes they offer for Internet. For example, I am used to buying for Tshs 500 - 100mb for a day. Now, at the same amount I get 8mb. That will make me ditch my device and use my books or other sources”. S7M

The review affected Internet bundles. Price remained, but size of megabytes reduced. The student argues, such reviews affect use of mobile devices. He identifies using recommended textbooks over mobile devices.

Despite concerns raised by S1M and S7M, S15M argues intention is important.

“If you intend on getting something, you won’t focus on the cost”. S15M

The student owns a Blackberry curve, same as S1M. The student argues, if a student intends, cost is not a concern.

### **6.5.5.2 Self-motivation**

Students are self-motivated in saving pocket money. Students are also motivated to share with peers. Students use several approaches in saving pocket money. Students skip meals, share meals and reduce expenses.

“So, I had to save some money to buy another device”. S2F

Students undertake such measures as they intend to acquire a mobile device. S2F depicts saving money to acquire a mobile device.

Students are proud of creating content and have sense of ownership. Students take picture and videos. Students record voice notes. Students use these affordances to explain concepts to peers.

“I have shared a video that I found on YouTube with my friends on WhatsApp”. S8M

“Pictures yes. I have also recorded videos and sent to friends. On pictures, I have taken pictures and moved them to a computer using USB and I placed them on a paper and shared with friends on a group. It was about a project and we focused on survey. I did something as part of it and once I had completed I placed them on paper and we could read from that. We send videos to each other about how to develop a webpage and what is needed”. S17M

Respondent S8M describes sharing a video from YouTube to peers on WhatsApp. S17M depicts taking pictures and recording videos he shared with project members. Students are self-starters and assist peers in individual capacity and as a group.

### **6.5.6 Effective use of mobile device**

Effective use of mobile devices for learning requires students to have goals. The goal must have a link with academic performance. Students access information using mobile devices for several purposes. Table 6 depicts 124 students use mobile devices to search for information. Searching for information affords students better explanation of academic content and planning.

“I look at the device durability and quality, how the device applications are equipped and will they assist me to attain my goals for what I will buy the device for”. S2F

“During holiday, our book-keeping teachers asked us to search for information about departmental accounts by using books or the Internet. I chose to use my phone to search for the information”. S5F

Students buy mobile devices to attain set goals. S2F illustrates. S5F describes academic purpose of acquiring a mobile device. The student argues, when assignments are given, it affords searching for information. When content is not clear, peers assist. Communication that leads to solutions. Teachers guide students by providing topics for next class.

Ineffective use of mobile devices is when students do not set goals and use mobile devices for non-academic use. Students did not dispute socializing and using for recreational purposes.

“It would mean you go out of the norms expected of a student. For example, if a student is watching pictures that are not good like pornographic and other which are not good for your age and you are a teenager”. S14M

“Negative is that a student would spend more time on their device than on reading. Mostly a student will spend time on social media watching things that are unrelated to school work”. S16M

Students argue, accessing non-academic content is against the norm. Accessing pornographic sites and spending hours editing pictures are not affordances students should use. S14M and S16M provide accounts of accessing inappropriate content.

#### **6.5.6.1 Better explanation of academic content**

Students use mobile devices to assist in completing assignments, homework, project and examination preparation. Assignments are completed in groups. Students share questions with peers. Peers assist struggling students as enacted by S16M.

“For example, if we are given questions and I struggle to find solutions, I contact my friend. This is in regard to homework”. S16M

Students use mobile devices to find definition of terms, use pictures and research to understand content. Students have access to online resources and share solutions with peers on social networks. Students use mobile device to search for definition of words. Instead of a physical dictionary, students use dictionary found on web browsers.

Internet bundles are expensive. Students understand peers are willing to assist. To avoid depleting Internet bundles, students take pictures of questions and share.

“Sometimes it is difficult to use the Internet when I don't have money. So, I take pictures and after taking the pictures of the question that I have difficulties with, I save it and I sent to my friends for assistance”. S6M

Respondent S6M elaborates on sending pictures to peers for assistance. The goal includes using multimedia to share academic content and assist others in learning.

Questions posed by teachers are a challenge to students. If students cannot find solutions on textbooks, mobile devices are used.

“For example, we are given a question, in history, "when they beat a drum in U.S.A, in Africa we dance. Complement". So, most of us did not understand and we could not find answers on the textbook. So, some students decided to Google for the answer and managed to get some points”.

S3F

The academic goal is learning how to approach questions. S3F explains students using search engine to complete an assignment.

Students have access to online resources. Online resources don't only include websites and search engines, but also online peers. Online peers are friends that students connect with on online platforms such as social networks and eLearning platforms. S10M depicts sharing solutions to mathematics questions found on Microsoft Math.

“You could submit the question and explain to others how you completed the question. The people I am sharing these questions with are not necessarily on my class. They could be from any other school or anywhere in the world. There was a time I was using my device and I found Microsoft Math. It has a Tanzanian syllabus for O-level and A-level mathematics. You can even create friendship with the people you share your solutions with”. S10M

Access to online resources provides students with peers willing to help, share and congratulate when a tough question is solved.

Respondent S7M explains using a mobile device for learning. The students used mobile device to read four topics in biology.

“For example, if someone loses their exercise books and the examinations are near. It happened to me before. I used Google to read about 4 topics in biology. Your exercise book might be stolen, or you might misplace it”. S7M

Despite using a mobile device, the student results were B+. Applying principle of suspicion, may be the student lied of results. However, interviews are collaborations built on trust. The student had no intention of being dishonest, no reward was given.

### **6.5.6.2 Use mobile devices to plan and manage school work**

Outside the classroom, effective use of mobile devices includes using a mobile device to plan. Students use mobile device to save dates on calendar and alarm for waking up and timing themselves when preparing for examination.

“I use the to-do list on my device. At weekends or when we are on short breaks, I used it to write some stuff. Now, I must study this subject, now I have to do this or this time I have to do that”. S1M

Students also use the calculator. S1M explains of using a mobile device to organize events. Events organized relate to studies and school work.

The alarm is used by students to wake up for studies and school preparation. Students use stop watch to time progress made. Attempts on past examinations and test preparation require students to use stop watch to ensure completion within expected timeframe.

Calculators are used for different subjects. Mathematics, book-keeping, physics and geography take precedence. Calculators on mobile devices assist students by simplifying tasks and completing with efficiency. Calculators provide precise answers.

Respondent S14M provides a counter argument. The student argues calculators are above his level. State prior, calculators are prohibited in examinations.

“I don’t use the calculator as it is not of my level”. S14M

Teachers insist students use analytical skills. Students fear using a calculator. Issue is not above his level, he will not use a calculator during examination. The student is removing reliance on using calculators on mobile devices.

## **6.6 Conclusion**

Effective use of mobile devices relies on mobile devices students sustain and goals created. Students use mobile devices to acquire better explanation and plan learning. Completing these goals using mobile devices depicts effective use of mobile devices.

The 2015 national Form IV examination results show students from the secondary school passed the examination. The results show 41 students had division I, 80 division II, 90 division III, 48 division IV and 0 with division O.

Division IV mean students passed but might not continue with Form V or must write an examination for at least one subject to get credit. Division I to III signify passing. In total 211

students passed the examination. Students use mobile devices effectively outside the classroom as shown by passing examinations as the academic goal.

## CHAPTER 7: QUANTITATIVE DATA ANALYSIS AND FINDINGS OF SCHOOL B IN CAPE TOWN, SOUTH AFRICA

This chapter deliberates data collection, analysis and findings of the secondary school in Cape Town, South Africa. Students and teachers are units of observation and analysis in individual capacity. The chapter begins by explaining the secondary school (in South Africa referred to as high school) setting, structure and facilities to depict external validity (Dubois & Gibbert, 2010).

### 7.1 Case description

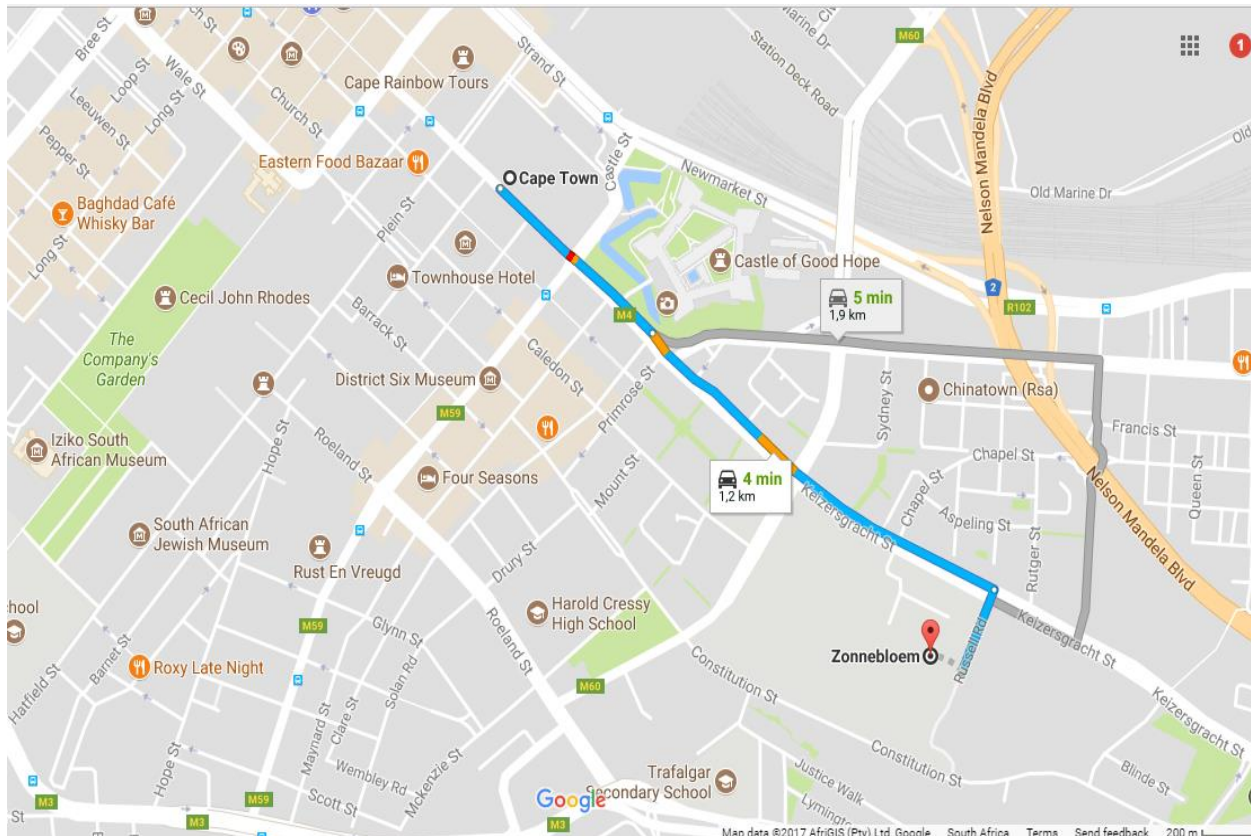


Figure 3: Zonnebloem district

The secondary school in Cape Town is a highly academically performing school (hereafter referred as School B). The school is in Zonnebloem district in Cape Town. Figure 3 shows borders of the district. Total surface area of Zonnebloem is 1.42 km<sup>2</sup> with total population of 5122 people in 2011 (Frith, 2011). Zonnebloem is predominantly a black African neighbourhood by race. Languages used in the area are, English, Afrikaans and isiXhosa.

The high school is situated 1.2 KM from Cape Town city centre (Google, n.d.). The school neighbours a grocery store in walking proximity, a Shell garage (petrol station) and a Ferrari car

dealership. The car dealership is the only supplier in South Africa. The school has 24 hours' security guard on premises and fenced. Water and electricity are available.

The school started operation in 1951 as a college and around 1980's the name was changed. The name is of an education activist. The activist fought for rights of blacks in education. However, the buildings are labelled as constructed in 1925.

The school is owned by Western Cape department of education and is certified safe school. A safe school has a teacher (or nurse) to operate first aid, trained safety representative, fire extinguishers and fire fighter representative. The school has an evacuation marshal.

The school is categories as quintile 4. In 2015, the high school required students to pay R 4,700 (\$ 350) for fees. Fees paid is in addition to R 503 (\$ 38) per student contribution by the department of education.

The school environment is clean and in a quiet neighbourhood. The school hall was completed in July 2015 and used by Grade 12 (equivalent to Form IV in Tanzania) students (learners) to write final examination (matric). The school is well maintained with few broken windows than expected in a government school.

Corridors have security cameras to capture unlawful acts. Unfortunately, some cameras were not operational. Evidenced by hanging cables. Teachers are given duties to monitor corridors. The school has genitors for daily cleaning. Students clean and organize classes during vacations. Genitors are responsible for outside classrooms cleanness.

High school in South Africa starts at Grade 8 and completes Grade 12 (Sayed & Motala, 2012; Vainio et al., 2014). The structure in South African schools is students move from one class to another depending on the subject. One period takes 40 minutes. Students thus move to teachers' classes.

Teachers have specific classes per subject. Each teachers' class is equipped with material relevant for the subject, a wireless projector and a laptop computer. Physics lab has 10 computers students use to enter, process and view data during practical classes. Wireless connection (Wi-Fi) is available at the school's special section library for free.

Teachers and Grade 12 students access free Wi-Fi. Grade 8 to 11 students do not have access to free Wi-Fi, but use the library. The school caters for Grade 12 subjects, isiXhosa, Afrikaans, English, pure mathematics, mathematics literacy, physical science, life orientation, computer application technology (CAT), accounting, business studies, economics, history and geography.

Students are mixed gender, mix religion and write at least 7 subjects in matric examination. Students that fail an academic year repeat. School requires average 40% pass in an academic year. The school ratio is at one teacher per subject for Grade 12. The school acquires resources and pay significantly.

Many teachers at the school are certified, the few not certified are perusing or completed Masters in different fields. Postgraduate teachers, assist students in understanding subjects as teachers are motivated to impact knowledge and understand the theory and practical better.

A day starts at 0700AM and ends at 0200PM. Breaks are between 10:20AM to 10:50AM and lunch break from 12:10PM to 12:50PM. The principal schedules meetings with guests and parents from 02:00PM. Trophies won are displayed at school reception. Trophies comprised sports (football), academic (Grade 9 mathematics) and recognition of HIV/AIDS, life skills and sexuality education. Security guards assist the school in several ways. They guard, assist in responding to guests and organizing sanitary products. Guards roll toilet papers (tissue) in small chunks that students, teachers and guests use. Female guard provides sanitary pads to female students when nurse is unavailable.

End of each term, parents get student reports. The report is generated from EDUMAN. EDUMAN is a decentralized mark capturing system owned by the Western Cape department of education. Teachers enter students' marks and reports are populated.

## **7.2 Data collection**

Before data collection, permission was requested. A meeting was organized with principal and research explained. The principal was informed of research purpose, data collection methods and reporting procedure. The principal was provided proof of ethics clearance from University of Cape Town and Western Cape department of education.

The principal was intrigued and willing to assist. A new appointment date was set for data collection. The date was last day of school for term one. The principals' aim was that students do not get disturbed from studies for data collection purposes. The last class week of the term students are revising and get assistance on problem topics. During last class week, classes end at 12PM.

On set date, at 11:40AM the principal went to each teachers' classroom with Grade 12 students and asked for permission. The principal then introduced the topic, purpose and asked students to participate by completing questionnaire provided.

Same questionnaire used for secondary school in Dar-es-salaam was used at the high school. Students were asked for permission by researcher to distribute questionnaire. When accepted, questionnaires were administered. Students spent 15 to 30 minutes to complete questionnaires.

The school has 110 Grade 12 students. 92 students completed questionnaires included for analysis. Six students took questionnaires and intended to submit during interviews. Unfortunately, the six students answered few questions and when assessed, questionnaires were discarded from analysis. Completed questions related to demographics.

The principal introduced the topic to teachers in staff room during tea break. Grade 12 teachers assisted by completing questionnaires. The intention of collecting quantitative data from teachers was to understand use of mobile devices for learning.

The questionnaire gauge teachers' views on students' use of mobile devices outside the classroom. Eleven Grade 12 teachers were given questionnaires. One teacher was on sick leave.

When the principal left the staff room, a teacher stated, "such researches are usually funded. A laptop for completing questionnaire is ideal" and another teacher requested chocolates as compensation. Teachers were informed the research is not funded and referred to research purpose.

### **7.2.1 Assessment of completed questionnaires from students and teachers**

Questionnaires were assessed for completion. 98 students responded and six completed demographics section. Demographics are not relevant for the study. For that, six questionnaires were discarded. Teachers' questionnaires were included.

One or two questions were skipped on students' questionnaire. The researcher deduced students were rushing to complete and go home. Questionnaires were completed after 12PM. Questionnaires intended to understand students and teachers' response in relation to concept of involvement of the children, questionnaires are and availability from

1. To what extent are secondary school students in South Africa using mobile devices for learning outside the classroom?
2. What mobile device affordances do secondary school students use mostly outside the classroom for learning?
5. What are teachers' perceptions on students' use of mobile devices for learning outside the classroom?

### **7.2.2 Creation of unique numbers on questionnaires**

Questionnaires were given unique numbers. The purpose is assist during data entry. Researcher can easily revert to a questionnaire for verification. Upon completion, data was entered on Epi Info 7.

Students were allocated two-digit codes per questionnaire from 01 to 98. Discarded questionnaires were coded to assist with elimination. Teachers' questionnaires were coded from 01 to 11. Students' questionnaires were coded separate from teachers.

### **7.3 Preparation of quantitative data entry and analysis tool**

Epi Info 7 was programmed for different sections. Epi Info 7 was programmed before Dar-es-salaam data collection. Much of the information, resembles section 5.3.

Epi Info 7 programming included creating forms, attaching labels, radio buttons, drop down menus, textboxes and grouping. The researcher would enter data on the form. Data was stored on a database, equivalent to MS Access.

When creating forms, conditions were created to assist with errors. Data entered with numbers higher than given range were rounded off to highest number on range. Data entered with numbers lower than range were given to lowest number. Conditions set were:

- Questionnaire numbers are 3 digits for students, 100, and 2 digits for teachers, 01.
- Age was limited to 2 digits and range for students, 12 to 25, and teachers, 25 to 70.
- Number of hours a student spends on a mobile device was ranged of 0 to 18.
- Number of hours a student spends using Internet was ranged of 0 to 18.

Errors noticed during data entry were based on range and interpretation. Range errors were:

- 9 students and 1 teacher use mobile devices for more than 18 hours in a day
- 3 students use social media on mobile devices for more than 18 hours.
- 1 teacher and 1 student use mobile device on Internet for less than an hour.

Within range errors, students wrote comments instead of hours. Responses included "it varies", "always", "not sure" and "all day". One student wrote "may be 6 hours", 6 hours were allocated to the student.

On company owning email address, students and teachers were asked to select (more than one option) companies owning email addresses they have. The list comprised Yahoo, Hotmail and

Google. This was an open question. Other option was included. 12 students, wrote use of Gmail account. This would mean they don't know the company owning Gmail, Google.

#### 7.4 Descriptive Analysis

Descriptive statistics was used to summarize survey data. Descriptive statistics can be performed on quantitative data with an intention of identifying frequencies, percentages, mean, median, mode and standard deviation (Domingo & Garganté, 2016; O'Bannon & Thomas, 2014; Orlikowski & Baroudi, 1991; Ozdamli & Uzunboylu, 2015). As identified by (Orlikowski & Baroudi, 1991; Oz, 2014), frequencies were used for this research. Questions asked emerged from SEUMD. Findings demonstrates students' and teachers' response to concepts identified.

A frequency table were created for each question. The exercises continued until each of the 25 students and teacher questions were illustrated on tables. The researcher used tables for basic understanding on the extent of mobile devices use, affordances and views teachers have on students' use of mobile devices.

#### 7.5 Students data analysis and findings

Table 19 illustrates students' demographics and general information. The discussion on students' data includes availability of mobile devices, innovation and network interconnectedness as part of a social system.

Demographics and general information			
No.	Concept	Characteristics and aspects	Frequency
1	Gender	Female	45
		Male	47
		Missing	0
		Total	92
2	Learning combination	Arts	16
		Commerce	27
		Science	38
		Missing	11
		Total	92
3	Age	17	27
		18	45
		19	18
		20	2
		Missing	0
		Total	92

4	Mobile device	Personal ownership	
		Yes	90
		No	2
		Missing	0
		Total	92
		If NO, sharing with uncle, aunt, brother, sister, or parents?	
		Yes	1
		No	1
		Total	2
		Internet on mobile device	
		Yes	91
		No	1
		Missing	0
		Total	92
5	Email address	Ownership	
		Yes	84
		No	8
		Missing	0
		Total	92
		Email address company	
		Yahoo	8
		Google	73
		Hotmail/Live	8
		Other	0

Table 19: Students demographics and general information.

Based on analysed questionnaires, Table 19 demonstrates Grade 12 students have more male than female students. Combination wise, students are spread among arts, commercial subjects and sciences. 11 students did not choose any combination. At Grade 12, students have chosen a combination for matric examinations.

Some students have subjects from different combinations and that could be the reason. 45 students described age as 18 years old which is the average age for Grade 12 students in South Africa. Two students answered 20 years. Students repeat a Grade based on poor academic performance.

Table 19 shows, 90 students demonstrate owning mobile devices for personal use. Of two students without a personal mobile device, one shares with a relative, sibling or parent. One student does not have a mobile device. 91 students have Internet access on mobile devices. Access to resources such as search engines, websites, blogs, social media, instant messaging applications and email is

through Internet. 84 students have email addresses and 73 students use Gmail. Students choose multiple email companies. No student illustrated owning other email address.

### 7.5.1 Availability of mobile devices

Students use mobile devices for several activities. Capturing hours spent on mobile devices and on Internet assists understanding of use.

Hours on mobile device (range)	0 to 2	3 to 5	6 to 8	9 to 11	12 to 14	15 to 17	18 and above	Missing	Total
How many hours in a day do you use your mobile device?	5	31	18	8	12	7	11	0	92
How many hours in a day do you use social media (Facebook, Twitter and Instagram)?	41	22	12	9	4	1	3	0	92

Table 20: Hours spent by students on mobile devices and Internet.

Table 20 illustrates, students spend between half an hour and 18 hours on mobile devices. Students communicate, share information, acquire information and play games. The range 3 to 5 hours had more students. Within the range, five students spending three hours, nine students spend four hours and 16 students spending five hours.

While on mobile devices, students use Internet to access social media. Students' hours on social media ranges from half an hour to 18 hours. Students spending between 0 and 2 hours on social media includes four students spending less than half an hour, 14 students spending one hour and 23 students spending two hours.

The significance of time spent by students on mobile devices and social media is students are active creators and receivers of information. Students read and create information on social media. Students share information with peers using social media.

### 7.5.2 Innovation

As an innovation, a mobile device comes with uncertainty. Information available on students' use of mobile devices depict adoption of the innovation. Students have adopted mobile devices and use daily. Several affordances and use as depicted on Table 21.

No.	Concept	Characteristics and aspects	Frequency			
			Yes	No	Missing	Total
1	General use					
		Socializing	79	13	0	92

		Searching for information	60	32	0	92
		Recreation	60	32	0	92
		Academic	55	37	0	92
2	Innovation					
		Relative advantage	74	18	0	92
		Compatibility	86	6	0	92
		Trialability				
		Google search	90	2	0	92
		YouTube	47	45	0	92
		Camera/Video	66	26	0	92
		Map	23	69	0	92
		Observability	64	28	0	92
		Complexity	55	37	0	92

Table 21: Students view on using a mobile device.

Table 21 shows, students use mobile devices for socializing, searching for information, recreation and academics. 79 students responded socializing using mobile devices. Socializing contains social media and instant messaging applications. Social media application are Facebook, Twitter and Instagram. Instant messaging applications are WhatsApp, Viber, IMO and Skype.

About 60 students use mobile devices to search for information. Searching for information comprises blogs, websites, news and sports channels. Searching for information assists students in increasing awareness of a topic and understanding of techniques to access different information sources.

Around 60 students use mobile devices for recreational purposes. Recreation contains listening to music and audio files, watching videos and playing games. Recreation might be assumed a time waster. Recreation provides students with insight on that read on search engines or seen on social media by viewing videos or listening to audio recordings.

About 55 students use mobile devices for academic purposes. Academic use consists of reading, studying and using calculator. Students use mobile devices to read electronic books (e-books), journals and websites with academic content.

Students study using mobile devices by using books and finding alternative sources to cross examine content read. During studying, students relate that read to environment. Meanings emergent are regard as contributory or for exclusion.

Based on general understanding of students' use of mobile devices, the questionnaire delved to understand characteristics of innovation.

### **7.5.2.1 Relative advantage offered by mobile devices**

Students using mobile device gives a relative advantage. 74 students stated a mobile device simplifies communication with relatives. The communication with relatives includes friends, peers, siblings, parents and relatives.

Mobile devices provide a platform for communication with peers. Communicating with peer's aid assistance as students without mobile devices struggle. Students enquire from peers on content covered in class, area of concentration during tests and chapters to read in preparation for class.

### **7.5.2.2 Compatibility of mobile devices with textbooks as supplementary sources**

Mobile devices can be used as supplementary source of learning material. Recommended textbooks are primary source of learning material. 86 students agree that mobile devices are supplementary sources of learning material.

Using mobile devices, students read e-books, search for information on Internet and listen to audio or watch videos for clarification. Mobile devices provide some additional platform students engage with content and acquire meaning of unclear concepts.

### **7.5.2.3 Trialability using Google search, YouTube, camera and maps**

Students have tried several affordances for learning. 90 students have used Google search to acquire material. Material required includes definition, explanation of difficult concepts and reading books. Google is the search engine students identify and use as a portal to access websites for learning.

About 47 students use YouTube as the source of supplementary information on mobile devices. YouTube as a video sharing website provides students ability to search for videos on different topics. Topics are explained by amateurs and experts.

Videos students watch explain use of multimedia to understand concepts. Concepts include those explained but not practiced in class. Science subjects, geography, mathematics and languages have videos that explain topics in detail on YouTube.

Students use cameras on mobile devices to take pictures and videos shared with peers and friends. Pictures and videos are accompanied with explanation of content to assist peers during learning.

Students with counter arguments provide an explanation on the platform. 66 students have used cameras to take pictures and videos for academic purposes.

About 23 students used maps for learning. Map applications found on mobile devices include Google maps, Earth and Waze. Students using maps on mobile devices see different terrains and satellite images.

Students use maps to learn and relate content taught in geography. Different topographies are displayed on maps and assist students in understanding physical geography, calculating distance between two points and identifying cities on maps. Maps on mobile devices have updated information than the Atlas.

#### **7.5.2.4 Observability from peers**

Before buying a mobile device, students observe peers and enquire. Students try mobile device owned by peers and family. Students are knowledgeable of a mobile device by the time they adopt. Students would then understand the mobile device limitations. 64 students had observed peers using a mobile device and were interested in owning.

Observing reduces uncertainty the mobile device comes with. Students identify applications to add or remove. Knowing of the mobile device before owning, assist students to acquire a mobile device familiar. Students know a mobile device with faster processor and ram affords games. A mobile device with big screen ideal for reading and watching videos.

#### **7.5.2.5 Complexity of using mobile devices for learning**

Using a mobile device for reading is a complex process. Mobile devices with small screen are not for learning. Students using mobile devices with big screens have other problems. Students are affected by messages (SMS, instant messages and notifications).

About 55 students identified learning using a mobile device as a complex process. 37 students view using mobile devices for learning simplifies life.

### **7.5.3 Social system**

Society argues students are not using mobile devices for learning but communication. To identify and provide explanations, students were asked on communication to peers and academic relationship.

Table 22 illustrates, students use mobile devices to communicate to peers and friends through social and knowledge networks on academic issues. The two networks for students are not separated. Students use phone calls, SMS and instant messaging to communicate to peers and friends on academic issues.

Around 70 students have called a peer on academic matters. 74 students received calls. Student communicate by calling peers and sharing academic information. Student do not separate instant messaging calling, WhatsApp call to a normal phone call. Students depict willingness to learn outside the classroom.

Concept	Characteristics and aspects	Frequency			
		Yes	No	Missing	Total
Social system					
	Network interconnectedness				
	Using calls				
	Call a peer to ask for solution	70	22	0	92
	Received a call requesting for solution	74	18	0	92
	Using SMS				
	Sent text to a peer requesting for a solution	58	34	0	92
	Received text asking for a solution	62	30	0	92
	Using instant messaging				
	Sent instant message asking for a solution	77	15	0	92
	Received instant text requesting for a solution	85	7	0	92

Table 22: Students use of networks for learning.

About 58 students used SMS to request for solutions on academic issues. 62 students received SMS requesting assistance. A student responded, “Not really answer to a question, but breakdown of what is required as answer”.

Despite the student depicting a breakdown, SMS are used for academic purposes. Sending SMS used to be a convenient method for students to share academic material, now students have moved to instant messaging.

Students use instant messaging than calling and SMS. 77 students recognized sending instant message for a solution and 85 students received instant messages providing solutions. Students rely on instant messages as it affords sending text messages, audio files, pictures and videos. Harnessing power of instant messages, students provide solutions to peers.

## 7.6 Teachers data analysis and findings

Teachers were given questionnaires to gauge use of mobile devices and views on students’ use of mobile devices. A total of 11 Grade 12 teachers responded to questionnaire.

Of the 11 Grade 12 teachers, 7 were female and 4 were male as illustrated on Table 23. Teachers include Arts, commerce and science combination. Teachers age range from 22 to 56 years old. In the age range 40 to 49 years, 2 teachers are aged 44 years old.

Demographics and general information			
No.	Concept	Characteristics and aspects	Frequency
1	Gender	Female	7
		Male	4
		Total	11
2	Teaching combination	Arts	5
		Commerce	3
		Science	3
		Total	11
3	Age	20 to 29	1
		30 to 39	1
		40 to 49	6
		50 to 59	3
		Total	11
4	Mobile device	Yes	11
		No	0
		Missing	0
		Total	11
		Internet on mobile device	
		Yes	10
		No	1
Missing	0		
5	Email address	Ownership	
		Yes	11
		No	0
		Missing	0
		Total	11
		Email address company	
		Yahoo	1
		Google	10
		Hotmail/Live	1
Other	0		

Table 23: Teachers demographics and ownership of mobile devices.

All teachers have mobile devices. With mobile devices, teachers communicate with colleagues, family, friends and students. One teacher does not have Internet access on mobile device. Mobile device affords teachers access to email. All teachers have email addresses, mostly using Gmail.

### 7.6.1 Availability of mobile devices

Teachers spend hours on mobile devices. It is significant to capture hours' teachers spend on mobile devices as it explains extent of use in a day.

Hours on mobile device (range)	0 to 2	3 to 5	6 to 8	9 to 11	12 to 14	above 14	Total
How many hours in a day do you use your mobile device?	4	4	1	1	0	1	11
How many hours in a day do you use social media (Facebook, Twitter and Instagram)?	8	2	0	1	0	0	11

Table 24: Hours teachers spend on mobile devices and social media.

Teachers spend between half an hour and 18 hours in a day on mobile devices as shown on Table 24. Table 23 illustrates teachers might have families, hence spending up to five hours on a mobile device. The youngest teacher spends 18 hours on a mobile device.

Hours teacher are on social media range from half an hour to 11 hours. Teachers spending half an hour to two hours on social media includes three teachers spending half an hour, three teachers spending an hour and two teachers spending two hours. Internet on teachers' mobile devices affords use of social media. Teachers read and contribute to content on social media.

### 7.6.2 Innovation

Teachers undertake several activities on mobile devices including communicating and socializing, searching for information, recreation and academic. Table 25 shows details on activities teachers perform on mobile devices.

No.	Concept	Characteristics and aspects	Frequency			
			Yes	No	Missing	Total
1	General use					
		Socializing	7	4	0	11
		Searching for information	7	4	0	11
		Recreation	3	8	0	11
		Academic	7	4	0	11
2	Innovation					
		Relative advantage	9	2	0	11
		Compatibility	11	0	0	11
		Trialability				
		Google search	10	1	0	11
		YouTube	6	5	0	11
		Camera/Video	5	6	0	11
		Map	5	6	0	11

		Observability	4	7	0	11
		Complexity	10	1	0	11

Table 25: Teachers general use of mobile devices and affordances of the innovation.

As an innovative technology, teachers use mobile devices for several activities. Table 25 illustrates, seven teachers use mobile devices to socialize. Socializing includes access and use of Facebook, Twitter, Instagram and WhatsApp.

Seven teachers use mobile devices to search for information. Searching for information includes access to blogs, websites, news and sports. Searching for information affords teachers enhancement of knowledge.

Three teachers use mobile devices for recreation. Recreational purposes consist of games, listening to music, audio files and watching videos. Seven teachers use mobile devices for academic purposes. Academic activities include reading, studying and using calculator.

With exception to recreational activities, teachers depicted use of mobile devices to socialize, search for information and academic issues. Perhaps, delving into characteristics would depict better information.

#### **7.6.2.1 Relative advantage offered by mobile devices**

Relative advantage related to using a mobile device to communicate to relative. Relatives comprise of colleagues, friends, sibling, family and relatives. Nine teachers responded to viewing mobile devices as providing a relative advantage.

Not only are teachers able to communicate to relatives, but also to students. Teachers provide clarification and guidance on students using mobile devices for learning.

#### **7.6.2.2 Compatibility of mobile devices with textbooks as supplementary sources**

Teachers use recommended textbooks to impact knowledge on students. Teachers prepare for class using varied materials required including recommended textbooks and supplementary textbooks. Mobile devices are used as supplementary source of material. Teachers use mobile devices to access notes, audio and video files explaining concepts. All teachers view use of mobile devices compatible to textbooks as supplementary source.

#### **7.6.2.3 Trialability using Google search, YouTube, camera and maps**

Teachers use several affordances on mobile devices to prepare for class. Ten teachers performed searches on Google in search of information. Teachers use Google to acquire definition, explain concepts and examples students relate to.

Six teachers used YouTube for academic purposes. Teachers access YouTube for videos explaining concepts or to understand a topic. Teachers' intention is impacting knowledge on students using different tools and techniques. Teachers find different tools during searches on YouTube. Teachers share information on tools to colleagues and later, students.

Teachers use cameras on mobile devices to take pictures and videos shared to colleagues and students. Teachers have WhatsApp groups with students for ease of communication. Five teachers depict using cameras on mobile devices for academic purposes. Pictures or videos shared are used by students to gain better understanding of concept.

Teachers use map applications to understand different geography related aspects. Five teachers have used map applications on mobile devices. Teachers want to know cities, calculate distance and provide examples on roads or desert areas, borders between countries and water bodies. Teachers access map applications to learn of identified aspects and share to colleagues and students.

#### **7.6.2.4 Observability from peers**

Four teachers observed colleague with mobile devices and were interested. Seven teachers did not observe any colleague and bought mobile devices with assistance from shop attendant or a contract. In terms of observation, teachers show independence and personal decision making.

#### **7.6.2.5 Complexity of using mobile devices for learning**

Teachers view using mobile devices for learning as a complex experience. Ten teachers responded by stating use of mobile devices is complex. Teachers at School B have access to computer laboratory with Internet access.

Access to computers with Internet affords searching for academic content in preparation for class. Mobile devices are viewed secondary to computers and are the reason teachers view mobile devices as complex.

### **7.6.3 Social system**

Teachers use knowledge and social networks on academic issues. As part of a social system, teachers communicate to networks using calls, SMS and instant messaging.

Table 26 illustrates teachers communicate with colleagues on academic matters. Networks teachers have encompassed colleagues. Nine teachers used mobile devices to communicate with a

colleague on academic matters. Academic matters embrace duties at the school, explanation of concepts or information on acquiring textbooks not at school premises.

No.	Concept	Characteristics and aspects	Frequency			
			Yes	No	Missing	Total
1	Social system					
		Network interconnectedness				
		Using calls				
		Sent/received a call from a colleague on academic matters	9	2	0	11
		Using SMS				
		Sent/received text from a colleague on academic matters	10	1	0	11
		Using instant messaging				
		Sent/received an instant message on academic matters	10	1	0	11

Table 26: Teachers identification of network interconnectedness.

Ten teachers use SMS to communicate to a colleague of academic related issues. Reliance on SMS is due to cheap price and assurance of content delivery. Ten teachers use instant messaging to communicate to colleagues. Using instant messages, teachers send SMS and multimedia to colleague.

#### 7.6.4 Teachers' concerns

Teachers feared students are not using mobile devices for learning. To validate (or falsify), questions were asked on teachers views of students use of mobile devices. Table 27 illustrates teachers' response.

Ten Teachers state students use mobile devices to search for information. Teachers' response relates to students use as shown on Table 21. Teachers agree students use mobile devices for socialization and recreational purposes. Lastly, ten teachers view students' use of mobile devices leads to learning.

Concept	Characteristics and aspects	Frequency			
		Yes	No	Missing	Total
Concern	Outside the classroom, do you think				
	Students use mobile devices to search for information?	10	1	0	11
	Students use mobile devices to socialize?	11	0	0	11
	Students use mobile devices for recreation?	11	0	0	11
	Students use mobile devices for academic purposes?	10	1	0	11

Table 27: Teachers concerns on student use of mobile devices.

Teachers' views related to students' general use of mobile devices in section 8.5.2. The confidence teachers have on students' academic use of mobile devices depicts participation and assistance received.

Teachers have WhatsApp groups for students to share resources. The teacher becomes facilitator of the group. Teachers assist students.

## **7.7 Conclusion**

Students use camera on mobile devices, search engines, video websites and map applications for academic purposes. Students search for information comprises of communicating with peers for solution (assistance) on academic matters and accessing search engines.

Students' use of mobile devices affords multi-tasking, communication and collaboration, multimedia information and student centred learning. Data discussed in this chapter, is elaborated in chapter 8.

## **CHAPTER 8: QUALITATIVE DATA ANALYSIS AND FINDINGS OF SCHOOL B IN CAPE TOWN, SOUTH AFRICA.**

Chapter 7 provided a quantitative account of data collected in School B in Cape Town, South Africa. The chapter unpacked data in relation to the theoretical framework and in response to research sub questions one, two and five. Chapter 8 provides qualitative explanation using Braun and Clarke (2006) thematic analysis approach.

### **8.1 Introduction**

Active observation and semi-structured interviews are discussed on this chapter. Active observation started at the school gate. Semi-structured interviews were undertaken using a research protocol developed from SEUMD. The framework shows following themes (concept), innovation, social systems, concern, available, sustainable and effective.

The main research question and sub-questions were linked to literature review. Literature review develops to SEUMD. The research protocol linking to framework, literature review and research question depicts construct validity. The research protocol is attached as appendix 3.

Themes from theoretical framework were linked to research sub-questions to answer the main question, *“What influence does effective use of mobile devices for learning outside the classroom have on academic performance of secondary school students in Tanzania and South Africa?”*. The research question is expanded to include sub-questions as,

1. To what extent are secondary school students in South Africa using mobile devices for learning outside the classroom?
2. What mobile device affordances do secondary school students use outside the classroom for learning?
3. What influences secondary school students use of mobile devices for learning outside the classroom?
4. What does effective use of mobile devices for learning outside the classroom infer in the context of secondary school students’ in South Africa and how does it influence academic performance?

## 8.2 Data collection

A 72 paged A5 exercise book was used to document active observations at B. Active observation included information on interactions between students, teachers, academic staff, parents, prospective students, supportive staff, school operations, classroom format and security. Active observation further included details on buildings and historical information as artefacts at School B.

Interviews were scheduled upon students completing questionnaires. Interviews were undertaken between third week of September and mid-October. Students are on vacation from third week of September for two weeks. Students were asked to volunteer for individual interviews. Students were informed interviews will occur at the school. 17 Grade 12 students volunteered from 3 classrooms.

Students were asked to select date and time convenient for interviews. Students organized with peers (fellow interviewees). Students discussed access to school, venue for hosting interviews. Using strategy employed in Dar-es-salaam, the researcher allowed students to select venue for comfortability.

A geography teachers' classroom was used for conducting the first set of interviews. Students stated "the teacher is our friend and we are happy to use her classroom for interviews. We can even ask her questions on geography results". Students exchanged phone (and WhatsApp) numbers with researcher for ease of communication. Students had mobile devices at school.

Even though the teacher was in her classroom during interviews, students responded to questions honestly. One student was reminded by the teacher on phone confiscation by Afrikaans teacher. The student was using a mobile device in classroom. Students came with peers. Students attending interviews in groups, presence of a friendly teacher and a classroom they know, students assumed control.

The geography teacher is a friend to students because of advice provided. Students admitted, she has changed lives. Troublesome and truancy students held personal meetings with geography teacher. The teacher assisted students to understand fears and home environment. She motivates students to focus on school and bonds are created.

During first set of interviews, students arrived at the school to clean the geography teachers' class. Students mop, dust and organizing desks and chairs. Five interviews were performed.

The second set of interviews was in sciences laboratory (classroom). Students identified the classroom open and knew the teacher seats in staff room. The researcher requested to use the classroom for interviews and was allowed. The classroom has laptop (used for presentations), speakers (audio or video presentations), projector and air condition.

The classroom includes 9 computers connected to Internet. During interviews, peers took turns using 3 computers available. 6 computers were used by other students. Nine students were interviewed. The last interview was in geography teachers' class with one student. The student came with peers.

A Samsung galaxy tab 2 and Sony Xperia LT30p were used to record interviews. Active observations were written on exercise book, field notes. The exercise book was also used to write summaries of interviews and document follow up questions. Preliminary analysis in form of documenting interviews allowed for enhancement of questions misunderstood or clarity on response.

Interview protocol was shared to interviewees before beginning proceedings. Students reviewed, asked and after clarification the interview began. Respondents recollection depicts data does not reside on respondent's memory, re-enacted when questioned.

### **8.3 Preparation of qualitative data analysis tool**

Atlas.ti version 7 was used for transcription and storage of qualitative data. Prior to loading interview recordings and field notes on the tool, necessary steps were taken.

A new hermeneutic unit was created and named School B. The hermeneutic unit was saved on a laptop that is password protected. Audio recordings were assessed to identify audible interviews with less background noise. One recording for each student was loaded on Atlas.ti.

Audio interviews and field notes were given unique identifiers. Audio interviews were given letter S, student, followed by number of interviewee and lastly gender as male or female. The number of interviewee was increased sequentially. Fifteen interviewed students were labelled S1M to S15F. Field notes were identified using date and.

Interviews were imported on Atlas.ti and a new text document created for each transcription and for each set of field notes. The project was saved and a copy on a secured external hard drive. The process of thematic analysis began.

## **8.4 Thematic Analysis**

Qualitative data analysis approaches include, discourse analysis, interpretative phenomenological analysis, content analysis or thematic analysis (Bryman, 2006; Gonzalez, 2016; Tong et al., 2007). Thematic analysis offers flexibility in identification or development of themes than other analysis techniques (Braun & Clarke, 2006). Thematic analysis offers flexibility and ease of application of steps in analysis leading to theme explanation. The process of thematic analysis begins with transcription and is completed when the final report is written.

Thematic analysis in deductive approach involves reading of transcribed data in relation to SEUMD. Focus is on responding to main research question by explaining a story. The story is explained from respondent's views.

Respondents' views were read and re-read for clarity and to understand. Analysis of School B data took two years. Thematic analysis was not rushed. Each phase was assessed to explain respondents' views. Following Braun and Clarke (2006) thematic analysis, the researcher performed a recursive process between phase one and six (Braun & Clarke, 2006; Clarke & Braun, 2013). The six phases of thematic analysis are summarized on

Name of phase	Activities
Phase 1: Familiarization with data	<p>During phase 1, field notes and interview summaries are read for initial understanding. Recorded interviews are transcribed and initial analysis of interviews is actively acquired.</p> <p>A period for reflexivity is important to aid fresh understanding. Transcribed data is read alongside recorded interviews for accuracy. Editing transcribed data is applied. Initial codes are developed on first impression and written on notebook.</p>
Phase 2: Generating initial codes	<p>On phase 2, each word, sentence, or paragraph is coded on Atlas.ti. Codes are produced based on respondent views and phenomenon of interest, initial coding.</p> <p>During initial coding, researcher intended to acquire initial impression of data. For each code, comparison was performed with respondent's views to ensure meanings from respondent is captured.</p>
Phase 3: Searching for themes	<p>Initial codes are categorised and combined. Combined codes give an overarching theme.</p> <p>Phase 3 enforces application of analytical skills on initial codes. Meaning is attached to each initial code and overarching representation labelled theme.</p>
Phase 4: Review themes	<p>Themes identified in phase 3 are reviewed and distinction developed. Themes are dissolved, merged or edited.</p> <p>Importance is placed on coherence of respondent views on each theme and sub-theme. Internal homogeneity and external heterogeneity are enforced.</p>
Phase 5: Defining and naming themes	<p>Themes are assessed to ensure sub-themes assist in telling the story. If sub-theme does not depict coherence, it is moved to miscellaneous.</p> <p>Themes are defined for scope and content. A table summarizes definition of themes.</p>
Phase 6: Producing the report	<p>A narrative story is developed explaining themes. During report writing, focus is respondent views support on themes. Rival explanations are included in findings. Quantitative data is used to support arguments.</p>

Table 28.

Name of phase	Activities
Phase 1: Familiarization with data	During phase 1, field notes and interview summaries are read for initial understanding. Recorded interviews are transcribed and initial analysis of interviews is actively acquired. A period for reflexivity is important to aid fresh understanding. Transcribed data is read alongside recorded interviews for accuracy. Editing transcribed data is applied. Initial codes are developed on first impression and written on notebook.
Phase 2: Generating initial codes	On phase 2, each word, sentence, or paragraph is coded on Atlas.ti. Codes are produced based on respondent views and phenomenon of interest, initial coding. During initial coding, researcher intended to acquire initial impression of data. For each code, comparison was performed with respondent's views to ensure meanings from respondent is captured.
Phase 3: Searching for themes	Initial codes are categorised and combined. Combined codes give an overarching theme. Phase 3 enforces application of analytical skills on initial codes. Meaning is attached to each initial code and overarching representation labelled theme.
Phase 4: Review themes	Themes identified in phase 3 are reviewed and distinction developed. Themes are dissolved, merged or edited. Importance is placed on coherence of respondent views on each theme and sub-theme. Internal homogeneity and external heterogeneity are enforced.
Phase 5: Defining and naming themes	Themes are assessed to ensure sub-themes assist in telling the story. If sub-theme does not depict coherence, it is moved to miscellaneous. Themes are defined for scope and content. A table summarizes definition of themes.
Phase 6: Producing the report	A narrative story is developed explaining themes. During report writing, focus is respondent views support on themes. Rival explanations are included in findings. Quantitative data is used to support arguments.

Table 28: Thematic analysis processes.

### 8.4.1 Familiarization with data

The first phase of thematic analysis is repeated reading of collected data with intention of identifying meanings, patterns and organizing respondents' views. In preparation, main research question and sub questions were read. Research protocol was read to identify possible expectations per question. Each protocol question was attached to a theme (or sub-theme) from SEUMD.

Field notes were read numerous times and interview recordings listened for first impression. Side notes were written on a notebook on meanings and patters from first impression. Data was transcribed following section 8.3.

Transcription of audio recorded interviews in School B was performed after data collection. Data was collected in the afternoon and evenings were used for transcription. Edited transcription approach was followed with focus on word and assisting to complete sentences (Kvale, 1988). Language used for interviews at School B was English. Transcription took between 2 and a half hours, to 4 hours for each respondent. Transcription followed question and answer format as audible on recordings.

Transcription involved listening to audio recordings. Samsung Galaxy tab and Sony Xperia were assessed on reduced background noise and clarity audio. Records meeting set criteria were selected and given unique identified. Records were loaded to Atlas.ti.

During transcription, side notes were refined for emerging meanings from respondents'. Each interview was transcribed independent of others. The researcher took a break from transcribing or reading research questions. The aim is relaxation and reflection of what was supposed to be done, what was done and what the data is informing.

Transcribed data was assessed against audio records for accuracy (Braun & Clarke, 2006) after reflection week. Where differences emerged, transcribed data was edited. Differences emerged because of, not accurately hearing due to background noise or accent. Field notes were transcribed after completing accuracy verification. Table 29 shows transcribed data as response to question on influence of mobile devices.

Table 29 consist of three columns, first column is innovation as a construct, the second column is identification for respondents and last column is respondent's views in relation to question posed. Students were asked, what influences use of mobile devices for learning.

Arguments provided by respondents emerge from mobile devices offering access to Internet that has a multitude of resources and providing a broader view of content. S3M depicted using far less time on mobile devices and viewed carrying of exercise books as not interesting.

Construct	Respondent identification	What influences your decision to use your device for learning?
Innovation	S3M	Its quicker for me, it's faster, you don't have to carry books and you don't have to write.
	S4F	Sometimes with the device it is more electronic and it's more understanding. It is visualizing what you see than in a book with lots of notes in it. So, it is much easier when you can see what you are doing with a device.

	S7M	Mostly in terms of searching for information, school information. For instance, I had an assignment and I did not have time to go to the library. I will just buy data and go to the Internet and search or I will ask someone about the information.
--	-----	---

Table 29: Familiarization with data.

Students search for pictures and video that assist in visualizing content and enhancing learning as argued by S4F. S7M portrays mobile devices assist students to reach peers as sources of information. Mobile devices are tools used by students when curious and the Internet provides source of information.

#### 8.4.2 Generating initial code

Side notes were revised for interesting aspects from respondent's views. Side notes were refined and initial codes created. Codes were created on interesting aspects of meaning and relationships from respondent's views. SEUMD and research questions were used for guidance during initial coding.

Each transcript was read and initial codes applied. Initial codes were applied to phrases, sentences or paragraph by tagging and naming (Braun & Clarke, 2006). Initial coding was based on respondents mentioning, explaining or providing interesting aspects to phenomenon of interest. The placing initial codes continued for all transcripts and field notes.

Using Atlas.ti, initial codes were manually applied to each transcript. Each transcript was given full attention and coded to represent interesting aspects.

On each transcript, alternative codes were used for rival explanations. Additional emergent aspects were coded, free coding. During initial coding, focus was on answering W and H questions,

- What are students doing with mobile devices?
- Why are students using mobile devices for learning?
- How are students effectively using mobile devices?
- Who are students asking for assistance, assisting or communicating to?
- Which affordances of mobile devices do students use for learning?
- When do, students use mobile devices for learning?

Transcription was done on different days and certain days meant returning to phase 1. This lead to creation of multiple free codes. The intention was to depict much of what the data communicates than codes. Through generating free codes, code book expanded to 130 codes (see appendix 5).

Coded transcripts were read to verify codes relate to response. Where a mismatch was identified, codes were replaced or added. Table 30 depicts initial codes in relation to question on what influences students use of mobile devices for learning.

Construct	Initial code	Respondents views
Innovation	life-long learning	For instance, if you look at our textbooks and you look at the amount of resources that the Internet offers. The Internet will give you a much broader view of what you are going to research (S2M).
		Its quicker for me, it's faster, you don't have to carry books and you don't have to write (S3M).
	Internet	For instance, if you look at our textbooks and you look at the amount of resources that the Internet offers. The Internet will give you a much broader view of what you are going to research (S2M).
		Well, I would go for my phone because in my opinion I think it is less boring. When going through the Internet, I can get may be audios, or pictures, or videos, about the information and its better than the textbook (S6F).
	Time	Its quicker for me, it's faster, you don't have to carry books and you don't have to write (S3M).

Table 30: Generating initial code

Three initial codes were applied showing students use mobile devices for life-long learning, access to Internet and assisting with time management. Life-long learning is on resources acquired online as narrated by S2M. S3M relates use of mobile device to future of learning. Students focus is on techniques to access information.

Carrying recommended textbooks is viewed an exercise some students do not intend to engage. Student extend traditional research. Research is acquiring material through Internet. Content acquired online is used to enhance understanding.

The Internet provides broader understanding on concepts students search as explained by S2M. Respondent S6F portrays the Internet as a catchy arena where students focus on content of interest. Due to familiarity, students view mobile devices as less boring. Internet offers access to multimedia that explains concepts better. The Internet is also used as source for rephrasing unclear question.

Students save time from reading recommended textbooks. As S3M depicts, students prefer technology that assisting to save time. On the Internet, students search for topics that enhance learning. Searches on Internet take few seconds subjective to a students' knowledge of search engines.

### 8.4.3 Searching for themes

Initial 130 codes were assessed to identify similar codes. Similar codes were initial codes created with similar meaning, but used different terms. For example, use for planning and use device to plan. This was a result of coding on different days. Initial codes were printed and linked on paper. Careful consideration was placed when linking similar codes. After linking similar codes on paper, the exercise was performed on Atlas.ti by using associated with. The initial code table reduced. The next step was sorting and linking of related codes.

Sorting of initial codes included organizing related codes in categories. Related categories were identified as themes. Themes are a broader understanding of respondent's views (Bartlett & Vavrus, 2014; Clarke & Braun, 2013; Kvale, 1988).

Respondents' view for each theme were identified and assessed to tell the story. Respondent views unrelated to theme, but belonging to initial code were assessed. Assessment resulted in editing initial codes. Codes that did not belong to the theme were moved to miscellaneous.

During theme generation, initial codes were used that lead to sub-themes. Each sub-theme included multiple accounts of respondent's views. Rival explanations were provided on respondent views. Contradictions were aligned within themes. Table 31 depicts themes generated from respondent views.

Theme	Description	Sub-theme	Respondents views (Respondents identification)
reasons to use mobile device for learning	Use of mobile device for learning is influenced by need for life-long learning and as a means of convenience.	life-long learning (Internet)	Mostly in terms of searching for information, school information. For instance, I had an assignment and I did not have time to go to the library. I will just buy data and go to the Internet and search or I will ask someone about the information (S7M).
		time	Its quicker for me, it's faster, you don't have to carry books and you don't have to write (S3M).
tool to support learning	Tools used to support learning include search engines and websites and are subject specific.	Subjects student uses device for learning	I used it last time on history. It was on exam paper as I was googling the similarities between the past papers and the paper that we had written. So, to make my studying easier (S8M).
		Search engine/website	I used it last time on history. It was on exam paper as I was googling the similarities between the past papers and the paper that we had written. So, to make my studying easier (S8M).

Table 31: Searching for themes.

Students' depicted reasons for using mobile devices for learning outside the classroom include life-long learning and time (convenience). Mobile devices are tools that support learning. Life-long learning and time were discussed during phase two.

As tools, mobile devices assist students in understanding content on several subjects. Subjects that students use mobile devices for learning include, History, Biology, Life science, English, Economics, Geography, Math Literacy, Life orientation, Business studies and Mathematics. Respondent S8M explains use of mobile device for history and that using a mobile device makes studies easier.

Mobile devices as tools include use of search engines or websites. Students access search engines or websites offering access to numerous resources. Respondents compare past papers found on websites using mobile devices as argued by S8M.

Students spend hours on video streaming websites such as YouTube. Websites such as Wikipedia are used by students as a supplementary source of information. Students know books have limited pages, but Internet, has abundant information.

#### **8.4.4 Reviewing themes**

Themes from phase three were analysed and refined. Refinement of themes allowed editing and identification of related themes. Related themes shared overarching story and were merged. A name was given to merged theme. Themes from phase three became sub-themes to newly created theme. During refinement of themes, attention was given to ensure internal homogeneity and external heterogeneity (Braun & Clarke, 2006).

Internal homogeneity shows respondents views within a theme telling the same story, coherence. Coherence of views is depicted by having each theme and sub-theme include relating respondent views. Each sub-theme included respondent's views that depict coherent pattern. Themes were provided with sub-themes that relate to show internal homogeneity.

External heterogeneity focuses on distinction between themes. Respondent's views for each theme were assessed and related to sub-themes. Themes were reviewed to ensure coherence. Themes were assessed to evaluate distinct features between them. Sub-themes not relating to themes were either merged or moved to miscellaneous.

The outcome of reviewing themes is provided on Table 32. Each theme was evaluated to show validity in relation to transcripts. SEUMD was used to guide development of themes for accurate

representation of respondent's views. Along with SEUMD, research questions were used to guide data analysis on students' effective use of mobile devices for learning outside the classroom. During review of themes, transcripts were read to ensure internal homogeneity on sub-themes and themes. Free coding was performed requiring revisiting phase two.

Reviewed Theme	Theme	Description	Subtheme	Respondents views
Compatibility	reasons to use a mobile device for learning	Use of mobile device for learning is influenced by need for life-long learning and as a means of convenience.	life-long learning	Mostly in terms of searching for information, school information. For instance, I had an assignment and I did not have time to go to the library. I will just buy data and go to the Internet and search or I will ask someone about the information (S7M).
			time (convenience)	...like no matter how many books we have at the school, it will have a certain amount of information, so having information on the Internet it will give you a better understanding and saving work (S2M).
	tool to support learning	Tools used to support learning include search engines and websites and are subject specific.	subject's students use devices for learning	I used it last time on history. It was on exam paper as I was googling the similarities between the past papers and the paper that we had written. So, to make my studying easier (S8M).
			search engine/website	The reason being, if something is in a book, it does not have more information than what you will get on the Internet in terms of Wikipedia that is if you want to learn about everything (S7M).
Observability	advice	Students receive and might follow advice provided by peers or shop attendants before purchasing a mobile device	peer advice	Sometimes I do listen to peer advice and sometimes I don't. Some can tell you the negatives of the devices and maybe you are not looking for those, you are looking at the positives of the phone (S4F).
			shop attendant advice	It was last minute decision at the shop. It was the shop attendance who gave me the idea of what to buy as they did not have stock of what I wanted to buy (S1M).
	technical support	Students depend on parents and peer support when in need of technical assistance with mobile device.	peer support	I mostly focus on what they are talking about in terms of applications that I can get on the phone and in terms of the camera if it is good or not, the space of the phone (storage) (S7M).
			parent support	So, I work with other family members and the money I get I could put on my devices as credit. My parents are teaching me how to manage my finances and my life by working (S2M).

	emotional decision (durability of device)	Students make emotional decisions on mobile devices to buy based on budget or durability	budget	Because sometime my friend told me to look at the iPhone 6c which has 64gb on the phone. I told her that is like R 13,000-16,000 loan, but she was looking at the black-market phones (from the Internet, without paying tax, or second hand), I also look for one. Because iPhone space is good and the Internet is fast and everything (S10M)
			durability	I will only focus on the megapixels of the phone, may be the phone takes better pictures, may be the battery last long and the camera of the phone, the model must be good (S12F).

Table 32: Reviewing themes.

Table 32 illustrates reviewed themes. Reasons for students using mobile devices for learning and tools used to support learning depict compatibility.

Observability is through students receiving advice, technical support and making emotional decisions. Respondents acknowledged advice from peers and shop attendant before buying a mobile device. Advice received assisted students in making decisions of mobile device to adopt. Students received technical support from peers and parents. Technical support comprised applications to download, camera quality, storage space and cheap Internet access. Parents assist by teaching children handling of finances.

Respondents depicted making emotional decisions on mobile devices to acquire despite observing peers. Emotional decisions were a result of sticking to budget and ensuring mobile device acquired is durable.

#### 8.4.5 Defining and naming themes

Themes were reviewed and purpose assessed. Themes that did not have a coherent story were refined and included on miscellaneous. Each theme was then defined. Respondent’s views were assessed to assist in telling the story.

Themes were assessed for response to research question and alignment to SEUMD. A detailed analysis was written on each theme and compared with other themes. Intention was to ensure external heterogeneity.

Theme names were assessed and decision to retain current names was undertaken. Scope and content of each theme was assessed for coherence. **Error! Reference source not found.** shows themes from respondent’s views.

	Theme	Description
Innovation	Relative advantage	Students use mobile devices as it affords contacting friends, family and relatives and provides a platform for socialization.
	Compatibility	As a supplementary source of information, students adopt and use mobile devices due to affordance in simplifying language, taking brief time when searching and life-long learning. Students conduct searches on search engines and websites.
	Observability	Students acquire advice from peers on what features to consider and mobile devices to buy. Students receive technical support from peers and parents. Some students make emotional decision during the process of acquiring mobile devices.
	Trialability	Students share multimedia and text on mobile devices for social and learning purposes.

	Complexity	Information overload and not understanding affordances on a mobile device deter students from adopting or using a mobile device for learning.
Social systems	Norm	Parents, teachers and elder sibling's perceptions coupled with cultures have affected students' use of mobile devices for learning.
	Network Interconnectedness	Students interact with peers and friends using groups created on social networks and instant messaging platforms.
	Consequence	Confiscation of mobile devices has affected students. When students need to use mobile devices, they are not at reach.
Concern	Moral enforcers	Announcements of 'no mobile devices' on school premises and ban by department of education have deterred students from using mobile devices within school environment.
	Moral creators	Government ban of mobile devices on school premises and teachers' perceptions on students' use of mobile devices plays a significant role in limited views on students' use of mobile devices for learning.
Availability		Mobile devices on students' hands are a resource when well used, fosters learning.
Sustainability	Self determination	Ownership and control of mobile devices is solely on students. Students buy credit (airtime) for phone calls, short messages services and Internet. When buying Internet, focus is on how long it will last.
	Willingness	Students save pocket money to buy airtime showing willingness to communicate. Students initiate conversations and sharing of educational content to peers and friends.
Effectiveness	better explanation	Students view effective use as using mobile devices for better explanation. Better explanation is through assisting on time management during studying and using mobile devices for research.
	use mobile device to plan	Using alarm, calculator and calendar on mobile devices, students can plan academic activities.

Table 33: Defining and naming themes.

#### 8.4.6 Producing the report

The report is provided in succeeding section as findings. Findings are discussed based on theme. Within each theme, sub-themes are used to provide rich details. Details given are linked with respondents' views. Using mixed method approach, arguments in findings include quantitative data to support qualitative data. Findings are generalized from respondents' views for the single secondary school in Cape Town (Lee & Baskerville, 2003; Walsham, 2006)..

## **8.5 Findings**

### **8.5.1 Innovation**

Mobile devices are adopted at School B. Table 19 shows 90 students adopted mobile devices. One student shares with family members and one has not. Table 21 shows 60 students use mobile devices for recreational purposes.

Recreational purposes consist of watching videos and playing games as described by S3M. 79 students use mobile devices to socialize. Socializing encompasses access to social network and instant messaging applications as narrated by S7M. The student is a blogger and shares current news on events and entertainment.

“There are so many things, listening to music, playing games, chatting online and watch videos on YouTube. I spend hours on YouTube”. S3M

“I am actually a blogger and I have my own page on Facebook where I search for events that are happening around. The latest trends, in terms of fashion and then I post these and someone will say yes. Because I normally search, almost each day I have something to search”. S7M

Table 21 also shows 60 students search for information. Students search for current news, sports and health. S9F searches for cooking information. Further, 55 students use mobile devices for academic purposes. The student illustrates importance of a mobile device when far from textbooks.

“I like googling things. If I watch a show and it’s a cooking show and I missed or something went wrong. I just Google to find out what did I miss. For example, I didn't put sugar.

“If you don't have your books on you and you are somewhere like in the train or taxi and you just need some information. You don't have to go home to look through your books. You have the phone on you so you just research”. S9F

Students use mobile devices as source of information. Students’ academic use involves enhancing that read when far from books. Students use distinct characteristics to adopt mobile devices and use for learning. Characteristics used by students include relative advantage, compatibility, trialability, observability and complexity. Each affects a students’ decision to adopt a mobile device and use for learning.

#### **8.5.1.1 Relative advantage**

Students argue receiving relative advantage from mobile devices. Table 21 shows 74 students perceive receiving relative advantage. Students get an advantage compared to peers not using

mobile devices. S11F receives an advantage from using a mobile device. S1M elaborates that using mobile devices affords access to various sources of information. Both students focused on using mobile devices for academic purposes.

“Because the work we are doing at school, it's not everything and when you use the device you get more information on certain topics and I think that is an advantage. Because you get to know more than what you have been given at school”. S11F

“I think it's a good feeling, because you know you could do a lot, you could get lots of information from a lot of various sources. It's so easy to get anything from the Internet”. S1M

The advantage students receive from using mobile devices is not only on academic issues, but other communication. Other communication includes socializing, contacting peers and family. Through socializing, students contact peers and share information on academic and non-academic issues.

#### *8.5.1.1.1 Socializing using mobile devices*

Students use social networks and instant messaging for communication. Students communicate with peers using mobile devices. Students access social networks such as Facebook, Twitter, Instagram and Flickr. Students also access instant messaging application such as WhatsApp, Messenger and Viber.

Respondent S7M identifies with socializing as a blogger. The student blogs by writing different content related to event and entertainment. The student posts all information on Facebook page.

“I am actually a blogger and I have my own page on Facebook where I search for events that are happening around. The latest trends, in terms of fashion and then I post these and someone will say yes. Because I normally search, almost each day I have something to search”. S7M

“I think it's the social networks, its effective in a way. Using it for school, may be chatting”. S12F

Respondent S12F uses social networks to chat. Communication through social networks or instant messaging applications referred as chatting.

#### *8.5.1.1.2 Students contact peers using mobile devices*

Students understand peers are available to assist. Students communicate with peers and exchange information on academic content. Peers offer support to aid understanding.

“Mostly in terms of searching for information, school information. For instance, I had an assignment and I did not have time to go to the library. I will just buy data and go to the Internet and search or I will ask someone about the information”. S7M

Students use peers as source of information. S7M explains contacting a peer for solutions when library is closed. Contacting peers involves phone calls, messages and Internet.

#### *8.5.1.1.3 Contacting family using mobile devices*

Students contact family members using mobile devices. Family members comprise parents, siblings, cousins and relatives. Parents inform children to use mobile devices wisely.

“I was searching for History and it was for a cousin of mine. She did not know the person she was supposed to do a research about and I also did not know the person. So, I asked her to give me the information and I was going to search for her and then I took it and then I used my phone and I searched about that person”. S7M

Parents communicate with children using airtime or Internet bundles. Parents contribute through buying Internet bundles. S7M explains how he assisted a cousin to acquire information in relation to history. While assisting the cousin, he also learnt. Contacting is not limited to communication, it extends to learning.

#### **8.5.1.2 Observability**

Students observe peers using mobile devices and are interested on adopting. Table 21 illustrates 64 students observed peers and were interested. Using prior knowledge on mobile devices and enquiring from peers, students adopt mobile devices of choice.

“I saw someone using it. A friend of mine had it. The friend had the iPhone 5 and since I previously had iPhone 4S, then I wanted to go bigger and ended buying the 5S. The iPhone 4S was a black-market product and it didn't work. So, this time I decided to buy from the shop”. S15F

Peers offer advice and technical support. Still, students adopt mobile devices of choice. S15F observed a peer using a mobile device she likes. The student had prior knowledge of iPhones. The student bought iPhone 5S which was an updated version.

#### *8.5.1.2.1 Students receive advice from peers*

Peers provide advice on mobile device to adopt. Students receive advice from peers on affordances in a mobile device. Not all advice is considered. Some students' priorities advice.

“But not just any friend. It's a person that I know is good at gadgets, or has a better phone than I have, or knows better”. S15F

Advice from peers who are skilled is given preference. S15F explains focusing on expert advice. Students accept peer advice after researching on a mobile device. Students use peers to validate mobile device to adopt.

#### *8.5.1.2.2 Technical support students receive from peers*

Students receive technical support from peers. Peers provide details on mobile devices students should adopt. Peers inform of camera quality, storage space, operating system, downloadable applications and touch ability. Still, not all technical support is considered. Some students prefer mobile devices with buttons than touch screens. S1M identifies several affordances a mobile device must have.

“It varies actually, I will focus on the software version. What version for example, KitKat and the other ones. I will focus on the camera features, megapixel quality, picture quality, camera features like panorama, focus HD features, also the amount of space on board. For example, some phones cannot take big memory cards, so you could get a memory card, a bigger one will be nice”. S1M

“Because sometime my friend told me to look at the iPhone 6c which has 64 GB on the phone. I told her that is like R 13,000-16,000, but she was looking at the black-market phones. I also looked for one. iPhone space is really good and the Internet is fast and everything”. S10M

Students use different approaches to adopt mobile devices. S10M identifies technical details on where to buy mobile devices. The student bought an iPhone through black-market. The mobile device is fast on Internet.

Despite advice from peers and technical support, students make emotional decisions. Students have preference of mobile devices to acquire. A mobile device that last long with charge and is within a students’ budget changes adoption decision.

“The space of the device, the pixels of the camera, the battery life and the model of the phone. I own an iPhone 5S which is better than 5 and that means the model of the phone determines my decision”. S15F

Respondent S15F observed a peer with an iPhone 5 but decided to adopt an iPhone 5S. The student acquired a mobile device with more storage capacity and fast Internet than observed mobile device.

#### **8.5.1.3 Trialability**

Students try mobile devices observed from peers and family. Students enquire on affordances mobile device offers and try. Students try mobile devices in stores. Table 21 illustrates 90 students

trying Google, 47 YouTube, 66 camera and videos and 23 maps on mobile devices. When trying mobile devices, students have different preferences.

Students use mobile devices to access affordance. S4F describes trying a mobile device from a peer.

“Yes, I tried it in store, Edgars. Also, a friend had it before”. S4F

The student tried the mobile device for the second time at a store. Some students do not try mobile device before adoption. When a student is satisfied with details of a mobile device, they may adopt without trying.

#### 8.5.1.3.1 *Students preference on multimedia*

Students try mobile devices and are interested in multimedia. Preference on multimedia includes audio, video, pictures and graphical images. Multimedia assists students to apply visual skills in understanding content explained.

“Well, if I happen to use my phone instead of the textbook and the other students is using a textbook, they won't get videos from the textbooks. I can watch videos of the information. For example, a play by Othello. A book that we are reading. I can go to the Internet and watch a video about Othello, while they are reading a book so I will have a better understanding than he/she has”. S6F

Respondent S6F uses multimedia on mobile device to understand content. The student argues, a mobile device is less boring. Students prefer observing than just reading. Content explained through multimedia captures students understanding.

Students don't only consume content from the Internet, they create content. S6F describes recording herself and sending an audio file to a group. Students would record approaches to a question and share. Other group members record response to question.

“It was audio discussing maths with some other students. It was a group, so I recorded and sent to the group. For example, question 1, I would record myself explaining how I did it and send to the group so that they tell me how they did it and if they have the same answers or what”. S6F

Some students are conflicted between multimedia and text. S7M presents an argument on applying both affordances.

“I think both work better for me. Because I will type something and may be the person does not understand, I will take a voice note to tell the person about the certain thing and if they don't

understand I will try and take a video and may be then they will put the puzzle together that this person was trying to say that and that”. S7M

The student cannot allocate of preference. Subconsciously, the student argues, multimedia without text is not explanatory.

#### 8.5.1.3.2 *Students preference on text*

None of the students explained preference on text only. Perhaps, due use of text in class, students prefer multimedia on mobile devices. Use of mobile devices outside the classroom affords students enhancement of content learnt in class.

“I prefer the combination but text works better because I am a visual learner and I can remember what is written. A visual learner is a person who memorizes things by seeing them and touching them, especially reading and writing”. S5F

This could account for students’ not selecting text as only preference. Students use text and visuals. S5F narrates on a visual learner. Student place emphasis on memorizing or understanding content by seeing or touching.

#### 8.5.1.4 **Compatibility**

Students view mobile devices compatible with traditional classroom. Compatibility is by complementary contribution mobile devices offer. Using mobile devices for learning is compatible with traditional classroom as both provide life-long learning. Table 21 proves 83 students view mobile devices compatible with traditional learning as a supplementary source of material.

Students use mobile devices to enhance content from class. Using mobile devices, students access search engines and websites providing convenience in acquiring content on the Internet. S7M uses a website, Wikipedia, that provides comprehensive content.

“The reason being, if something is in a book, it does not have more information than what you will get on the Internet. In terms of Wikipedia that is if you want to learn about everything. For instance, there is an assignment for history and we must search about someone. I will get more information than those people because they give me more information about a certain person”. S7M

The student is sceptical though. Accuracy of content available on the Internet is important. The student argues, recommended textbooks might offer simplified and clear information than the Internet.

“Sometimes like the information that you get on the Internet, you are not sure if it’s accurate. So, like the best thing will be like in terms of comparing. Because I will search for certain thing when I am doing my assignment. Search on my phone where as if I would search on a certain book that your teacher told to search on, may be the information is better than what you were going to get on the Internet. Sometimes on the book the explanation is simplified or quoted in better terms than what you were going to get on the Internet”. S7M

Searching on mobile devices offers students access to content on Internet. Mobile devices are source of supplementary learning material. Students favour use of mobile device for learning as a supplementary source of material.

#### 8.5.1.4.1 *Reasons to use mobile devices for learning*

Students use mobile devices as it affords life-long learning and due to convenience. Life-long learning is related to skills and knowledge acquired. Students employ skills on using mobile devices to search for information. Knowledge acquired enhances students’ prior knowledge. Students call peers, send SMS, communicate through social network and instant messaging applications. Students search the Internet for information. Students know peers aid with information from the Internet.

“No matter how many books we have at the school, it will have a certain amount of information. So, having information on the Internet it will give you a better understanding and saving work”. S2F

“I think it's a good thing, it's really helpful. Because sometimes we really can't understand our teachers or we are afraid to ask and our devices help us get more information and understanding”. S14F

The Internet is the source of information with multimedia. S2F explains books limited capacity on content and the Internet can be used to supplement. S14F explains using a mobile device to understand content that was unclear in classroom. Student are either afraid to inform teachers of not hearing or understanding. Mobile devices offer students ability to contact peers for explanation outside the classroom.

Respondent S7M describes implications students have when using mobile devices. The student explains how easily attention is lost on mobile devices. The student provides a scenario as provided by teachers.

“It's easy for someone to get distracted while using your mobile device, in terms of studying. You see. Because you are going to get a message and then you get distracted. As our teachers, there is a teacher who once said, "it's impossible for you to study with your phone, because you are going to get a message and then you are going to get distracted" and that is where you don't gain anything. You are busy on your phone chatting to people”. S7M

Life-long learning is impacted by disturbance students get when using mobile devices for learning. Mobile devices offer convenience to students. Mobile devices simplify access to academic content. Mobile devices also reduce time students would use to access content. Libraries operate on fixed times. Students’ access to library is limited by operational hours. When information on the Internet is not answering students’ question, peers are contacted for assistance.

Mobile devices assist students when teachers write content on the whiteboard. The whiteboard has limited space and teachers wipe to write additional content.

“In class, we normally, when we are lazy to write the breakdown or the work on the board, then we take pictures and send to each other. When we are to do a team work, group session and we take pictures and just work through pictures on WhatsApp or Facebook”. S9M

Students who cannot cope with teachers writing speed, take pictures of content and discuss on social networks and instant messaging applications. S9M explains of the phenomenon.

#### *8.5.1.4.2 Tools used to support learning on mobile devices*

Mobile devices are used in different subjects to support students’ learning. Students use mobile devices in geography, mathematics, math literacy, economics and English.

Students use mobile devices to access websites and search engines. Websites include Wikipedia and YouTube. Search engine students access mostly is Google.

“I know they support the use because if I would ask the question and they want me to figure out the answer, they will tell me to go Google whatever I asked and see what the answer is and try to put it in my own words”. S8M

S8M illustrates using Google to search for academic content. Wikipedia, YouTube and Google are tools students use for learning. From tools for recreational purposes, same tools are used for learning.

#### **8.5.1.5 Complexity**

Use of mobile devices for learning is a complex process. Table 21 illustrates 55 students view using mobile devices for learning complex. Complexity is brought by need for accuracy of

information on the Internet, information overload and not understanding operating a mobile device.

Students strive for accurate information. Students using mobile devices for learning understand not all information on the Internet is credible.

“Sometimes, like the information that you get on the Internet, you are not sure if it's accurate. So, like the best thing will be like in terms of comparing. Because I will search for certain thing when I am doing my assignment. Search on my phone. Whereas, if I would search on a certain book that your teacher told to search on, may be the information is better than what you were going to get on the Internet. Sometimes on the book the explanation is more simplified, or quoted in better terms than what you were going to get on the Internet. On the Internet, you get like large [comprehensive] information. When you read that information, you get bored somehow and then you lose concentration”. S7M

“Sometimes like your book gives a lot of information and the phone sometimes just simplifies everything”. S9M

Striving for credibility enforces students to use recommended textbooks as explained by S7M. The student depicts information overload from accessing content on the Internet. Ironically, textbooks contain information overload as argued by S9M. Teachers assist with reducing credibility by explaining to students. To reduce information overload, teachers guide students on websites to access and books to read.

“It's not easy to use an iPhone as you have to be patient, but you learn a lot of things”. S15F

Respondent S15F describes experience of an iPhone owner. Owning an iPhone requires patience in learning how to operate. Thereafter, to use the mobile device for learning. Students explained of applications used to share files between iPhone and Android mobile devices and among Android users. Applications such as share It, send anywhere and WhatsApp aid sharing.

### **8.5.2 Social system**

Students use mobile devices in communities that include teachers and parents. Norms affects students use mobile devices for learning. Students collaborate with peers to form groups on social networks and instant messaging applications. Groups share academic content amongst other information. Students have suffered consequences from having mobile devices. Running out of Internet and confiscation of mobile devices are among the consequences.

### **8.5.2.1 Norms in the society students operate affect use of mobile devices for learning**

Students are affected by norms. The society has created an image of students misusing mobile devices. Parents and teachers hold perceptions on students' use of mobile devices. Academic use of mobile devices is considered by some parents. Each of the views discussed were given by students while recollecting parents and teachers' comments.

#### *8.5.2.1.1 Parents perceptions on students use of mobile devices*

Parents ensure students are not misusing mobile devices. Parents confiscate children mobile device. Parents begin by threatening to confiscate mobile devices followed by confiscating. Parents use harsh words to children like "if you fail your exams, it is because of the mobile device". Students are forced to abandon mobile devices despite using for learning. Students spending considerable hours on mobile devices is perceived misuse. Parents assume students are chatting for socialization. S7M illustrates parents' perceptions.

"Sometimes my parents have a problem because they say I am always on my phone instead of being on my books. Why don't I use the time that I am always on my phone, on social media, use that time for doing my studies?" S7M

When students have intention to learn using mobile devices, hours on mobile devices are used for learning. Few parents inform their children the onus of learning is upon them.

#### *8.5.2.1.2 Teachers perceptions on students use of mobile devices*

Teachers hold perceptions on students' use of mobile devices. Teachers argue students using mobile devices assists in losing attention on learning. Students suffer the complexity of being disrupted.

"Teachers discourage us because they know we are not really using it on our school work. It distracts us in classes as that is all we concentrate on. We don't learn much from what they are teaching us. Instead, we are busy on our phones and concentrating on them. Our business teacher discourages a lot". S5F

Teachers discourage use of mobile devices due to fear of students failing. S5F explains views from another teacher. Students go to school with mobile devices despite prohibition. In classrooms, students do not use mobile devices unless asked by a teacher. Teachers support students using mobile devices outside the class.

### 8.5.2.1.3 *Cultural environment*

The culture in the society has labelled constant use of mobile devices as misuse. S15F provides explanation on the phenomenon. The student insists, peers should monitor use of mobile devices to considerable hours.

“It's not a bad thing if you don't constantly do it. But currently we don't understand several things, especially in learning. So, I think it's quite an advantage. But it can also be a disadvantage as we try and rely mostly on the Internet without doing our own research first”. S15F

However, the student highlights the current generation will always use mobile devices to search for information. This is the 21<sup>st</sup> century with promises of science and technology and mobile devices is technology students have adopted.

### 8.5.2.2 **Network interconnectedness**

Students work in collaboration with peers to complete projects, assignments, homework and prepare for examination. Working in group's aid students understanding of content. Peers offer solutions using social networks and instant messaging applications. Students take pictures and audio records in classroom and share in groups. Groups are created on instant messaging applications and social networks.

“Like in class we normally, when we are lazy to write the breakdown or the work on the board, then we take pictures and send to each other. When we are to do a team work, group session and we take pictures and just work through pictures on WhatsApp or Facebook”. S9M

Students take pictures of notes and share in groups. Notes shared assist absent peers and lazy students to understand content covered. S9M explains. The student depicts use of WhatsApp and Facebook to complete tasks as a group.

Students record voice notes and share with peers. Voice notes recorded explains to peers how to approach a question from assignment. Peers record response and share.

### 8.5.2.3 **Consequences**

Students have suffered for having mobile devices. Students incur costs in buying Internet bundle on mobile devices. Students suffer due to mobile devices being confiscated. Confiscation of mobile devices happens both, at home and at school.

#### 8.5.2.3.1 *Expenses on Internet bundles (data)*

Students incur extra costs in buying Internet bundles. Internet use requires students to buy Internet bundles, also called data. When a mobile device is out of data, patience is important. Student waits for peers to call.

“Previously before we wrote our mock exams. I lost my phone. It was stolen. I suffered a lot because I used it for BIS and I didn't have to buy data all the time. But like now, its data, data, data, all the time”. S7M

Respondent S7M depicts impact of data. The student migrated from a Blackberry where Blackberry Internet Service (BIS) provide fixed Internet rate per month. Now the student buys Internet bundle that is capped. Finishing a bundle before allocated date means student must use pocket money for data.

#### 8.5.2.3.2 *Confiscation of mobile devices*

Mobile devices are confiscated from students. Confiscation happens both, at home and at school. At home parents and siblings deny students access to mobile devices. Parents confiscate mobile devices. Parents threaten children on confiscating mobile devices.

Students' mobile devices are confiscated at schools. Teachers insist on students not going to school with mobile devices. Students are either fined or mobile devices are confiscated if found at school.

“Parents have never stopped me from using my device. I have just got to the point of stopping myself from using my device and I give it to them”. S4F

Some parents have taken a different approach to confiscation. Parents have allowed children to use mobile devices and teach self-control. S4F depicts controlling use by giving parents her devices when she wants to study.

### **8.5.3 Concern**

Students, teacher and parents are all concerned on students' use of mobile devices for learning. Teachers and parents have the role as moral enforcers to ensure students do not misuse mobile devices. Principals must follow policies as moral creators. Policies at school do not allow use of mobile devices inside classroom.

Outside the classroom, students are worried of peer's misuse of mobile devices. Mobile devices with Wi-Fi and cameras are a source of distraction for students. Students take pictures, selfie and use Wi-Fi to distribute pictures. Wi-Fi- used is of free access.

“Most cases I doubt it. As I stated before, it's easy for someone to get distracted while using your mobile device, in terms of studying. You see. Because you are going to get a message and then you get distracted. As our teachers, there is a teacher who once said, "it's impossible for you to study with your phone, because you are going to get a message and then you are going to get distracted" and that is where you don't gain anything. You are busy on your phone chatting to people”. S7M

Teachers are concerned that students using mobile devices leads to disruption. Messages alter students’ attention to chatting as elaborated by S7M.

The principal announced during assembly of no mobile phone policy at the school. Announcing such claims during assembly enforces students fear and hinders use of mobile devices for learning.

“There is no teacher that opposes, it’s just a rule in the school not to use your phone in class, but if the teacher says its ok then they use it. I don’t think there will be a teacher that opposes researching something that you don’t understand it, if you have their permission of course”. S8M

Ironically, S8M identifies such statements as just following school rules. The student argues, no teacher opposes use of mobile devices outside the classroom. Teachers allow students to use mobile devices in classrooms to get definition of words. Teachers allowing students to use mobile devices guide students on what to search and where to search.

### **8.5.3.1 Moral enforcers**

Teachers are supposed to ensure students follow rules at school. Parents ensure students observe norms at home. Table 27 illustrates teachers’ views on students’ use of mobile devices. At least ten teachers accept student use mobile devices to socialize, search for information, recreational purposes and academic purposes.

Teachers are split on students’ use of mobile devices. Some teachers support use of mobile devices by challenging students, offering guidance and enquiring on students’ progress.

“I do not know of any teachers that oppose the use of devices for learning”. S2M

S2M argues all teachers support use of mobile devices for learning outside the classroom.

#### *8.5.3.1.1 Teachers supporting students use of mobile devices for learning*

Teachers supporting students use of mobile devices assist students to remember valuable information. Students contact teachers and acquire assistance. Teachers challenge students as a form of assisting.

“Majority of the teachers do support. Our English teacher told us that if we don't understand anything, we can go to Spark Notes. Use our phone and go to Spark Notes. She knows everyone has a phone and constantly on the Internet. So, she tells us to go to Spark Notes to get some English literature, reviews, summaries and stuff like that”. S15F

Teachers give assignments and details on where to download information. S15F identifies a website given by English teacher. The teacher asks students to access Spark Notes outside the classroom. The teacher not only supports students’ use of mobile devices for learning, but offers guidance.

Teachers allow students to use mobile devices for a limited time. S5F explains of life orientation teacher allowing students to search for information. Students access search engines during classroom interaction.

“Our life orientation teacher sometimes encourages us to use our devices. If she doesn’t have access to Internet, she will say, "Quickly go to your phones" and we must check. Once we are done with that, we must put our phones aside. Also, when she can't find what she wants to explain on the textbooks”. S5F

Students use mobile devices under guidance of teacher. Skills acquired during classroom interaction assist to polish students’ knowledge. This is not only on the subject, but also use of mobile devices for learning.

#### 8.5.3.1.2 *Teachers opposing students use of mobile devices for learning*

In one of the classes, as questionnaires were distributed, students submit phones to a teacher before class starts and are given back after class. Teachers opposing students’ use of mobile devices for learning are influenced by position, age and subject. Teachers are also misunderstood by students to oppose use of mobile devices. Teachers don’t want to lose control in classrooms. Students using mobile devices without teachers’ permission is a sign of a teacher not controlling the class.

Teachers in administrative positions ensure students observe school rules. Principal and deputy principal ensure students do not use mobile devices at school. S7M depicts teachers’ position affects views on students use of mobile devices.

“Our principal and our deputy principal discourage the use of devices, they say it’s a distraction. Because they have the mentality of back then where there was no way of getting to your phone to get information, they had to stick to their books and that was all”. S7M

Teachers opposing use of mobile device have confiscated mobile devices or charged R50 fine. The mobile device is given to the student after school hours.

Teachers who are digital immigrants don't support students' use of mobile devices. Teachers argue students will not have access to mobile devices during examination. Counter argument is, neither will recommended books be allowed in examination room. Mobile devices afford students multimedia that enhances learning.

Subjects influence teachers opposing use of mobile devices. Subjects such as mathematics and Afrikaans require attention from students. S15F describes subject specific teachers opposing use of mobile devices.

“The math teachers, says that we must just focus on the question papers they give us. We should put our phones away so that we can just focus for some time. The Afrikaans teacher also opposes, because we cannot get anything in Afrikaans on the Internet”. S15F

In School B, most of the teachers do not oppose use of mobile devices. Teachers want use outside the classroom. Subject like mathematics and Afrikaans are taken by dislike with some students. Students could use groups on instant messaging and social networks to share content on these subjects and motivate peers.

Teachers hold assumptions of students misusing mobile devices. S4F describes teachers mistrust on students using mobile devices.

“Some teachers don't believe as they say devices don't help. A student will say they will do the necessary stuff but they don't do what they must do. They just sat down and waste time on messaging and everything. The life-orientation teacher does not support the use of devices”. S4F

Students view using mobile devices in selected cases lead to information overload. S9F presents a discussion on information overload and the need to contact teachers for clarification.

“It's actually a safe way because Google does not give you everything. Yes, it gives you everything, but sometimes it gives you a lot of information for one question and then it ends up getting complicated. So, if you are like me, just go to the teacher and find out more”. S9F

Students fear interacting with teachers and find comfort on mobile devices provide. Absence of teachers means using mobile devices to supplement classroom interaction. Content not understood in class is aided by peers.

### **8.5.3.2 Moral creators**

The school has a policy of no mobile devices within school premises. Mobile devices should be used outside the school or in emergency. S8M depicts the school rule. The student also argues, teachers provide permission once asked.

“There is no teacher that opposes, it’s just a rule in the school not to use your phone in class, but if the teacher says it’s ok then they [students] use it. I don’t think there will be a teacher that opposes researching something that you don’t understand, if you have their permission of course”. S8M

The use must be for academic purposes. Using platforms like parents meeting and morning assembly to insist on no mobile devices at school has deterred students. Students fear to use mobile devices for learning.

### **8.5.4 Availability of mobile devices**

Students have adopted mobile devices. Students spend hours on mobile devices. Students use mobile device affordances to communicate and search for information. Students are not only information consumers, but also information creators. Students take pictures, record audio and video and share with peers. Peers provide comments on content shared. Students share academic and non-academic content.

#### **8.5.4.1 Mobile device affordances**

Students own mobile devices from Blackberry, Apple, Samsung, Huawei, LG, Sony and Nokia. Students own cell phones, smartphones and tablets. Students migrate from one company to another when buying new mobile devices. Mobile devices operate on Android, Blackberry, Windows and iOS.

Mobile devices afford students phone calls, messages and Internet. On the Internet, students access search engines, websites, social networks and instant messaging applications. S1M describes frustrations of migrating from Blackberry 8520 to Huawei P7. The student argues Internet bundles deplete quick.

“I had a blackberry 8520, the social media, BBM, WhatsApp and the fact I could use BIS was so good that you could save money and just buy airtime. The new phone I use now is much more data using and is much more expensive. In other words, the BIS is much cheaper”. S1M

The student describes using BBM and WhatsApp as instant messaging applications. The Internet is amongst affordances for students.

“I currently have a tablet [Proline] and a Sony Ericson. The tablet it's mostly the software, surfing the Internet is much easier on that one. On the Sony, it's just phone calls and messages. This means regular SMS and WhatsApp messages”. S2M

Other affordances comprise of, phone calls, SMS, instant messaging, social media, camera, storage space, multimedia and battery life.

#### **8.5.4.2 Loss or damage of mobile devices**

Students are at risk of losing mobile devices. Thieves target students as they believe most students own mobile devices and are afraid.

“Does that include my phone being stolen? It was someone just stole it. So, I lost my phone”. S1M

“On the current phone, I had to buy it myself. Because my parents had that "you have a phone, why do you have to buy another phone?" So, I had to save up to buy myself a phone. I did not tell them I had lost my phone”. S7M

Students losing mobile devices creates fear on carrying the mobile device. Students miss opportunity to use mobile device for learning. S1M gives an account of losing a mobile device. S7M could not tell parents his phone is stolen.

Students' mobile devices get damaged. Students incur the cost of repairing the damaged mobile device.

“I had an iPhone 5. I like the interface on it and all the other features, as the camera, the Internet, everything about it but. Unfortunately, it fell in the toilet. I like the phone but it fell on the toilet. iPhone is not waterproof yet”. S8M

Not all mobile devices are waterproof. Mobile devices damaged are of concern to students as argued by S8M. Solutions are buying a new mobile device or repairing damaged.

#### **8.5.5 Students ability to sustain mobile devices**

Students sustain mobile devices through buying airtime (credit) and Internet bundles. Students sustain mobile devices by sharing with peers in groups. Students have self-determination and are self-motivated in using mobile devices for learning.

“I had a blackberry 8520, the social media, BBM, WhatsApp and the fact I could use BIS was so good that you could save money and just buy airtime. The new phone I use now is much more data using and is much more expensive. In other words, the BIS is much cheaper”. S1M

Students save pocket money to buy Internet bundles and credit. Increase in Internet expenses means saving more pocket money. S1M recalls using a Blackberry device without Internet bundle problems. The Internet bundle lasted for a month. The student uses more Internet with a new mobile device.

#### **8.5.5.1 Self-determination in maintaining a mobile device**

Students are eager to learn. When library is closed or far, students use mobile devices to search for information. Searching for information includes using a mobile device to reach peers for assistance. It contains using a mobile device to search for information.

“Mostly in terms of searching for information, school information. For instance, I had an assignment and I did not have time to go to the library. I will just buy data and go to the Internet and search or I will ask someone about the information”. S7M

Students save travelling time and cost by contacting peers when library is closed or far. S7M explains using a mobile device to contact peers and search for information when the library is far.

Internet bundles that students have last for a specific period. Using Blackberry services affords Internet bundles lasting a month. When a student switches to another operating system, charges on Internet affect budget. Students using Blackberry mobile devices get affordance of Blackberry Internet Services (BIS) and reduces expenses.

Not every student visit library to study. Some students visit the library to access free Internet.

“Its data. The Internet takes a lot of the bundles and for that only I would only use the library because there is free access to the Internet. For anything that is urgent, I have no choice but to use my phone”. S6F

Respondent S6F preference is using the library. The student narrates, use of the library is to access free Internet. The student concludes, if she is in a hurry, a mobile device will be used.

#### **8.5.5.2 Students self-motivation in maintain mobile devices**

Students save from pocket money to buy mobile devices. Students also save from pocket money to buy airtime and Internet bundles.

“I work for them to put credit on them [devices she owns]. So, I work with other family members and the money I get I could put on my devices as credit. My parents are teaching me how to manage my finances and my life by working”. S2F

Families assist students to understand importance of saving. S2F explains of the lesson she is learning in the family. The student assists in family business and wages received buys airtime.

### **8.5.6 Effective use of mobile devices for learning**

Students depict effectively using mobile devices for learning. Students argue effective use of mobile devices is achieved by acquiring better explanation. Students also argue mobile devices assist in managing activities related to school. Table 21 shows 60 students supporting use of mobile devices to search for information.

Respondent S8M explains using a mobile device to understand content unclear in classroom.

“When for example I do not understand the question, or when a teacher explains something and said, "go home, research about it and find out" and I put my books away and I just concentrate on finding information. Sometimes like your book gives a lot of information and the phone sometimes just simplifies everything”. S8M

Content on the Internet is simplified and assists in understanding concepts. The student shows a relationship between using a mobile device for learning and achieving goals set.

Ineffective use of mobile devices emerges when students are distracted by messages and don't complete learning goal.

“They mean that not to go overboard. Just stick to the learning part and not to like, something out of line of learning. Just use your device to educate yourself, or for something that will help your mind grow and not for something like violence”. S15F

Students using mobile devices without goals experience ineffective use. S15F explains importance of students focusing on learning goals.

#### **8.5.6.1 Better explanations received from using mobile devices**

Students want mobile devices used as supplementary source of information. Effective use to S6F means using a mobile device when a student is struggling. S1M supports the argument. The student argues, when far from textbooks, a student should use a mobile device.

“I think it means use it for something that is important, like you can't get it from a book or anything. Don't just get a question and quickly go to the Internet. Sometimes you can get a question and you easily think on your own, but when something you can't get, then you can go to your phone. I think that is what it means”. S6F

“By importance I mean, if you don’t understand something, it’s easy. If you don’t have your books on you and you are somewhere like in the train or taxi and you just need some information. You don’t have to go home to look through your books. You have the phone on you so you just research”.

S1M

Respondent S1M also depicts using a mobile device to research. Searching for information is defined by students as researching. Textbooks have limited pages. Researching using a mobile device is limited by Internet bundle a student has. Students can search for information on the Internet due to unlimited content.

Students use social networks to communicate on academic content. Chatting provides students with assistance from peers. Receiving academic assistance is the goal of some students.

“It will actually improve more people’s knowledge and myself. We are always on our phones nowadays. It’s just to get better understanding of the work if we use the phones. Because the teacher is just talking and we don’t listen, but we can go through our phones and memories it”. S10M

Students chat with peers. Chatting affords students to break social networks into learning networks. S10M argues, so long as students are on mobile devices, students understand content better.

Students use mobile devices effectively by accessing multimedia on the Internet. Students view pictures and videos and listen to audio files. Students also read content on the Internet. Using multimedia, students understand content. Students visualize that taught. Students relate content to environment while learning.

Students contact peers as support structure. Students have formed groups where peers assist with academic queries.

“Yes. It was audio discussing maths with some other students. It was a group, so I recorded and sent to the group. For example, question 1, I would record myself explaining how I did it and send to the group so that they tell me how they did it and if they have the same answers or what”. S6F

Respondent S6F depicts producing content by recording a voice note. Content is shared with peers on instant messaging or social networks. Where students do not understand, teachers assist. Teachers supporting students’ use of mobile devices challenge by giving assignments. Thereafter, provide guidance on where to find specific content.

### **8.5.6.2 Students use of mobile devices to plan school related activities**

Students use multitude of affordances offered on mobile devices. Students do not only use the library for studying, they create content by taking pictures. Students take pictures of pages on books and during study hours, read on mobile devices. Pictures are now equivalent to reading a book.

“I will use the camera if I go to the library and I need to take pictures without editing. That is what happened in my exam. The phone is very loud, so the alarm can be good and it still wakes me up. My files, it’s easy to find my downloads and stuff I do”. S10M

Respondent S10M explains on taking pictures in the library. The student also uses other mobile device affordance, alarm and files. Students download multimedia from websites that are saved on a mobile device. The student refers to downloading such content as downloading files.

Student use mobile device alarm to wake him up to complete learning plans. Students uses calculator. Use of mobile devices calculators is expanded by S6F.

“I use my calculator for math, economics and sometimes for business studies. Or I can also use it for my languages when calculating the number of words in an essay. I use the camera to take pictures from someone else's book that I don't have”. S6F

The student uses calculator in different subjects including English to count words

Some students do not use mobile devices to plan school activities. Parents would wake up students and belief on mobile devices for learning is limited. S4F supports the argument.

“I don’t use the alarm as my mom wakes me up these days. In the past I used the alarm. I have a normal calculator that is in my bag. So, I don't use my phone for that”. S4F

Students use calendar on mobile devices to plan on academic activities. S8M uses mobile device to record exam dates.

“Like if I have appointments I will use the planner to set out my appointments. To set out exam dates. To set alarms like when to study and when I must return things to the library”. S8M

Students depict dependency on mobile devices through planning for academic activities. Students effectively use mobile devices to aid learning outside the classroom.

## **8.6 Conclusion**

Effective use of mobile devices is argued to emerge from better understanding students acquire. Better understanding includes using teachers to clarify information from the Internet. Students use mobile devices when far from textbooks. Students research using mobile devices. Using social networks, students access multimedia and share with peers. Peers are students support structure. Students use mobile devices to plan on school activities. Students use alarm, calculator, calendar and camera. Instead of lending a book from the library, students take pictures and use them for learning.

Final examination results for 2015 show the high school had a 96.5% pass rate. Few students didn't acquire marks permitting university entry. Students effectively use mobile devices as supplementary source of information.

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

The following sections of this chapter aggregates findings from Chapter 5 and 6 that provided findings from School A in Dar es Salaam Tanzania and Chapter 7 and 8 that analysed data from School B in Cape Town South Africa. Through complementary analysis, this chapter harmonises quantitative and qualitative findings from Dar-es-salaam and Cape Town in response to the research question. The chapter also relates findings to research on students' use of mobile devices for learning. It starts with thematic discussions and then proceeds by responding to research sub-questions. Lastly, the chapter concludes by discussing the main research question, limitations and realities.

Figure 4 provides the final framework on student's effective use of mobile devices for learning outside the classroom. The final framework aggregates three theories identified in chapter 3. The discussion relates final framework with the research findings. The discussion provides support from previous research. The framework is a theoretical contribution this research makes to the field of Information Systems.

The framework explains student's effective use of mobile devices for learning outside the classroom. The framework also explains teacher's perceptions and how students are affected. Further, the framework provides support from teachers using mobile devices for learning and assisting students. Students depict ability to sustain mobile devices and use effectively. Sustainability and effective use are discussed from high academic performing students. The patron from School A in Dar-es-salaam and geography teacher at School B in Cape Town assisted the researcher during data collection. The teachers informed the researcher of academic performing students per class.

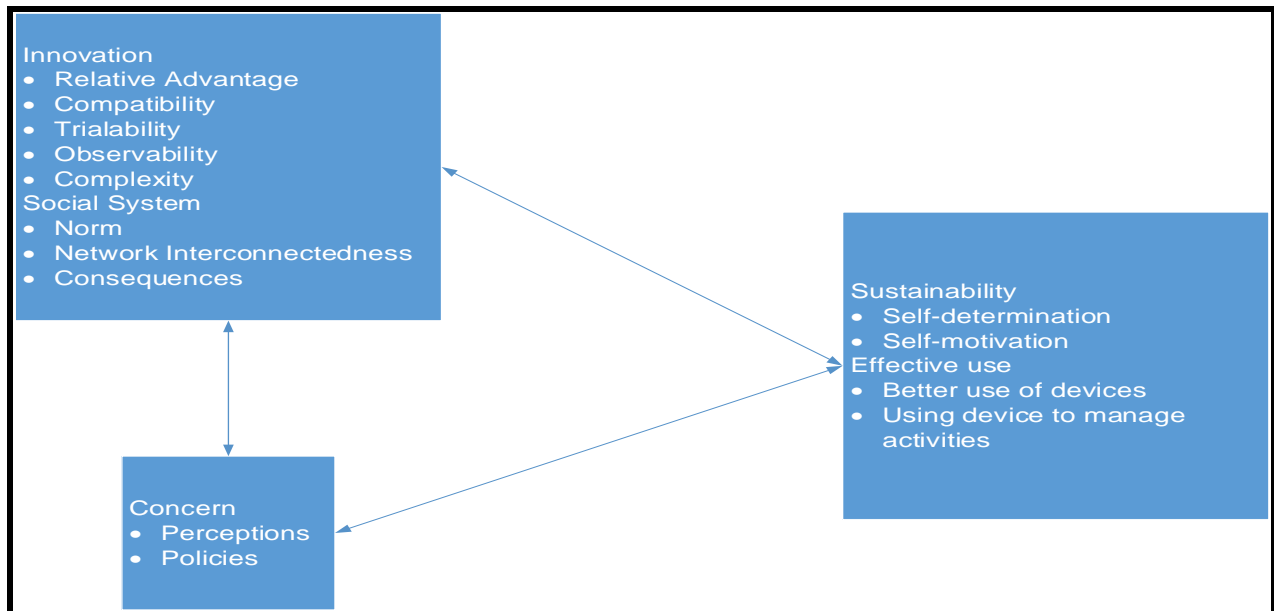


Figure 4: Revised framework on students' effective use of mobile devices for learning outside the classroom.

## 9.1 Innovation

Students have adopted mobile devices and use in their lives daily. Students use mobile devices to socialize, search for information and for recreational purposes. Similar findings have been presented in other research (Oblinger, Oblinger, & Lippincott, 2005; Seixas, Gomes, & Filho, 2016). Students use mobile devices for academic purposes as noted by Ciampa (2014).

Mobile devices afford student's access to the Internet, multimedia, social networks and instant messaging applications. Affordances are argued in previous studies (Bappah, 2013, Page & Kobsa, 2010, Rajasingham, 2011, Roodt et al., 2012). Affordances put students at risk of their mobile devices being confiscated and damaged (Kihwele & Bali, 2013; Twebaze, 2015). Mobile devices as an innovation, are characterised by relative advantage, observability, compatibility, trialability and complexity.

Students argue having a relative advantage when using mobile devices. Relative advantage is through student's ability to socialize, contact family and teachers (Markett, Sanchez, Weber, & Tangney, 2006; Seixas et al., 2016). Students also use mobile devices to download and use social networks and instant messaging applications.

Research shows, students download applications to access these affordance (Alsalem, 2013; Osakwe, Dlodlo, & Jere, 2017). One student responded by stating blogging as an affordance employed on mobile device owned. In this case, blogging allows the student access to social

networks and the platform to share content with his peers (Santos & Ali, 2012). Subsequently, peers contribute through comments (Ng'ambi (2013).

Students share content and trust content shared by their peers. The trust is argued to enhance students learning through (Johnson, Maasdorp, & McElwee, 2014; Krutka, Bergman, Flores, Mason, & Jack, 2014).

Students use mobile devices to contact family during emergencies. They also use mobile devices to chat with other family members, relatives and peers. Within families, students assist siblings through mobile devices to on academic issues.

Parents from School B often instruct their children to use mobile devices wisely since they can easily get disrupted by incoming messages from peers and social networks when using mobile devices for learning. Previous research substantiates this claim by arguing that such disruption leads to students abandoning current tasks to chat (Porter et al., 2016).

Students in School B did cite being able to contact teachers as a relative advantage to using mobile devices. Students in School A on the other hand contact teachers on several issues. Students mentioned that they contact teachers to wish them happiness during festive seasons, to enquire about their grades and to inform teachers when they will be absent. Research agrees on students contacting teachers using mobile devices as explained in Looi et al. (2016).

Students observe peers as they use mobile devices before adopting them. (Looi et al., 2016). While observing, students become interested in the process and subsequently seek advice from peers and shop attendants on which mobile devices to acquire.

Students receive technical support from peers and relatives on affordances of interest. Technical support includes details on the operating system and storage capacity of a mobile device. Regardless of advice and support, students make emotional decisions during adoption. Factors that influence student's emotional decisions relate to the cost of the mobile device and issues such as within budget, durability and quality.

Students try mobile devices before acquiring. From observations, students inquire and try mobile devices before they purchase one (Ciampa, 2014; Ma, 2017). Students prefer a blend of multimedia and text in both secondary schools as supported by previous research (Johnston, 2013; Parajuli, 2016). Students use Google, YouTube, camera and video and maps on mobile devices for learning outside the classroom. These affordances enhance and enrich learning (Keren-Kolb, 2013).

Students also demonstrated that using a mobile device for learning outside the classroom is compatible with traditional education. Research maintains impact is on lifelong learning (Cavus, Bicen, & Akcil, 2008; Parajuli, 2016; Sharples, Taylor, & Vavoula, 2005). Students argue mobile devices are convenient due to affordance of reading while travelling, in cafeterias, taxis and trains (Motiwalla, 2007).

Students use mobile devices for almost all subjects. In language subjects, such as Afrikaans and Swahili, students employ mobile devices. This point is supported by several researchers (Chen, 2013, Demouy, Jones, Kan, Kukulska-Hulme, & Eardley, 2016, Ma, 2017).

Google is cited as the search engine used by students in both countries for learning. Students often used the phrase “I Googled” to mean the use of the search engine. Apart from search engines, students use websites, Wikipedia and YouTube for learning. Similar findings are explained by different research (Kaliisa & Picard, 2017, Roodt et al., 2012).

Language on Internet is of great concern in School A. English as a medium of communication has received criticism from academics (Vavrus, 2009). During interviews in School A students used Swahili. The researcher allowed students to use Swahili as they argued English might not communicate that intended.

Students depict Swahili is the strongest language in secondary schools especially in countries where English is not mother tongue (Brock-Utne, 2005). Students stated struggling to use the Internet due to complex English. Students that failed to understand content on Internet often returned to using their textbooks. This supports the argument that, mobile devices are supplementary to traditional methods of learning. Students have read textbook and use mobile devices for better explanation.

Students from both cases argue for increased accuracy of content on the Internet since the Internet provides multitude of sources of information (Koole, 2009; Rozario, Ortlieb, & Rennie, 2016). Accessing incorrect information may not be productive for a secondary school student. Accessing inaccurate information may lead to students failing examinations due to confusion and as such, students contact teachers to clarify content.

Students argue mobile devices are not as complex as the researcher assumed. Students are sceptical of information overload. Students need to be vigilant of content beyond their level. Device incompatibility may influence students to abandon mobile device as it will be viewed complex. Students want mobile devices that will simplify academic work as explained by (Kafyulilo, 2014).

## 9.2 Social system

The social system in both countries has affected student's use of mobile devices for learning outside the classroom. Norms in the society have created perceptions from students, parents and teachers on student's misuse of mobile devices (Prensky, 2007). Choliz (2010) argues that such perceptions are fuelled by the hours' students spend on mobile devices. Teachers claim students fail their subjects due to the hours spent on mobile devices. Teacher's claims are supported by Chen & Yan (2016) who explain that mobile devices affects the attention span on students which adversely impacts students' performance.

In addition to societal norms, culture also affects student's use of mobile devices. Teachers uphold traditional classroom norms and view the use of mobile devices as a cause for disruption. The outcome is a clash of culture between teachers and students (Winters, 2007). This is demonstrated in School A whereby students are not allowed to have mobile devices at school.

Research shows mobile devices are banned from use in classroom in several countries (Ally & Tsinakos, 2014; Campbell, 2006; Kafyulilo, 2014; Porter et al., 2016). From this research, students in School B went to school with mobile devices and were not allowed to use mobile devices in classrooms unless the teacher requests. Students were allowed to use mobile devices during breaks and communicate to peers and family members.

Using mobile devices, students use network of peers for assistance and explanation of unclear content. Students provide support to peers through social networks and instant messaging applications. Choliz (2010) provides similar findings. Peer support extends to include online friends in different countries that support or contribute solutions to online questions.

Consequences students face from using mobile devices include complain of misuse and device confiscation. Peers and family members complain about misuse of mobile devices including accessing inappropriate material such as pornographic pictures and videos (Porter et al., 2016). Family members investigate siblings' access and use of mobile devices due to fear of accessing inappropriate content and communicating to strangers. Much of the fear is built on hours' students spend on mobile devices.

Mobile devices found in possession of students have been confiscated at home and schools when accessing different content than related to learning during study hours. Twebaze (2015) provides evidence of similar findings in Uganda. In School B teachers returned confiscated mobile devices to students after class or after students have paid a fine. Similarly, teachers in School A return

mobile devices to students at the end of a term. In extreme cases, students found possessing mobile devices at schools have been publicly humiliated during morning school assemblies or have had their mobile devices destroyed

### **9.3 Concern**

Teachers, who are seen as moral enforcers are split between supporting and opposing the use of mobile devices for learning outside the classroom. Teachers that support student's use of mobile devices have often given their personal mobile numbers to students in order for student to report on absenteeism.

In using mobile devices, teachers offer guidance and assistance to secondary school students on content to read. Lai (2015) and Prensky (2007) provide evidence of teachers communicating with students using mobile devices for learning. Teachers challenge students to use mobile devices for learning. Teacher provide homework or assignments where students can use both their textbook or Internet for solutions. During feedback, teachers validate or falsify student's answers.

Validating answers gives students the courage to use mobile devices for learning. Teachers in School B offer limited time access for students to use mobile devices in classrooms to search for information. Searching for definitions and arguments in a question with teachers support empowers students and enhances learning as expounded in previous researches (Ciampa, 2014; Kaliisa & Picard, 2017).

Teachers opposing the use of mobile devices for learning are digital immigrants and are in academic positions in schools. Teachers instilling a ban on mobile devices for learning are impaired by failure to use the technology themselves and subsequently pin this on students (Prensky, 2007). Teachers fear students that use mobile devices will access inappropriate content. Generally, teachers expressed that their greatest worry is that students will fail their subjects and the school will be blamed.

Furthermore, teachers opposing the use of mobile devices want students to understand the application of formulae instead of relying on the calculator on the mobile device. Teachers believe using mobile devices for learning makes students weak in providing arguments. Teachers also claim that students will find content on the Internet and not apply skills or recollect from the taught content to answer questions (Cardoza & Tunks, 2014).

Teachers claim students use mobile devices to socialize, for recreational purposes and searching for information (Oblinger et al., 2005). Teachers in School A can learn from colleagues in School B belief on student's use of mobile devices for learning. Teacher have not realized that students quickly, efficiently and effectively adopt mobile devices for learning. Teachers enhance learning by aiding, guiding and supporting the use of mobile devices for learning outside the classroom.

#### **9.4 Sustainability**

Students sustain mobile devices through self-determination and self-motivation. Students depict behaviours inherent in ensuring daily use of mobile devices. Students save from pocket money to buy Internet bundles and airtime. Porter et al. (2016) found that students save pocket money and sacrifice food and school books for airtime and Internet bundles.

Students in School A are affected by the reduction of Internet bundles. Students use more money to acquire Internet bundles or join student bundles that have time restrictions. Despite the reduction in Internet bundles, students save money to buy Internet bundles in order to use their mobile devices for learning.

One interesting finding was student's willingness to create and share solution. Chen (2013) found students share academic content with peers. Student's access search engines and websites and share academic information with their peers by taking pictures, videos and record audio files that are shared with peers offering solutions on academic content.

#### **9.5 Effective use**

Students use mobile devices in an effective way. Effective use relates to goals students create while using mobile devices (Martin & Ertzberger, 2013; Ng'ambi, 2013; Thornton & Houser, 2005). Student's effective use of mobile devices includes acquiring better explanation and managing school activities. This discussion on effective use is argued from high academic performing students.

Better explanation comprises of using mobile devices to assist in completing academic activities such as completing of assignment, homework and test preparation. An example of better explanation is students use mobile devices to search for definitions. Further, students communicate with their peers for assistance on academic content and explanation. Students have online friends that aid in understanding content as found by Ng'ambi (2013). As such, mobile devices often

enhance students learning with examples from multimedia websites. Habler, Major & Hennessy (2016) provides a similar explanation on the enhancement of content and collaborative work.

Students use mobile devices to plan school activities. Applications on mobile devices that student use include accessing the calendar and to-do list to organize schedules. Students also use an alarm function to wake them up in the morning and the stop-watch when practising for their mock-examinations. Another function commonly used by students is a calculator that aid in acquiring accurate answers. These affordances enrich students learning environment by controlling and monitoring progress towards attaining goals.

Mobile device affordances organize and simplify students' lives as identified by previous research (Ally & Tsinakos, 2014; Kafyulilo, 2014; O'Bannon & Thomas, 2015; Santos & Ali, 2012). Secondary school students in School A went further to request that calculators should be accepted in examinations to assist with accurate answers.

Effective use of mobile devices by students affords access to search engines and websites offering information which complements and enhances the information that students apply in classroom. Ownership of a mobile device provides an opportunity for a student to create their own reading targets. Ciampa (2014) explains students gain a sense of ownership through mobile devices and content creation.

Setting and attaining own goals not only depicts effective use, but also student-centred learning. Students are active learners through mobile devices. Similar findings on students as active learners and student-centred learning are echoed by researchers Chen (2013), Khaddage et al. (2015) and Motiwalla (2007).

## **9.6 Experienced realities**

Chapter 1 section 1.7 Research limitations and assumptions, provides the assumptions the researcher held prior to data collection. Assumptions held were, a) students use mobile devices daily b) teachers oppose students use of mobile devices and c) In rare occasions, students use mobile devices for learning.

Findings illustrate students use mobile devices in daily life and that students not only use mobile devices to socialize, search for information and recreational purposes, but also used it for learning. Furthermore, while students learn from peers and teacher alike they also use mobile device affordances to assist them in learning. Functions and platforms used on mobile devices for learning

include calling, sending SMS and the Internet. These functions are used as they afford students with quick responses from peers and easy access to information on search engines and websites assisting with concept clarification and understanding.

Not all teachers however oppose student's use of mobile devices. Teachers in administrative positions oppose use of mobile devices for learning inside and outside the classroom as they claim students' access inappropriate content. Other teachers support students' use of mobile devices for learning outside the classroom. Teachers provide support, guidance and assistance to students through mobile devices.

## **9.7 Recalling research sub-questions**

The research was guided by a main question and sub-questions. This section offers solutions to sub-questions in verge of answering main question. Thereafter, the main research question is answered.

### **9.7.1 To what extent are secondary school students in Tanzania and South Africa using mobile devices for learning outside the classroom?**

Quantitative data from table 5.3 and 7.3 illustrate that almost all students have adopted mobile devices. The data illustrated that students use mobile devices to socialize, search for information, for recreational and academic purposes. Students also used mobile devices while in cafeterias, taxis, buses and trains for learning.

Students use mobile device in different subjects. Students search for solutions on assignments, tests, practical and mock-examinations. They also used mobile devices for clarification on concepts that are hard to understand or unclear. Students contact peers and teachers for assistance and support on content unclear. Students are guided by teachers on content to read for classroom preparation.

Students are determined to use mobile devices for learning outside the classroom by saving pocket money to buy mobile devices, credit and Internet bundles. Reduction in Internet bundles sizes has affected students as more pocket money needs to be saved. Still, students create videos, pictures and audio files and share with their peers.

### **9.7.2 What mobile device affordances do secondary school students use outside the classroom for learning?**

Students own cell phones, smartphones and tablets. Mobile devices provides affordances to students such as calling, sending SMS and access to Internet. Outside the classroom, students call and text peers to either offer or to enquire on academic issues. Students use social networks such as Facebook, Twitter and Instagram to share academic information. Students also use instant messaging applications, WhatsApp, Viber and Messenger for learning.

Students use multimedia and text to create content. Content created is shared with peers through social networks or instant messaging applications. Students also assist other peers by explaining content and offering solutions to assignments. Using their mobile devices, students provide assistance to siblings on academic issues.

Students employ calculator, alarm, dictionary and calendar and to-do list on their mobile devices to assist with completing academic activities. Not only are students able to wake up early, they can search for unfamiliar words on their mobile devices and organize activities with peers by placing them on calendar. To-do list assists students to organize thoughts and tasks they have to complete. In using the Internet, students access search engines and websites to acquire academic content through Google, YouTube and Wikipedia to assist in explaining unclear content. Content acquired is also shared to peers and teachers for further explanation and clarification.

### **9.7.3 What influences secondary school students use of mobile devices for learning outside the classroom?**

Students demonstrated to have confidence in the functions of mobile devices. Students use mobile devices as a platform for communication. Students chat with peers on general issues and academic content. Students are influenced by the need to communicate with academic achieving peers. Students know that by communicating with such peers, access to solutions is easily accessible. Students also demonstrated to use peers as a point of reference in understanding content.

Students are influenced by group assistance offered through instant messaging applications and social networks.. Sharing of resources prompts students to use mobile devices outside the classroom. Students understand teachers are available for guidance and assistance on content that is unclear and they require further information. Further, students are influenced to communicate with teachers where they inform of absenteeism from school.

Students use mobile devices to access multimedia. Students create multimedia content and share with peers. Multimedia content is also shared with teachers. Students' access multimedia through search engines and website such as Google, YouTube and Wikipedia for better concept clarification and details to enhance that explained in traditional recommended textbooks.

Students are influenced to use mobile devices by the presence of calculator, alarm, dictionary and calendar. Teachers challenge the use of calculators on mobile devices as they fear students will not know formulae and fail in national examinations. Providing solutions without showing their work or how students' solved a question often leads to teachers believing that students cheated during an examination.

#### **9.7.4 What does effective use of mobile devices for learning outside the classroom infer in the context of secondary school students' in Tanzania and South Africa and how does it influence academic performance?**

Effective use of mobile devices supports better explanation and managing school activities. Student's effective use entails communicating with peers for assistance in completing assignments, acquiring definitions and seeking clarification of concepts from peers and teachers. Students also have online friends that assist with solutions or comments. Teachers challenge students and guide inquiry on unclear concepts.

Students use a blend of multimedia and text to understand concepts. Students access multimedia websites for clarification of concepts. Students have used multimedia affordances in their mobile devices that are shared with peers for assistance which not only expand their understanding but also provides examples students can relate to in explaining a concept.

Students manage school work by using alarm, stop-watch, calculator, calendar and to-do list to organise future events. The use of these affordances assists students to organize school issues and attend to activities with certainty. Students attend class and meeting on time and prepare for tests and examinations with knowledge of time to consider for each question and amount of effort to place on it.

Mobile devices have aided student's academic performance. In both schools, students mentioned using mobile devices for learning outside the classroom. Contrary to teacher's assumptions that students will fail, students in both secondary schools passed. School A had 81.5% pass rate, while

School B had 96.5% pass. Few students in School A did not continue with Form V. In school B, a number of students did not immediately pursue undergraduate studies.

Students have an academic goal when using mobile devices which relates use of mobile devices to effective use. Students do not provide an account of how many hours they use mobile devices for learning, rather, completion of a particular task is of utmost importance. Using mobile devices, students acquire information assisting with passing examinations.

### **9.7.5 What are teachers' perceptions of students' use of mobile devices for learning outside the classroom?**

Teachers believe students use mobile devices to socialize, search for information and recreational purposes. Teachers tend to support student's use of mobile devices for clarification of concepts and provide guidance. On the other hand, teachers do encourage the use of mobile phone by informing student's on topics to read and sources to use that are accessible through mobile phone devices. Similarly, students communicate with teachers to enquire about content that they have read on websites and other platforms while using mobile devices.

Teachers that support the use of mobile devices require students to inform them on dates and reasons they will be absent from school. As such, students call, send SMS and use social networks such as Facebook to communicate with teachers on administrative issues. Students also communicate with teachers on academic reports.

Teachers at School B give students access to mobile devices for a limited period during classroom interactions where definitions and examples are provided based on content found on the Internet. When students encounter unfamiliar content, teachers provide explanation and assistance which extends students learning.

Teachers opposing students' use of mobile devices are digital immigrants that inform policy and school rules including prohibition of using mobile devices in school premises. As moral enforcers teachers in School A enforce the no mobile device policy in secondary schools.

Teachers apprehension with mobile devices stems from the fear that students will access inappropriate content since students use of mobile devices is uncontrolled by teachers. Teachers' also associate long period's spent on mobile devices by students to misuse of mobile devices. In this instance, misuse is related to accessing inappropriate content such as pornographic material. Teachers also claim misuse of mobile devices may lead to student's failure in examinations.

Teachers want students not to rely on mobile devices. Teachers argue, student's reliance on calculator and dictionaries will have a negative effect during examinations as access to such affordances is limited. Students are not allowed to enter into examination rooms with mobile devices.

## **9.8 Response to the main research question**

This study aimed to answer the primary research question which was, *what influence does effective use of mobile devices for learning outside the classroom have on the academic performance of secondary school students in Tanzania and South Africa?*

In order to answer the research question, I defined effective use as achievements (goals) students intend to acquire when using mobile devices for learning outside the classroom. Ability to attain such goals must be demonstrated in the students' examination results. Use of mobile devices outside the classroom by secondary school students can only be measured through examination results, academic performance.

In the study, both schools passed in 2015 final examinations. School A attained 85% pass in Form IV examinations. School B acquired 96% matric pass. This illustrated that Mobile devices, when effectively used outside the classroom aid students learning and influence academic performance. The research found effective use of mobile devices for learning outside the classroom is influenced by several factors, which include, mobile device affordances, contacting peers, contacting teachers and concerns by teachers and parents. Effective use of mobile devices and its functions also lead to better explanation of course content and managing school activities.

Mobile device affordances include calling, sending SMS and using the Internet. Students use mobile devices in all subjects to complete assignments, homework, practical and mock-test or examinations. The ability to use mobile devices in different locations such as cafeterias, taxis, buses and trains makes the use of mobile devices more accessible. Through the use of mobile devices, the Internet affords students access to search engines, websites, social networks and instant messaging applications. Access to such tools assists students in understanding concepts, seeking clarification on unclear concepts and aids in the preparation for classroom interaction.

Students access several affordances on mobile devices such as calculators, stopwatches, alarms, calendars, to-do list and dictionary. Each affordance introduces a student to a world of simplified work and convenience. For instance, students do not have to cram test and examination dates since

the calendar aids in managing their dates, students monitor progress when undertaking mock-examinations using their stop-watch, Students do not have to round-off numbers leading to errors, calculators assist with such. When effectively used, these affordances enhance students learning by managing school activities.

A blend of multimedia affordances and text aid students understanding course content. Clarification of arguments is vivid once a student observes a picture or video explaining content accompanied by text. Students also use audios to explain concepts to peers. New understandings and explanations are shared with peers.

Students contact peers that explain unclear concepts. Students don't only socialize with peers and family through chatting, student's aid peers and siblings learning through the use of mobile devices. Students communicate with peers in groups on social networks and instant messaging applications. Students share content found on websites and search engines with peers. Students also create content and share with peers. Such interactions create a high sense of ownership among students which further motivates them to share content.

Students depict self-determination by saving pocket money to enhance mobile device affordances. When out of credit students contact peers by sending request for call back and peers call to offer assistance. Students access multimedia affordances while using Internet bundle bought from saved pocket money. Students buy airtime and mobile devices using their pocket money.

Students contact teachers for clarification of concepts and preparation for the classroom. Teachers explain unclear concepts through phone calls, SMS, social networks and instant messaging applications. Teachers provide challenges to students forcing use of mobile devices to answer. Teachers provide guidance to students on responding to challenges and content accessed. Teachers require students to inform on absenteeism as a support role. Teachers use the technique to reduce truancy.

Concerns that students have when effectively using mobile devices for learning relate to language, content, how to use the mobile devices themselves and the risk of the mobile phone being confiscated. Student's state language used on the Internet is complex. When students struggle to understand content from the Internet while using mobile devices they often refer back to their recommended textbooks for further clarification. The complexity of language emerges after switching from mother tongue to English.

Moreover, students are concerned with information overload and accuracy of content that they access using their mobile devices. Information overload emerges when students access content above their grade level. In such cases, students usually do not have copies of curriculum and do not know how to set a limit on content from the Internet. Instead of printing curriculum and distributing to students, schools can place curriculum on the school website which is accessible to students through mobile devices. Students require accurate information and failure to get accurate information leads to students responding to incorrect content in examinations. The accuracy of information and website validity can only be performed by teachers who offer guidance. Students who don't contact teachers are thus left to fend on unaccredited content.

Various functions on mobile devices are of concern to students. This includes device incompatibility and cost of mobile devices. For instance, mobile devices produced by iPhone are incompatible on Bluetooth affordance with other mobile devices. As such, students view acquiring an iPhone limits learning. Using the Bluetooth function, students share multimedia academic content with peers. Students are also concerned about expensive mobile devices that require buying through black-market as they cannot afford prices at the shop.

Student's mobile devices are confiscated resulting in limiting their learning. Confiscation occurs at home and school. At home, mobile devices are confiscated by parents and siblings. At school, confiscation is conducted by administrative teachers. Teachers in rare cases listen to student explanations and return the mobile device. Students are fined for owning mobile devices. Student's mobile devices get destroyed or are returned at end of term limiting both, access and learning. Harshly, students are paraded during morning assembly and given warning letters. Accumulation of three warning letters warrants suspension or dismissal. Such concerns often hinder some students from adopting mobile devices for learning.

The use of the word influence has assisted in linking effective use to academic performance by showing the relationship that exists between the concepts and providing empirical evidence to support the outcome using the school pass rate. Influence is used not only as a noun but also as a verb by providing an explicit explanation of effective use of mobile devices and connecting it to students' academic performance during national examinations (matric examination). By so doing, the research appropriates and concretizes SEUMD as a framework that can be used to understand adoption of a technology and its relationship to learning through a distinct explanation of effective use of mobile devices.

## **9.9 Conclusion**

Perhaps there is a need to assess and review policies. Mobile devices are often seen as an obstacle by teacher's opposing student's use of mobile devices for learning. Teachers greatest fear has been hours' students are on mobile devices and the possibility of students accessing inappropriate content.

The 'no mobile device' policy in secondary schools and high school needs a review. As a starting phase, students can be given limited and guided access to mobile devices. Teachers can inform students on how to use mobile devices outside the classroom. Students in remote locations can learn from peers instead of regarding mobile devices as a communication tool.

## CHAPTER 10: CONCLUSION

Chapter 10 begins by assessing the application of interpretive research paradigm on this research. The chapter proceeds to a discussion on research contribution. Finally, the paper provides a conclusion and area for future research.

### 10.1 Evaluation of Interpretive research

Information systems research requires a review of qualitative processes to ensure confirmation to set standards. Interpretivist research employs Klein & Myers (1999) principles as argued by Okoli & Schabram (2010) to review a research output using seven principles. The seven principles are,

1. **The fundamental principle of the hermeneutic circle.** Before data collection, the researcher applied literature on student's use of mobile devices for learning outside the classroom to approach and understand students use.

The researcher iterated an understanding of the respondents view from individual students to the population. Each student was assessed in their individual capacity. Individual responses in a theme were assessed to identify different inherent arguments.

Thereafter, themes were assessed to ensure sub-themes relate the story. Respondent views were then organized in a logical manner with a focus on showing supporting or rival explanations. A review was undertaken on each theme to ensure conformity to internal homogeneity and external heterogeneity.

2. **The principle of contextualization.** The two data collection locations were approached independently. School A is situated in a low-income community and students come from several parts of Dar-es-salaam. Students travel up to 15km to school. The school has boarding and day scholars. Boarding facilities are for students whose families reside outside Dar-es-salaam and are in Form IV.

School B has historical significance given then country's history. The school is in the central business district (CBD) in Cape Town in a predominant population of coloureds. Before conversion of the district name to Zonnebloem, the area was called District Six.

The school was named in 1953 after a coloured education activity. He was the first coloured man to graduate with a *Bachelor of Arts degree* from the University of Cape Town (South Africa) in 1911.

3. **The principle of interaction between the researcher and the subjects.** The researcher spent considerable time at the secondary schools. Prior to data collection, an appointment was made with the school head masters and principals. The headmaster in Dar-es-salaam directed the researcher to the second master and then to the school patron. The school patron assisted by introducing the researcher to students and teachers. The principal in Cape Town assisted by entering each class with the researcher.

In both cases, the researcher initiated communication in classrooms by asking students to complete questionnaires for quantitative data. In the process of submitting questionnaires, a female student in Dar-es-salaam identified another student had documented age as 12 years instead of 17 years. The student raised the issues in class and informed the researcher the students' accurate age. The interaction in this case depicts the uniqueness that engagement with subjects should not focus on acquiring data but rapport is also important. Students volunteered for interviews but were also filtered to include students that perform well in academics.

Students in Dar-es-salaam used Swahili, those in Cape Town used English. Students in Cape Town exchanged numbers with researcher and organized interviews through WhatsApp. Changes in date, time or location were communicated using WhatsApp, SMS and calling students where necessary. Students in Dar-es-salaam preferred physically meeting and intense planning was done after collecting quantitative data by students selecting a date, time and venue the researcher can interview them.

Through interviews, students assisted the researcher to know of companies manufacturing mobile devices. Yxtel and Ditel were companies the researcher heard from students for the first time. Through interviews, students also realized they are learning when using mobile devices.

4. **The principle of abstraction and generalization.** Quantitative and qualitative data are discussed using SEUMD which affords abstraction. During discussion of findings, respondent's views are related to themes adapted from the framework. Using the framework provides for an abstraction in comparison to analysing using research protocol questions.

Generalization is arrived by explaining student's access to mobile devices and use through their ability to save on pocket money for airtime and Internet bundles which affords

communication with peers through instant messaging and social networks. Conversations students focused on were on academic content. Teachers play a significant role by providing support and guidance, clarifying concepts and challenging students.

5. **The principle of dialogical reasoning.** The researcher started data collection with the assumption that few students use mobile devices for learning. The expectation was students predominately use mobile devices to socialize, search for information and for recreational purposes. Specifically, the researcher did not expect much contribution to use of mobile devices for learning by students in School A. This is partly because mobile devices are banned at schools and due to low exposure to learning through mobile devices as identified in the literature.

Students surprised the researcher through quantitative data as students depicted using mobile devices for learning. Students depicted calling, texting and using instant messaging for learning. Students depicted using YouTube, Google, camera and video and Maps for learning.

The researcher expected students to argue using mobile devices for learning is a complex process. However, data from the interviews demonstrated that students view using mobile devices for learning as a process that simplifies school work and aids in the learning with few hesitations on language and validity of the websites.

6. **The principle of multiple interpretations.** The principle was applied in several themes to depict multiple explanations from respondents on similar questions. Students argue Internet bundles are expensive. Students who used Blackberry and migrated to Android complain about Internet cost. Findings depict peers believe if a student intends to learn, Internet cost and period will not deter.

The other area multiple interpretations were applied is in communication with teachers. Students in Dar-es-salaam argue teachers wrote mobile phone numbers on the blackboard during classroom interactions. Ironically, some students argue they do not have their teacher's phone numbers and they were not given in classrooms. The difference depicts either students were not interested on having their teachers number or absent from school on stated date.

7. **The principle of suspicion.** The principle of suspicion was applied to mobile device affordance. A student that owns a Samsung mobile device with Internet access claimed not

having YouTube. The student did not know Samsung devices use Android and YouTube is preloaded by Samsung on each mobile device.

## **10.2 Contribution**

The research on student's effective use of mobile devices for learning outside the classroom is unique in that student's explanation in comparison to teacher's views have not been argued for especially in South African and Tanzania. To better understand this, the research used abduction to depict student's effective use and explain affordances students apply from their mobile devices.

### **10.2.1 Contribution to literature**

The research contributes to a body of knowledge on outside the classroom access and use of mobile devices for learning from developing countries, specifically South Africa and Tanzania. The research also contributes to students and teachers views on the use of mobile devices for learning outside the classroom. In general, the research contributes to education and adoption of technology for learning.

The research assesses responses from students and teachers as stakeholders and brings to question networks assistance in the adoption of a technology. Effective use is argued by students and necessitates the need for policy makers and stakeholders to revisit ban of mobile devices in secondary schools as students are already using them outside the classrooms. The practical application of the research is that it can be used as a discussion opener towards providing education on the effective use of mobile devices to secondary school students.

### **10.2.2 Contribution to theory**

The framework on student's effective use of mobile devices for learning outside the classroom (SEUMD) explains unique interactions that happen between students and mobile devices. These interactions are relevant in developing countries where the shortage of teaching and learning material are rampant. To topple the problems, classrooms are often overcrowded and the shortage of skilled teachers is on the rise.

The framework provides sustainable solutions to secondary school students on effectively applying technology at reach and how it can be self-maintained. Using empirical findings, the framework identifies learning outside the classroom is assisted by networks that students have and the need to sustain the mobile devices by saving pocket money to buy airtime or Internet bundles.

The framework provides a complementary explanation to teachers concerns and how it affects student's use of mobile devices. The framework also demonstrates students are indeed learning using mobile devices. This is demonstrated by students who communicate with teachers for support, guidance and clarification of content. Further, the framework uses multiple case studies to offer explanations unique in developing countries and that can affect how a technology is adopted in informal settings.

To understand effective use, the research connects adoption of mobile devices to academic performance through the use of the word influence. Influence affords providing an explanation on technology adoption in education through viewing concerns that stakeholders have and relating to that subjects of the study have access to and can sustain. SEUMD thus affords an explanatory study where it informs of *how* and *why* an innovation can be employed in informal learning.

### **10.2.3 Contribution to methodology**

This research contributes to the methodology by applying SEUMD on multiple case study. SEUMD is a combination of concepts from the Diffusion of Innovation theory, the theory of Moral Panic and the theory of Positive Deviance. The framework has been used to provide explanation and understand how students in secondary schools in South Africa and Tanzania effectively use mobile devices outside the classroom for learning.

The research uses multiple case studies and within each employs a mixed method to understand the phenomenon of interest. Since the framework is new the combination of methods provides for methodological contribution. The use of multiple analysis approach and especially in a sequential mixed method approach provides for uniqueness based on the use of SEUMD. This research thus explains the application of the framework on multiple unique and high academic performing cases. The use of cross-sectional timeframe on Interpretivist approach strengthens contribution to the methodology by relating appropriateness of the framework to the multiple cases.

Further, assessment and critique of theories and approaches used in understanding adoption of technology in education in developing countries provides for a methodological contribution. The research therefore provides for a discussion on the difference in contexts, approaches and methods that other adoption researches have applied and justified on non-applicability to this study which is relevant prior to introducing a new framework.

### **10.3 Conclusion**

This research aimed at explaining student's effective use of mobile devices for learning outside the classroom. Considering education problems in developing countries, using mobile devices for learning assists with poverty alleviation. One way of eradicating poverty is argued to be through obtaining an education. Developing countries have several problems affecting formal education setting. Application of ICT technologies outside the classroom assists to overcome said problems. Central to ICT technology use is the need for sustainability. Sustainable solutions allow students to use mobile devices to acquire knowledge and transform learning life. For most students in developing countries, a mobile device is the technology they possess. Students sustain mobile devices by saving on pocket money and buying airtime and Internet bundles.

The ability to share information with peers, searching for information and using mobile device affordances is argued to allow students to foster in education. The ability to search for information when the need arises is assumed to allow students to overcome the need of being employed upon completion and opens opportunities for self-employment.

By self-employing, students can contribute by paying tax and employing others. Students can use the networks created to foster capital for business development or investments. Throughout, students increase government income, which in turn can be used to curb shortages in education systems in the countries.

Despite hype on effective use of mobile devices for learning, there are areas of concern for policy developers and implementers. Students struggle with language used on the Internet. Whether English is their first language or not, content on the Internet is abundant and there is a need to verify the accuracy and authenticity of certain websites. Realizing shortage of resources in education in Africa, teachers may use mobile devices as supplementary technology. Students can be guided, assisted and supported on using mobile devices instead of confiscating.

Removing the ban on mobile devices in secondary schools will aid with students learning better techniques of employing them. The policy on banning mobile devices requires critical review in the 21<sup>st</sup> century. The century has seen the use of science and technology taking precedence as students learn with mobile devices. An African child should not meet technology in a computer lab or a university while walking with a mobile device.

The use of SEUMD as a framework affords a sustainable solution to African problems. The framework accounts for adoption as a process and integrates this with concerns in the society.

Effectiveness is argued as an indication of sustainability that the framework offers. Effective use is thus a product of adopting a technology and using it to attain goals that the society might not have recognized.

The process of adoption puts in consideration presence of peers that may either be challenged in using technology or technology savvy. The framework argues for contributions that peers provide in the process of adoption and why this is relevant. Contributions discussed assists in reducing the uncertainty that a technology adopter might have and this is achieved through observing and trying to use the technology. The reduction of uncertainty provides comfort and change in perception over the technology and its application. An adopter reduces their views on how they will struggle with the technology and starts looking at how the technology will be beneficial in their lives.

In relation to the adoption of innovative technology the society always has views on what is acceptable and not. By looking at the society as a social system and considering the value of norms, the framework provides a distinct and comprehensive view of that hindering adoption of a technology. Viewing the norm in combination with consequences that technology adopters might suffer necessitates the need for peers as a network to assist in reducing any doubt one has on the technology. The network that technology adopters have may also reduce concerns that are inherent in the society.

SEUMD as a framework provides for technology adoption as a process linking adoption to post-adoption and considers individuals network contribution in adopting a technology. The framework also looks at adoption hindrances such as norm, concerns and consequences and considers the need for information that an adopter should receive during adoption. The framework affords sustainability by looking at adopters' goals and how the use of the technology is geared towards attaining the goal effectively. SEUMD can be applied in studies that relate technology adoption and attaining stated goals (whether formalized or not) by an individual in a society that views adoption of the technology as a negative issue, holds assumptions and myths on the technology.

#### **10.4 Area for future research**

This research focused on student's use of mobile devices for learning. Data was collected from interviews and questionnaires from students and teachers. Future research could triangulate by collecting qualitative data from teachers, policymakers and other education stakeholders. These moral enforcers and moral creators will inform on reasons for banning mobile devices. The

discussion may invoke thoughts on a review of policies in education in Tanzania. Teachers in South Africa may provide details of ambitions in assisting students learning with mobile devices outside the classroom.

## REFERENCES

- Ahmed, S., & Parsons, D. (2013). Abductive science inquiry using mobile devices in the classroom. *Computers & Education, 63*, 62–72.
- Ally, M., Lin, F., McGreal, R., Woo, B., & Li, Q. (2005). An intelligent agent for adapting and delivering electronic course materials to mobile learners. In *Proceedings MLearn 2005 - Mobile Technology: The future Of Learning In Your Hands* (pp. 1–8). Cape Town.
- Ally, M., & Tsinakos, A. (Eds.). (2014). *Increasing access through mobile learning*. Vancouver: Commonwealth of learning & Athabasca University.
- Alrasheedi, M., Capretz, L. F., & Raza, A. (2016). Managements perspective on critical success factors affecting mobile learning in higher education institutions-An empirical study. *Journal of Educational Computing Research, 54*(2), 253–274.
- Alsaleem, B. I. A. (2013). The effect of “WhatsApp” electronic dialogue journaling on improving writing vocabulary word choice and voice of EFL undergraduate Saudi students. *Arab World English Journal, 4*(3), 213–225.
- Alvarez, C., Brown, C., & Nussbaum, M. (2011). Comparative study of netbooks and tablet PCs for fostering face-to-face collaborative learning. *Computers in Human Behavior, 27*(2), 834–844.
- Ampofo, S. Y., Bizimana, B., Mbuti, J., Ndayambaje, I., Ogeta, N., & Orodho, J. A. (2014). Information communication technology penetration and its impact on education: Lessons of experience from selected African countries of Ghana, Kenya and Rwanda. *Journal of Information Engineering and Applications, 4*(11), 84–95.
- Avgerou, C. (2008). Information systems in developing countries: A critical research review. *Journal of Information Technology, 23*(3), 133–146.
- Badat, S., & Sayed, Y. (2014). Post-1994 South African education: The challenge of social justice. *The ANNALS of the American Academy of Political and Social Science, 652*(1), 127–148.
- Bagozzi, R. P. (2011). Measurement and meaning in information systems and organizational research: Methodological and philosophical foundations. *MIS Quarterly, 35*(2), 261–292.
- Bairagi, A. K., Roy, T., & Polin, A. (2011). Socio-economic impacts of mobile phone in rural Bangladesh: A case study in Batiaghata Thana, Khulna District. *International Journal of Computer and Information Technology, 2*(1), 42–48.

- Bappah, A. S. (2013). Appraisal of social learning potentials in some trending mobile computing applications. *International Journal of Computer Trends and Technology*, 4(7), 2017–2021.
- Bartlett, L., & Vavrus, F. (2014). Transversing the vertical case study: A methodological approach to studies of educational policy as practice. *Anthropology and Education Quarterly*, 45(2), 131–147.
- Basit, T. (2003). Manual or electronic? The role of coding in qualitative data analysis. *Educational Research*, 45(2), 143–154.
- Baskerville, R. L., & Myers, M. D. (2015). Design ethnography in information systems. *Information Systems Journal*, 25(1), 23–46.
- Bates, A. W. (2005). *Technology, e-learning and distance education* (2nd ed.). New York: Routledge.
- Becker, J., & Niehaves, B. (2007). Epistemological perspectives on IS research: A framework for analysing and systematizing epistemological assumptions. *Information Systems Journal*, 17(2), 197–214.
- Ben-Yehuda, N. (2009). Foreword: Moral panics-36 years on. *British Journal of Criminology*, 49(1), 1–3.
- Benbasat, I., Goldstein, D. K., & Mead, M. (1987). The case research strategy in studies of information systems. *MIS Quarterly*, 11(3), 369–386.
- Bennell, P., & Mukyanuzi, F. (2005). *Is there a teacher motivation crisis in Tanzania?* Brighton: Knowledge and Skills for Development.
- Berk, R. A. (2009). Multimedia teaching with video clips: TV, movies, YouTube, and mtvU in the college classroom. *International Journal of Technology in Teaching and Learning*, 5(1), 1–21.
- Blum, R. . (2007). Youth in Sub-Saharan Africa. *Journal of Adolescent Health*, 41, 230–238.
- Boell, S. K., & Cecez-Kecmanovic, D. (2014). A hermeneutic approach for conducting literature reviews and literature searches. *Communications of the Association for Information Systems*, 34(12), 257–286.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.
- Brinkhoff, T. (2012). Charambe. Retrieved July 20, 2017, from <http://www.citypopulation.de/php/tanzania-coastal-admin.php?adm2id=070310>

- Brock-Utne, B. (2005). Language-in-education policies and practices in Africa with a special focus on Tanzania and South Africa. In V. Edwards, A. M. Y. Lin, & P. W. Martin (Eds.), *Decolonisation, Globalisation: Language in education, policy and practice* (pp. 615–631). Clevedon: Multilingual Matters Ltd.
- Brock-Utne, B. (2007). Language of instruction and student performance: New insights from research in Tanzania and South Africa. *International Review of Education*, 53(5–6), 509–530.
- Brown, I., Moola, I., Mugjenkar, A., & Sands, M. (2008). Impediments on the path to academic success in an IS degree programme: A South African perspective. *South African Computer Journal*, (41), 64–74.
- Brown, T. H. (2005). Towards a model for m-learning in Africa. *International Journal on E-Learning*, 4(3), 299–315.
- Bryman, A. (2006). Integrating quantitative and qualitative research: How is it done? *Qualitative Research*, 6(1), 97–113.
- Buckingham, D., & Jensen, H. S. (2012). Beyond “media panics.” *Journal of Children and Media*, 6(4), 413–429.
- Burton-Jones, A., & Grange, C. (2013). From use to effective use: A representation theory perspective. *Information Systems Research*, 24(3), 632–658.
- Cameron, D. (2005). The net generation goes to university? In *Proceedings of Journalism Education Association Conference* (pp. 1–11). Chicago.
- Campbell, S. W. (2006). Perceptions of mobile phones in college classrooms: Ringing, cheating, and classroom policies. *Communication Education*, 55(3), 280–294.
- Cardoza, Y., & Tunks, J. (2014). The bring your own technology initiative: An examination of teachers’ adoption. *Computers in the Schools*, 31(4), 293–315.
- Carlson, S. (2005). Tech-savvy “millennials” have lots of gadgets, like to multitask, and expect to control what, when, and how they learn. Should colleges cater to them? *The Chronicle of Higher Education*, 52(7), 34–37.
- Cavus, N., Bicen, H., & Akcil, U. (2008). The opinions of information technology students on using mobile learning. In *Proceedings of 08 International Conferences on Educational Sciences* (pp. 1–7). Magosa.
- Chambo, F. F., Laizer, L. S., Nkansah-Gyekye, Y., & Ndume, V. (2013). Mobile learning model for Tanzania secondary schools: Case study of Kilimanjaro region. *Journal of Emerging*

- Trends in Computing and Information Sciences*, 4(9), 698–701.
- Chen, Q., & Yan, Z. (2016). Does multitasking with mobile phones affect learning? A review. *Computers in Human Behavior*, 54, 34–42.
- Chen, X.-B. (2013). Tablets for informal language learning: Student usage and attitudes. *Language Learning & Technology*, 17(1), 20–36.
- Cheng, K.-H., & Tsai, C.-C. (2013). Affordances of augmented reality in science learning: Suggestions for future research. *Journal of Science Education and Technology*, 22(4), 449–462.
- Cheon, J., Lee, S., Crooks, S. M., & Song, J. (2012). An investigation of mobile learning readiness in higher education based on the theory of planned behavior. *Computers and Education*, 59(3), 1054–1064.
- Chigona, A., & Chigona, W. (2008). MXit it up in the media: Media discourse analysis on a mobile instant messaging system. *African Journal of Information and Communication*, 9, 42–57.
- Chiluwa, I. (2008). SMS text-messaging and the Nigerian christian context: Constructing values and sentiments. *The International Journal of Language Society and Culture*, (24), 11–20.
- Choliz, M. (2010). Mobile phone addiction: A point of issue. *Addiction*, 105(2), 373–374.
- Ciampa, K. (2014). Learning in a mobile age: An investigation of student motivation. *Journal of Computer Assisted Learning*, 30(1), 82–96.
- Clarke, V., & Braun, V. (2013). Teaching thematic analysis: Over-coming challenges and developing strategies for effective learning. *The Psychologist*, 26(2), 120–123.
- Cloete, S., de Villiers, C., & Roodt, S. (2009). Facebook as an academic tool for ICT lecturers. In *Proceedings of the 2009 Annual Conference of the Southern African Computer Lecturers' Association* (pp. 16–22). Port Alfred.
- Coffey, A., Holbrook, B., & Atkinson, P. (1996). Qualitative data analysis: Technologies and representations. *Sociological Research Online*, 1(1), 1–28.
- Cohen, S. (1972). *Folk devils and moral panics-The creation of the mods and rockers*. London: Granada Publishing Limited.
- Cohen, S. (1999). Moral panics and folk concepts. *Paedagogica Historica*, 35(3), 585–591.
- Crescente, M. L., & Lee, D. (2011). Critical issues of m-learning: Design models, adoption processes and future trends. *Journal of the Chinese Institute of Industrial Engineers*, 28(2), 111–123.

- Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Los Angeles: Sage publications.
- Dangel, H. L., & Wang, C. X. (2008). Student response systems in higher education: Moving beyond linear teaching and surface learning. *Journal of Educational Technology Development and Exchange*, *1*(1), 93–104.
- Davison, R. M., & Martinsons, M. G. (2016). Context is king! Considering particularism in research design and reporting. *Journal of Information Technology*, *31*(3), 241–249.
- Demouy, V., Jones, A., Kan, Q., Kukulska-Hulme, A., & Eardley, A. (2016). Why and how do distance learners use mobile devices for language learning? *The EuroCALL Review*, *24*(1), 10–24.
- Department of Basic Education. (2016a). *2016 school realities*. Pretoria: Department of Basic Education.
- Department of Basic Education. (2016b). *Education statistics in South Africa 2014*. Pretoria: Department of Basic Education.
- Domingo, M. G., & Garganté, A. B. (2016). Exploring the use of educational technology in primary education: Teachers' perception of mobile technology learning impacts and applications' use in the classroom. *Computers in Human Behavior*, *56*, 21–28.
- Donner, J., & Toyama, K. (2009). Persistent themes in ICT4D research: Priorities for inter-methodological exchange. In *Proceedings of the 57th session of the International Statistics Institute* (pp. 1–10). Durban.
- Doyle, G. J., Garrett, B., & Currie, L. M. (2014). Integrating mobile devices into nursing curricula: Opportunities for implementation using Rogers' diffusion of innovation model. *Nurse Education Today*, *34*(5), 775–782.
- Dubois, A., & Gibbert, M. (2010). From complexity to transparency: Managing the interplay between theory, method and empirical phenomena in IMM case studies. *Industrial Marketing Management*, *39*(1), 129–136.
- Dunleavy, M., Dede, C., & Mitchell, R. (2009). Affordances and limitations of immersive participatory augmented reality simulations for teaching and learning. *Journal of Science Education and Technology*, *18*(1), 7–22.
- Educational Technology. (2014). Mobile learning infographics. Retrieved October 5, 2016, from <http://elearninginfographics.com/category/mobile-learning-infographics/>

- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532–550.
- Falloon, G. (2013). Young students using iPads: App design and content influences on their learning pathways. *Computers & Education*, 68, 505–521.
- Fereday, J., & Muir-Cochrane, E. (2006). Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *International Journal of Qualitative Methods*, 5(1), 80–92.
- Ferrer, F., Belvís, E., & Pàmies, J. (2011). Tablet PCs, academic results and educational inequalities. *Computers & Education*, 56(1), 280–288.
- Fitzgerald, B., & Howcroft, D. (1998). Towards dissolution of the IS research debate: From polarization to polarity. *Journal of Information Technology*, 13(4), 313–326.
- Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, 12(2), 219–245.
- Forrest-Lawrence, P. (2011). Moral panic and risk-A working model. In G. Coventry & M. Shircore (Eds.), *Proceedings of the 5th Annual Australian and New Zealand Critical Criminology Conference* (pp. 60–67). Queensland.
- Frith, A. (2011). Zonnebloem. Retrieved July 20, 2017, from <https://census2011.adrianfrith.com/place/199041019>
- Frohberg, D., Göth, C., & Schwabe, G. (2009). Mobile learning projects: A critical analysis of the state of the art. *Journal of Computer Assisted Learning*, 25(4), 307–331.
- Furió, D., Juan, M.-C., Seguí, I., & Vivó, R. (2015). Mobile learning vs. traditional classroom lessons: A comparative study. *Journal of Computer Assisted Learning*, 31(3), 189–201.
- Gao, Q., Yan, Z., Wei, C., Liang, Y., & Mo, L. (2017). Three different roles, five different aspects: Differences and similarities in viewing school mobile phone policies among teachers, parents, and students. *Computers and Education*, 106, 13–25.
- Garland, D. (2008). On the concept of moral panic. *Crime Media Culture*, 4(1), 9–30.
- Georgiev, T., Georgieva, E., & Smrikarov, A. (2004). M-learning-A new stage of E-learning. In *Proceedings of the 5th international conference on Computer Systems and Technologies* (pp. 1–4). Rousse.
- Gill, G. (2011). *Informing with the case method: A guide to case method research, writing & facilitation*. California: Informing Science Press.

- Gonzalez, M. M. (2016). The coding manual for qualitative research: A review. *The Qualitative Report*, 21(8), 1546–1548.
- Google. (n.d.-a). Google map of Charambe. Retrieved August 14, 2017, from <https://goo.gl/maps/XkxE3QqPtFH2>
- Google. (n.d.-b). Google map of Zonnebloem. Retrieved August 14, 2017, from <https://goo.gl/maps/6eyNeQg2AET2>
- Gregor, S. (2006). The nature of theory in information systems. *MIS Quarterly*, 30(3), 611–642.
- Gurstein, M. (2003). Effective use: A community informatics strategy beyond the digital divide. *First Monday*, 8(12).
- Halaweh, M. (2012). Integration of grounded theory and case study: an exemplary application from e-commerce security perception research. *Journal of Information Technology Theory and Application*, 13(1), 31–51.
- Hargittai, E. (2010). Digital natives? Variation in internet skills and uses among members of the “net generation”. *Sociological Inquiry*, 80(1), 92–113.
- Hashemi, M., Azizinezhad, M., Najafi, V., & Nesari, A. J. (2011). What is mobile learning? Challenges and capabilities. *Procedia - Social and Behavioral Sciences*, 30, 2477–2481.
- Haßler, B., Major, L., & Hennessy, S. (2016). Tablet use in schools: A critical review of the evidence for learning outcomes. *Journal of Computer Assisted Learning*, 32(2), 139–156.
- Hew, T. S., & Leong, L. Y. (2011). An empirical analysis of Malaysian pre-university students’ ICT competency gender differences. *International Journal of Network and Mobile Technologies*, 2(1), 15–29.
- Hier, S. P. (2008). Thinking beyond moral panic: Risk, responsibility, and the politics of moralization. *Theoretical Criminology*, 12(2), 173–190.
- Hier, S. P. (2011). Tightening the focus: moral panic, moral regulation and liberal government. *The British Journal of Sociology*, 62(3), 523–541.
- Hsu, C. L., Lu, H. P., & Hsu, H. H. (2007). Adoption of the mobile Internet: An empirical study of multimedia message service (MMS). *Omega*, 35(6), 715–726.
- Huang, H. (2009). *Globally distributed information technology work: A study of cross-cultural influences, communication, and management*. The Pennsylvania State University, Pennsylvania, United States of America. Retrieved from [https://etda.libraries.psu.edu/files/final\\_submissions/2250](https://etda.libraries.psu.edu/files/final_submissions/2250)

- Hughes, R., & Coakley, J. (1991). Positive deviance among athletes: The implications of overconformity to the sport ethic. *Sociology of Sport Journal*, 8, 307–325.
- Ifenthaler, D., & Schweinbenz, V. (2013). The acceptance of tablet-PCs in classroom instruction: The teachers' perspectives. *Computers in Human Behavior*, 29(3), 525–534.
- International Telecommunication Union. (2016). *Measuring the information society report*. Geneva: International Telecommunication Union.
- Internet World Stats. (2016). Africa by country internet stats and 2016 population. Retrieved November 3, 2016, from <http://www.internetworldstats.com/africa.htm>
- Isaacs, S. (2007). *ICT in education in South Africa. Survey of ICT and Education in Africa: South Africa Country Report*. Retrieved from [http://www.infodev.org/infodev-files/resource/InfodevDocuments\\_429.pdf](http://www.infodev.org/infodev-files/resource/InfodevDocuments_429.pdf)
- Ito, M. (2005). Mobile phones, Japanese youth, and the re-placement of social contact. In *Mobile Communications. Computer Supported Cooperative Work* (pp. 131–148). London: Springer.
- Jeng, Y.-L., Wu, T.-T., Huang, Y.-M., Tan, Q., H, S. J., & H Yang, S. J. (2010). The add-on impact of mobile applications in learning strategies: A review study. *Journal of Educational Technology & Society*, 13(3), 3–11.
- Jinyevu, S. A. (2013). Is there a relationship between employees satisfaction and their performance?: The case of teachers in Tanzania government-owned schools. *European Journal of Business and Management*, 5(25), 82–92.
- Johnson, O., Maasdorp, L., & McElwee, C. (2014). Scaling up to meet the enormous education challenges in Africa. In W. E. Forum (Ed.), *Education and Skills 2.0: New Targets and Innovative Approaches* (pp. 31–35). Geneva: World Economic Forum.
- Johnston, K. (2013). A guide to educating different generations in South Africa. *Issues in Informing Science and Information Technology*, 10(1), 261–273.
- Jones, C., Ramanau, R., Cross, S., & Healing, G. (2010). Net generation or Digital Natives: Is there a distinct new generation entering university? *Computers & Education*, 54(3), 722–732.
- Jouhki, J. (2011). Eomjijok-The Korean thumb tribe reflections of young and urban Koreans' mobile communication. In S. Kangas (Ed.), *Proceedings of Digital Pioneers: Cultural drivers of future media culture* (pp. 65–80). Helsinki.
- Kafyulilo, A. (2014). Access, use and perceptions of teachers and students towards mobile phones as a tool for teaching and learning in Tanzania. *Education and Information Technologies*,

19(1), 115–127.

- Kaliisa, R., & Picard, M. (2017). A systematic review on mobile learning in higher education: The African perspective. *Turkish Online Journal of Educational Technology*, 16(1), 1–18.
- Kalolo, J. F. (2015). Addressing the tensions and controversies towards quality science education: A pragmatic approach. *Issues in Social Science*, 3(1), 97–119.
- Karim, A. K. M. R., & Nigar, N. (2014). The internet addiction test: Assessing its psychometric properties in bangladeshi culture. *Asian Journal of Psychiatry*, 10, 75–83.
- Kearney, M., Burden, K., & Rai, T. (2015). Investigating teachers' adoption of signature mobile pedagogies. *Computers and Education*, 80, 48–57.
- Kemp, S., & We Are Social. (2016). Digital in 2016: We are social's compendium of global digital, social, and mobile data, trends, and statistics. Retrieved April 11, 2017, from <http://wearesocial.com/sg/special-reports/digital-2016%5Cnhttp://www.slideshare.net/wearesocialsg/digital-in-2016>
- Keren-Kolb, L. (2013). Engage, enhance and extend Learning! *Learning & Leading with Technology*, 40(7), 20–27.
- Khaddage, F., Christensen, R., Lai, W., Knezek, G., Norris, C., & Soloway, E. (2015). A model driven framework to address challenges in a mobile learning environment. *Education and Information Technologies*, 20(4), 625–640.
- Kibona, L., & Mgaya, G. (2015). Smartphones' effects on academic performance of higher learning students. *Journal of Multidisciplinary Engineering Science and Technology*, 2(4), 777–784.
- Kihwele, J. E., & Bali, T. A. L. (2013). The perceptions of teachers, parents and students on the effects of mobile phone use on student learning in Tanzania. *Journal of Education and Practice*, 4(25), 101–107.
- Klein, H. K., & Myers, M. D. (1999). A set of principles for conducting and evaluating interpretive field studies in information systems. *MIS Quarterly*, 23(1), 67–93.
- Koole, M. L. (2009). A model for framing mobile learning. *Mobile Learning: Transforming the Delivery of Education and Training*, 1(2), 25–47.
- Kopcha, T. J. (2012). Teachers' perceptions of the barriers to technology integration and practices with technology under situated professional development. *Computers and Education*, 59(4), 1109–1121.

- Kreutzer, T. (2009). *Generation mobile: Online and digital media usage on mobile phones among low-income urban youth in South Africa*. University of Cape Town. Retrieved from <https://www.semanticscholar.org/paper/Generation-Mobile%3A-Online-and-Digital-Media-Usage-Kreutzer/b3014d36653e3c032f9d864df5bfa755a67ade6e>
- Krutka, D. G., Bergman, D. J., Flores, R., Mason, K., & Jack, A. R. (2014). Microblogging about teaching: Nurturing participatory cultures through collaborative online reflection with pre-service teachers. *Teaching and Teacher Education, 40*, 83–93.
- Kumar, L. S., Jamatia, B., Aggarwal, A. K., & Kannan, S. (2011). Mobile device intervention for student support services in distance education context—FRAME model perspective. *European Journal of Open Distance and ELearning, 14*(2), 1–10.
- Kvale, S. (1988). The 1000-page question. *Phenomenology and Pedagogy, 6*(2), 90–106.
- Lai, C. (2015). Modeling teachers' influence on learners' self-directed use of technology for language learning outside the classroom. *Computers & Education, 82*, 74–83.
- Lee, A. S. (1989). A scientific methodology for MIS case studies. *MIS Quarterly, 13*(1), 33–50.
- Lee, A. S., & Baskerville, R. L. (2003). Generalizing generalizability in information systems research. *Information Systems Research, 14*(3), 221–243.
- Leung, L. (2004). Net generation attributes and seductive properties of the internet as predictors of online activities and internet addiction. *Cyber Psychology & Behavior, 7*(3), 333–348.
- Lewin, K. M. (2009). Access to education in sub-Saharan Africa: Patterns, problems and possibilities. *Comparative Education, 45*(2), 151–174.
- Lindhe, V., Malmberg, K., & Temu, E. B. (2004). *Sida Support to Teacher Education in Tanzania 1997-2002*. Stockholm: Department for democracy and social development.
- Looi, C., Lim, K. F., Pang, J., Lay, A., Koh, H., Seow, P., ... Soloway, E. (2016). Bridging formal and informal learning with the use of mobile technology. In C. Chai, C. Lim, & C. Tan (Eds.), *Future learning in primary schools* (pp. 79–96). Singapore.
- Looi, C., Sun, D., Seow, P., & Chia, G. (2014). Enacting a technology-based science curriculum across a grade level: The journey of teachers' appropriation. *Computers & Education, 71*, 222–236.
- Lujara, S. K. (2008). *Development of e-learning content and delivery for self learning environment: Case of selected rural secondary schools in Tanzania*. Blekinge Institute of Technology. Retrieved from <http://urn.kb.se/resolve?urn=urn:nbn:se:bth-00405>

- Lujara, S. K., Kissaka, M. M., Bhalalusesa, E. P., & Trojer, L. (2007). Learning objects: A new paradigm for e-learning resource development for secondary schools in Tanzania. *Proceedings of World Academy of Science, Engineering and Technology*, 24, 102–106.
- Lujara, S. K., Kissaka, M. M., Trojer, L., & Mvungi, N. H. (2006). Introduction of open-source e-learning environment and resources: A novel approach for secondary schools in Tanzania. *International Journal of Social Sciences*, 1(4), 237–241.
- Lyytinen, K., & Damsgaard, J. (2001). What's wrong with the diffusion of innovation theory? In *Diffusing Software Product and Process Innovations*. (pp. 173–190). Boston: Springer.
- Ma, Q. (2017). A multi-case study of university students' language-learning experience mediated by mobile technologies: A socio-cultural perspective. *Computer Assisted Language Learning*, 30(3–4), 183–203.
- Mac Callum, K. (2010). Adoption theory and the integration of mobile technology in education. In S. Mann & M. Verhaart (Eds.), *Proceedings of Annual Conference of Computing and Information Technology, Education and Research in New Zealand* (pp. 139–150). Dunedin.
- MacVaugh, J., & Schiavone, F. (2010). Limits to the diffusion of innovation. *European Journal of Innovation Management*, 13(2), 197–221.
- Markett, C., Sanchez, I. A., Weber, S., & Tangney, B. (2006). Using short message service to encourage interactivity in the classroom. *Computers and Education*, 46(3), 280–293.
- Marsh, D. R., Schroeder, D. G., Dearden, K. A., Sternin, J., & Sternin, M. (2004). The power of positive deviance. *Education and Debate*, 329(7475), 1177–1179.
- Martin, F., & Ertzberger, J. (2013). Here and now mobile learning: An experimental study on the use of mobile technology. *Computers and Education*, 68, 76–85.
- Marvasti, A. B. (2014). Analysing observations. In U. Flick (Ed.), *The SAGE handbook of qualitative data analysis* (pp. 354–367). London: Sage publications.
- Melhuish, M., Falloon, G., & Melhuish, K. (2010). Looking to the future: M-learning with the iPad. *Computers in New Zealand Schools Learning Leading Technology*, 22(3), 1–16.
- Mestry, R., & Berry, B. (2016). The perceptions of stakeholders of the implementation of a state funding model in South African public schools. *Africa Education Review*, 13(2), 82–95.
- Mifsud, L., Mørch, A. I., & Lieberg, S. (2013). An analysis of teacher-defined activities with mobile technologies: Predecessor and successor tool use in the classroom. *Learning, Media and Technology*, 38(1), 41–56.

- Miles, M., & Huberman, M. (1984). *Qualitative data analysis: A sourcebook of new methods*. California: Sage publications.
- Minges, M., Mannisto, L., & Kelly, T. (1999). The future is bright, the future is mobile. *Info*, 1(6), 485–496.
- Miranda, S. M., Kim, I., & Summers, J. D. (2015). Jamming with social media: How cognitive structuring of organizing vision facets affects IT innovation diffusion. *MIS Quarterly*, 39(3), 591–614.
- Modisaotsile, B. M. (2012). The failing standard of basic education in South Africa. *Africa Institute of South Africa Briefing*, 72, 1–7.
- Mohamad, M., & Woollard, J. (2012). *Mobile learning in english language learning: An implementation strategy for secondary schools in Malaysia*. *Mobile learning in English Language Learning*. University of Southampton.
- Motiwalla, L. F. (2007). Mobile learning: A framework and evaluation. *Computers and Education*, 49(3), 581–596.
- Motlik, S. (2008). Mobile learning in developing nations. *The International Review of Research in Open and Distributed Learning*, 9(2), 1–4.
- Mtebe, J. S., Mbwilo, B., & Kissaka, M. M. (2016). Factors influencing teachers' use of multimedia enhanced content in secondary schools in Tanzania. *The International Review of Research in Open and Distributed Learning*, 17(2), 1–12.
- Mtebe, J. S., & Raisamo, R. (2014). Investigating students' behavioural intention to adopt and use mobile learning in higher education in East Africa. *International Journal of Education and Development Using Information and Communication Technology*, 10(3), 4–20.
- Mtega, W. P., Bernard, R., Msungu, A. C., & Sanare, R. (2012). Using mobile phones for teaching and learning purposes in higher learning institutions: The case of Sokoine university of agriculture in Tanzania. In *Proceedings and report of the 5th Ubuntu Net Alliance annual conference* (pp. 118–129). Dar-es-salaam.
- Myers, M. D., & Newman, M. (2007). The qualitative interview in IS research: Examining the craft. *Information and Organization*, 17(1), 2–26.
- National Bureau of Statistics. (2013). *Tanzania in figures 2012*. Dar-es-salaam: National Bureau of Statistics.
- Ndlovu, M. C. (2011). Re-envisioning the scholarship of engagement: Lessons from a university-

- school partnership project for mathematics and science teaching. *South Africa Journal of Higher Education*, 25(7), 1397–1415.
- Ndume, V., Tilya, F., & Twaakyondo, H. (2008). Challenges of adaptive elearning at higher learning institutions: A case study in Tanzania. *International Journal of Computing and ICT Research*, 2(1), 47–59.
- Ng’ambi, D. (2013). Effective and ineffective uses of emerging technologies: Towards a transformative pedagogical model. *British Journal of Educational Technology*, 44(4), 652–661.
- Ng’ambi, D., & Bozalek, V. (2013). Leveraging informal leadership in higher education institutions: A case of diffusion of emerging technologies in a southern context. *British Journal of Educational Technology*, 44(6), 940–950.
- Nguyen, L., Barton, S. M., & Nguyen, L. T. (2014). iPads in higher education-Hype and hope. *British Journal of Educational Technology*, 46(1), 190–203.
- Ngwenyama, O., Andoh-Baidoo, F. K., Bollou, F., & Olga, M. (2006). Is there a relationship between ICT, health, education and development? An empirical analysis of five West African countries from 1997-2003. *The Electronic Journal on Information Systems in Developing Countries*, 23(5), 1–11.
- Nkyabonaki, J., & Mkunde, B. (2013). The fruit of MKUKUTA in Tanzania ’s education sector: The case of secondary education by field evidence from two districts. *Social Evolution & History*, 12(1), 88–114.
- Norman, D. A. (1999). Affordance, conventions, and design. *Interactions*, 6(3), 38–43.
- Norqvist, L. (2016). Learning, tablet, culture-Coherence? *Universal Journal of Educational Research*, 4(6), 1306–1318.
- Nyahende, V. R. (2013). The success of students’ loans in financing higher education in Tanzania. *Higher Education Studies*, 3(3), 47–61.
- O’Bannon, B. W., & Thomas, K. (2014). Teacher perceptions of using mobile phones in the classroom: Age matters! *Computers & Education*, 74, 15–25.
- O’Bannon, B. W., & Thomas, K. M. (2015). Mobile phones in the classroom: Preservice teachers answer the call. *Computers & Education*, 85, 110–122.
- Oblinger, D., & Oblinger, J. (2005). Is it age or IT: First steps toward understanding the net generation. *Learning*, 2(1–2), 20–36.

- Oblinger, D., Oblinger, J., & Lippincott, J. K. (2005). *Educating the net generation*. Brockport Bookshelf. Brockport.
- Ochieng, C. M. O. (2007). Development through positive deviance and its implications for economic policy making and public administration in Africa: The case of Kenyan agricultural development, 1930-2005. *World Development*, 35(3), 454–479.
- Okoli, C. (2012). *A critical realist guide to developing theory with systematic literature reviews*. Montreal: Social Science Research Network.
- Okoli, C., & Schabram, K. (2010). A guide to conducting a systematic literature review of information systems research. *Working Papers on Information Systems*, 10(26), 1–51.
- Orlikowski, W. J., & Baroudi, J. J. (1991). Studying information technology in organizations: Research approaches and assumptions. *Information Systems Research*, 2(1), 1–28.
- Osakwe, J., Dlodlo, N., & Jere, N. (2017). Where learners' and teachers' perceptions on mobile learning meet: A case of Namibian secondary schools in the Khomas region. *Technology in Society*, 49, 16–30.
- Oz, H. (2014). Prospective English teachers' ownership and usage of mobile devices as m-learning tools. *Procedia - Social and Behavioral Sciences*, 141, 1031–1041.
- Ozdamli, F., & Uzunboylu, H. (2015). M-learning adequacy and perceptions of students and teachers in secondary schools. *British Journal of Educational Technology*, 46(1), 159–172.
- Page, X. W., & Kobsa, A. (2010). Navigating the social terrain with Google Latitude. In *Proceedings iConference 2010* (pp. 174–178). Illinois.
- Parajuli, K. P. (2016). Mobile learning practice in higher education in Nepal. *Open Praxis*, 8(1), 41–54.
- Pelgrum, W. J. (2001). Obstacles to the integration of ICT in education: Result from worldwide educational assessment. *Computers and Education*, 37, 163–178.
- Phillips, K. D. (2013). Dividing the labor of development: Education and participation in rural Tanzania. *Comparative Education Review*, 57(4), 637–661.
- Porter, G., Hampshire, K., Milner, J., Munthali, A., Robson, E., De Lannoy, A., ... Abane, A. (2016). Mobile phones and education in Sub-Saharan Africa: From youth practice to public policy. *Journal of International Development*, 28(1), 22–39.
- Prensky, M. (2001). Digital Natives, Digital Immigrants. *On the Horizon*, 9(5), 1–6.
- Prensky, M. (2007). How to teach with technology: Keeping both teachers and students

- comfortable in an era of exponential change. *Emerging Technologies for Learning*, 2(4), 40–46.
- Pringle, J., Drummond, J., McLafferty, E., & Hendry, E. (2011). Interpretative phenomenological analysis: A discussion and critique. *Nurse Researcher*, 18(3), 20–24.
- Probyn, M. (2005). Language and the struggle to learn: The intersection of classroom reality, language policy, and neo-colonial and globalisation discourses in South African schools. In A. M. Lin & P. W. Martin (Eds.), *Decolonisation, Globalisation: Language-in-Education Policy and Practice. New Perspectives on Language and Education* (pp. 153–172). Clevedon: Multilingual Matters Ltd.
- Rajasingham, L. (2011). Will mobile learning bring a paradigm shift in higher education? *Education Research International*, 2011, 1–10.
- Rena, R. (2006). Higher education in Africa - A case of Eritrea. *Journal of Educational Planning and Administration*, 21(2), 125–140.
- Rivard, S. (2014). The ions of theory construction. *MIS Quarterly*, 38(2), iii–xiv.
- Roberts, N., Spencer-Smith, G., Vanska, R., & Eskelinen, S. (2015). From challenging assumptions to measuring effect: Researching the Nokia mobile mathematics service in South Africa. *South African Journal of Education*, 35(2), 1–13.
- Rochadel, W., Da Silva, S. P., Da Silva, J. B., Luz, T. D., & Alves, G. R. (2012). Utilization of remote experimentation in mobile devices for education. In *IEEE Global Engineering Education Conference, EDUCON* (pp. 1–6). Marrakesh.
- Rogers, E. M. (1983). *Diffusion of innovation* (3rd ed.). London: Collier Macmillan Publishers.
- Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York: Free Press.
- Roodt, S. (2013). Using Youtube to support student engagement for the net generation in higher education. In *Proceedings of the European Conference on Information Management & Evaluation* (pp. 223–231). Ho Chi Minh City.
- Roodt, S., de Villiers, C., & Joubert, P. (2012). Collaborative learning for the net generation: Using social networks in an undergraduate course. *International Journal of Innovation in the Digital Economy*, 3(3), 14–27.
- Rozario, R., Ortlieb, E., & Rennie, J. (2016). Interactivity and mobile technologies: An activity theory perspective. In D. Churchill, J. Lu, T. Chiu, & B. Fox (Eds.), *Mobile learning design: Theories and application* (pp. 63–82). Singapore: Springer.

- Rubagumya, C. M. (1991). Language promotion for educational purposes: The example of Tanzania. *International Review of Education*, 37(1), 67–85.
- Sahin, I. (2006). Detailed review of Rogers DOI theory and educational technology-related studies based on Rogers theory. *The Turkish Online Journal of Educational Technology*, 5(2), 14–23.
- Santos, I. M., & Ali, N. (2012). Exploring the uses of mobile phones to support informal learning. *Education and Information Technologies*, 17(2), 187–203.
- Sarker, S., Xiao, X., & Beaulieu, T. (2013). Qualitative studies in information systems: A critical review and some guiding principles. *MIS Quarterly*, 37(4), iii–xviii.
- Sayed, Y., & Motala, S. (2012). Getting in and staying there: Exclusion and inclusion in South African schools. *Southern African Review of Education*, 18(2), 105–118.
- Scala, E. (2015). Tailoring tertiary education and ICTs for sustainable development in LDCs: Challenges and opportunities. *TIGOR*, 7(1), 15–34.
- School4SA. (2017). Browse schools in Cape Town at school4SA. Retrieved March 17, 2017, from <http://www.schools4sa.co.za/province/western-cape/cape-town/>
- Schultze, U., & Avital, M. (2011). Designing interviews to generate rich data for information systems research. *Information and Organization*, 21(1), 1–16.
- Schwonke, R., Ertelt, A., Otieno, C., Renkl, A., Alevin, V., & Salden, R. J. C. M. (2013). Metacognitive support promotes an effective use of instructional resources in intelligent tutoring. *Learning and Instruction*, 23(1), 136–150.
- Scornavacca, E., Huff, S., & Marshall, S. (2009). Mobile phones in the classroom: If you can't beat them, join them. *Communications of the ACM*, 52(4), 142–146.
- Secondary Education Department. (2013). Dar-es-salaam region-SEDP performance report: October-December 2012. Retrieved March 17, 2017, from <http://www.dsm.go.tz/kurasa/elimu/SEDP MKOA OCT- DEC2012.pdf>
- Seixas, L. . R., Gomes, A. S., & Filho, I. J. M. (2016). Effectiveness of gamification in the engagement of students. *Computers in Human Behavior*, 58, 48–63.
- Semali, L. M., & Mehta, K. (2012). Science education in Tanzania: Challenges and policy responses. *International Journal of Educational Research*, 53, 225–239.
- Sharples, M., Arnedillo-Sanchez, I., Milrad, M., & Vavoula, G. (2007). Mobile learning: Small devices, big issues. In S. Ludvigsen, N. Balacheff, T. Jong, A. Lazonder, & S. Barnes (Eds.),

- Technology Enhanced Learning: Principles and Products*. Dordrecht: Springer.
- Sharples, M., Taylor, J., & Vavoula, G. (2005). Towards a theory of Mobile learning. In *In Proceedings of mLearn* (pp. 1–9). Cape Town.
- Shonola, S. A., Joy, M. S., Oyelere, S. S., & Suhonen, J. (2016). The impact of mobile devices for learning in higher education institutions: Nigerian universities case study. *International Journal of Modern Education and Computer Science*, 8(8), 43–50.
- Shudong, W., & Higgins, M. (2006). Limitations of mobile phone learning. *The Jalt Call Journal*, 2(1), 3–14.
- Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning*, 2(1), 1–8.
- Singh, J. (2014). Mobile messaging through android phones: An empirical study to unveil the reasons behind the most preferred mobile messaging application used by college going students. *International Journal of Multidisciplinary and Current Research*, 2, 367–372.
- Sokolovsky, M. (1996). Case study as a research method to study life histories of elderly people: Some ideas and a case study of a case study. *Journal of Aging Studies*, 10(4), 281–294.
- Sooryamoorthy, R. (2017). *Networks of communication in South Africa*. Cambridge: Cambridge University Press.
- Spreitzer, G. M., & Sonenshein, S. (2004). Toward the construct definition of positive deviance. *American Behavioral Scientist*, 47(6), 828–847.
- StatsSA. (2012). *Census 2011*. Pretoria: Statistics South Africa.
- Straub, E. T. (2009). Understanding technology adoption: Theory and future directions for informal learning. *Review of Educational Research*, 79(2), 625–649.
- Sung, Y. T., Chang, K. E., & Liu, T. C. (2016). The effects of integrating mobile devices with teaching and learning on students' learning performance: A meta-analysis and research synthesis. *Computers & Education*, 94, 252–275.
- Swarts, P., & Wachira, M. E. (2010). *Tanzania: ICT in education situational analysis*. Dar-es-salaam: Global e-Schools and Communities Initiative.
- Sylvester, A., Tate, M., & Johnstone, D. (2011). Beyond synthesis: Re-presenting heterogeneous research literature. *Behavior & Information Technology*, 32(12), 1199–1215.
- Tanzania Institute of Education. (2013). *Curriculum for ordinary level secondary education in Tanzania*. Dar-es-salaam: Tanzania Institute of Education.

- Tanzania Invest. (2016). Tanzania mobile subscriptions increase by 24% in 2015 and internet penetration reach 34%. Retrieved November 3, 2016, from <http://tanzaniainvest.com/telecoms/tanzania-mobile-subscriptions-reach-39-million-and-internet-penetration-reach-34-percent-in-2015>
- Tao, S. (2013). Why are teachers absent? Utilising the capability approach and critical realism to explain teacher performance in Tanzania. *International Journal of Educational Development*, 33(1), 2–14.
- Tapscott, D. (1999). Educating the net generation. *Educational Leadership*, 56(5), 6–11.
- Taua, C., Neville, C., & Hepworth, J. (2014). Research participation by people with intellectual disability and mental health issues: An examination of the processes of consent. *International Journal of Mental Health Nursing*, 23(6), 513–524.
- Teo, T. (2015). Comparing pre-service and in-service teachers' acceptance of technology: Assessment of measurement invariance and latent mean differences. *Computers & Education*, 83, 22–31.
- Thornton, P., & Houser, C. (2005). Using mobile phones in English education in Japan. *Journal of Computer Assisted Learning*, 21(3), 217–228.
- Tobin, G. A., & Begley, C. M. (2004). Methodological rigour within a qualitative framework. *Journal of Advanced Nursing*, 48(4), 388–396.
- Tong, A., Sainsbury, P., & Craig, J. (2007). Consolidated criteria for reporting qualitative research (COREQ): A 32- item checklist for interviews and focus group. *International Journal of Qualitative in Health Care*, 19(6), 349–357.
- Traxler, J. (2010). Students and mobile devices. *Research in Learning Technology*, 18(2), 149–160.
- Trifonova, A., & Ronchetti, M. (2003). Where is Mobile Learning Going? In A. Rossett (Ed.), *World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education* (Vol. 2003, pp. 1794–1801). Phoenix.
- Twebaze, R. M. (2015). Mobile phone use in Uganda's boarding secondary schools: A case study of Bushenyi district. *Journal of Educational Studies, Trends & Practices*, 5(1), 28–38.
- UNFPA South Africa. (2014). *Fact Sheet: Young People of South Africa*. Pretoria: UNFPA South Africa.
- Vainio, T., Walsh, T., & Varsaluoma, J. (2014). Cross-cultural design of mobile mathematics

- learning service for South African schools. *IADIS International Journal on WWW/Internet*, 12(1), 81–93.
- Valente, T. W., & Rogers, E. M. (1995). The origins and development of the Diffusion of Innovations paradigm as an example of scientific growth. *Science Communication*, 16(3), 242–273.
- Vavrus, F. (2009). The cultural politics of constructivist pedagogies: Teacher education reform in the United Republic of Tanzania. *International Journal of Educational Development*, 29(3), 303–311.
- Venkatesh, V., Brown, S. A., & Bala, H. (2013). Bridging the qualitative – quantitative divide: Guidelines for conducting mixed methods research in information systems. *MIS Quarterly*, 37(1), 21–54.
- Viriyapong, R., & Harfield, A. (2013). Facing the challenges of the one-tablet-per-child policy in Thai primary school education. *International Journal of Advanced Computer Sciences and Applications*, 4(9), 176–184.
- Visser, M., Juan, A., & Feza, N. (2015). Home and school resources as predictors of mathematics performance in South Africa. *South African Journal of Education*, 35(1), 1–10.
- Wakala ya Serikali Mtandao. (2016). Seti za takwimu - Open data Tanzania. Retrieved November 2, 2016, from <http://opendata.go.tz/sw/dataset>
- Walsham, G. (2006). Doing interpretive research. *European Journal of Information Systems*, 15(3), 320–330.
- Wang, Y. S., Wu, M. C., & Wang, H. Y. (2009). Investigating the determinants and age and gender differences in the acceptance of mobile learning. *British Journal of Educational Technology*, 40(1), 92–118.
- Webster, J., & Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *MIS Quarterly*, 26(2), xiii–xxiii.
- Wedgwood, R. (2007). Education and poverty reduction in Tanzania. *International Journal of Educational Development*, 27(4), 383–396.
- Weiser, M. (1993). Some computer science issues in ubiquitous computing. *Communications of the ACM*, 36(7), 75–84.
- Winters, N. (2007). What is mobile learning? In M. Sharples (Ed.), *Big Issues in Mobile Learning* (pp. 7–11). Nottingham.

- Woempner, C. (2007). Teaching the next generation. *Mid-Continent Research for Education and Learning*, 1–5.
- Wright, S., & Parchoma, G. (2011). Technologies for learning? An actor-network theory critique of “affordances” in research on mobile learning. *Research in Learning Technology*, 19(3), 247–258.
- Wu, W. H., Jim Wu, Y. C., Chen, C. Y., Kao, H. Y., Lin, C. H., & Huang, S. H. (2012). Review of trends from mobile learning studies: A meta-analysis. *Computers and Education*, 59(2), 817–827.
- Wyse, D., Sugrue, C., Fentiman, A., & Moon, S. (2014). English language teaching and whole school professional development in Tanzania. *International Journal of Educational Development*, 38, 59–68.
- Yin, R. K. (1981). The case study crisis: Some answers. *Administrative Science Quarterly*, 26(1), 58–65.
- Yin, R. K. (2003). *Case study research: Design and methods* (5th ed.). California: SAGE Publications.
- Yin, R. K. (2013). *Case study research: Design and methods* (5th ed.). California: SAGE Publications.
- Young, J. (2009). Moral panic: Its origins in resistance, resentment and the translation of fantasy into reality. *British Journal of Criminology*, 49(1), 4–16.
- Young, J. (2011). Moral panics and the transgressive other. *Crime Media Culture*, 7(3), 245–258.
- Young, M. (1997). The devil goes to day care McMartin and the making of a moral panic. *Journal of American Culture*, 20(1), 19–25.
- Ziani, A., Elareshi, M., & Gunter, B. (2015). The use of mobile phone and the internet in obtaining local news in GCC regions: University students’ perspectives. *Donnish Journal of Media and Communication Studies*, 1(1), 1–10.

## Appendix 1: Student Questionnaire

### Preamble

I am a PhD student in the Department of Information Systems at University of Cape Town and would like to get a richer understanding on students' use of mobile devices for learning **outside the classroom environment**. Examples of mobile devices are; Cell phones (Mobile phones), Smart phones, PDA, Tablet PC's (iPad, Galaxy Tab), iPods, Laptops and Portable Computers.

You are expected to complete this questionnaire in 20 minutes. Below are questions to help me with collection of data for this research. I kindly ask you to respond as **genuinely as possible**. Your cooperation in answering the questions is highly appreciated. If you have any questions or would like any further clarification, please feel free to ask.

You are allowed at any time to withdraw from filling this questionnaire. Any information provided here will not be linked to you and will remain confidential.

Thank you for your cooperation and assistance.

---

Tick where applicable.

1. What is your gender?                      F                       M
  
2. What is your age (in years)?
  
3. What is your learning combination?
  
4. Do you own a mobile device?                      Yes                       No
  
5. If you answered "NO" to question 4, is there a mobile device you share with an uncle, aunt, brother, sister, or parents?                      Yes                       No

6. Does your mobile device have internet access? Yes  No

7. What do you use your mobile device for most? (More than one answer is acceptable)

Search for information <input type="checkbox"/>	Socializing <input type="checkbox"/>
(Blogs, websites, news, sports)	(Facebook, twitter, WhatsApp, Instagram)
Recreation <input type="checkbox"/>	Academic <input type="checkbox"/>
(Games, Music, video, Audio etc.)	(Reading, studying, calculation etc.)

**The following questions focus on the use of your mobile device outside the classroom.**

8. Since January have you used your device to call a friend to ask for answer(s) to a homework/assignment/essay? Yes  No

9. Since January have you received a call from a friend requesting for answer(s) to a homework/assignment/essay? Yes  No

10. Since January have you sent an SMS to a friend to ask for answer(s) to a homework/assignment/essay? Yes  No

11. Since January have you received an SMS from a friend requesting for answer(s) to a homework/assignment/essay? Yes  No

12. Since January have you used instant messaging (WhatsApp, Skype, Viber, Line, KakaoTalk and Google Talk) to ask a friend for answer(s) to a homework/assignment/essay? Yes  No

13. Since January have you received an instant messaging (WhatsApp, Skype, Viber, Line, KakaoTalk, and Google Talk) from a friend to answer(s) a homework/assignment/essay?  
Yes  No

14. How many hours in a day do you use your mobile device?

15. How many hours in a day do you use social media (Facebook, Twitter and Instagram)

16. Is your mobile device simplifying communication between you and your relatives?  
Yes  No

17. Do you view using your mobile device for learning as a complex process?

Yes  No

18. Did you observe a friend using a mobile device and was interested in owning it?

Yes  No

19. Do you think you can use your mobile device and your textbooks for studies?

Yes  No

20. Since January have you used Google for school work? Yes  No

21. Since January have you used YouTube for school work? Yes  No

22. Since January have you used your camera/video for school work? Yes  No

23. Since January have you used any Map program for school work? Yes  No

24. Do you have an email address? Yes  No

25. If yes to question 24, which company does it belong to? (More than one answer is allowed)

Yahoo  Google  Hotmail/Live

Other (mention) \_\_\_\_\_

**\*\*THANK YOU FOR YOUR PARTICIPATION.\*\***

## Appendix 2: Teacher Questionnaire

### Preamble,

I am a PhD student in the Department of Information Systems at University of Cape Town and would like to get a richer understanding of teacher's perceptions of students' use of mobile devices for learning outside the classroom. Examples of mobile devices are; Cell phones (Mobile phones), Smart phones, PDA, Tablet PC's (iPad, Galaxy Tab), iPods, Laptops and Portable Computers.

You are expected to complete this questionnaire in 20 minutes. Below are questions to help me with collection of data for this research. I kindly ask you to respond as genuinely as possible. Your cooperation in answering the questions is highly appreciated. If you have any questions or would like any further clarification, please feel free to ask.

You are allowed at any time to withdraw from filling this questionnaire. Any information provided here will not be linked to you and will remain confidential.

Thank you for your cooperation and assistance.

---

Tick where appropriate.

1. Gender                      F                                            M
2. Age (in years)                      |
  
3. Teaching combination?    Arts     Commerce     Science
4. Do you own a mobile device?
5. Does your phone have internet access?
6. What do you use your mobile device for most? (More than one answer is allowed)  
Search for information                       Socializing   
(Blogs, websites, news, sports)                      (Facebook, twitter, WhatsApp, Instagram)

Recreation   
(Games, Music, video, Audio etc.)

Academic   
(Reading, studying, calculation etc.)

**The following questions focus on students' use of mobile device outside the classroom.**

7. Do you think students use their mobile devices outside the classroom to search for information (Blogs, Websites, News, Sports)? Yes  No
8. Do you think students use their mobile devices outside the classroom for socializing (Facebook, Twitter, WhatsApp, Instagram)? Yes  No
9. Do you think students use their mobile devices outside the classroom for recreation (Games, Music, Video, Audio)? Yes  No
10. Do you think students use their mobile devices outside the classroom for academic reasons (Reading, Writing, Calculation etc.)? Yes  No

**The following questions focus on the use of your mobile device.**

11. Since January have you sent/received a call to/from a colleague on academic matters? Yes  No
12. Since January have you sent/received an SMS to/from a colleague on academic matters? Yes  No
13. Since January have you sent/received an instant message (WhatsApp, Skype, Viber, Line) to/from a colleague on academic matters? Yes  No
14. How many hours in a day do you use your phone?
15. How many hours in a day do you use social media (Facebook, Twitter and Instagram)
16. Is your mobile device simplifying communication between you and your relatives? Yes  No
17. Do you think it is complex to use your mobile device for learning? Yes  No
18. Did you observe a colleague using a mobile device and was interested in owning it? Yes  No
19. Do you think you can use your mobile device to support your textbooks? Yes  No

20. Since January have you used Google academically? Yes  No
21. Since January have you used YouTube academically? Yes  No
22. Since January have you used your camera/video academically? Yes  No
23. Since January have you used any Map program academically? Yes  No
24. Do you have an email address? Yes  No
25. If yes on question 24, which company does it belong to? (More than one answer is allowed)      Yahoo       Google       Hotmail/Live
- Other (mention) \_\_\_\_\_

**\*\*THANK YOU FOR YOUR PARTICIPATION.\*\***

### Appendix 3: Student Interview

Respondent Number (S1F): ..... Age: ..... Form: .....

Examples of mobile devices are; Cell phones (Mobile phones), Smart phones, PDA, Tablet PC's (iPad, Galaxy Tab), iPods, Laptops and Portable Computers.

#### Interview Questions.

- 1) You are participating in this interview because you stated you are willing to, and you use your mobile device for learning outside the classroom. Is this correct?
- 2) When searching for a mobile device to buy, what features do you focus on?
- 3) Do you follow advice from your classmates on what mobile device features to look for?
- 4) What mobile device (s) do you own and what features does it have?
- 5) Is this device better than your previous one, and what features did the previous have?
- 6) Did you try this mobile device before buying it and was it from a friend, relative, or a shop?
- 7) What features do you use the most on your mobile device?
- 8) What influences your decision to use your mobile device for learning?
- 9) Do you think by using your mobile device for learning you are gaining a certain advantage over classmates?
- 10) Tell me about an instance when you used your mobile device to learn or locate information that is of a *personal interest*.
- 11) How do you feel about using your mobile device to support your learning?
- 12) Tell me about an instance when you tried to use your mobile device to help you learn something related to your *schoolwork*.
- 13) Tell me about a time when you used your mobile device to take pictures, record an audio, or a video that is related to schoolwork or you shared with your classmates?

- 14) When learning using your mobile device, what do you focus more between text and audio, video, and multimedia information?
- 15) Tell me about a situation where you used calling, texting, or social networking service on your mobile device to communicate with your teacher or classmates (example of each).
- 16) How do you feel about using your mobile device for communicating with your teacher or classmates?
- 17) What mobile device features would be important in your decision to use a mobile device for learning?
- 18) Is there anything that makes you reluctant or unwilling to use your mobile device for academic learning?
- 19) How do you view learning using personal mobile devices?
- 20) In general, how helpful or supportive have your teachers been in your use of mobile devices for learning? Can you provide me an example of how a teacher has encouraged/discouraged its use?
- 21) Tell me about how you utilize your mobile device functions to manage your schoolwork. These could include calculator, clock, camera etc.
- 22) What does effective use of your mobile device for learning mean to you?
- 23) Have you suffered any problem(s) because of using your mobile device for learning? (Provide me with an example).

**\*\*THANK YOU FOR YOUR PARTICIPATION\*\***

## Appendix 4: School A initial codes

Codes hierarchy

Code-Filter: All

---

HU: Dar Interviews and Field notes

Date/Time: 2015-11-23 13:07:35

---

Code Number	Code Name
1	academic reason to contact teacher <is> Root
2	administrative officials <is> Root
3	advice from parent <is> Root
4	age of respondents and ethics issues <is> Root
5	applications mostly used <is> Root
6	assist sibling in academic issues <is> Root
7	available <is> Root
8	better understanding or explanation <is> Root
9	break times <is> Root
10	can not rely on teacher mostly <is> Root
11	clarification from teacher <is> Root
12	class times <is> Root
13	communicate with friends from other school for academic reasons <is> Root
14	compatibility <is> Root
15	complexity <is> Root
16	computer lab and its environment <is> Root
17	concern towards teachers <is> Root
18	confusion as a result of searching on the internet <is> Root
19	consequences <is> Root
20	contacting friends <is> Root
21	contacting relatives <is> Root
22	contacting teacher <is> Root
23	cost <is> Root
24	cost of buying device <is> Root
25	create friendship <is> Root

26	culture <is> Root
27	delegation of power by leaders to subordinate <is> Root
28	device features <is> Root
29	distance from nearest bus stop <is> Root
30	destruction from using device <is> Root
31	dress codes for students <is> Root
32	effective <is> Root
33	email <is> Root
34	entry requirements to school <is> Root
35	extra classes <is> Root
36	extra curricula <is> Root
37	failure on trialability <is> Root
38	farewell functions <is> Root
39	fear of attacks at school <is> Root
40	features to consider for learning using devices <is> Root
41	feeling after contacting teacher <is> Root
42	feeling of using device <is> Root
43	fees <is> Root
44	festive season <is> Root
45	focus on multimedia <is> Root
46	focus on text <is> Root
47	friend <is> Root
48	friend advice <is> Root
49	generation gap between students and elders <is> Root
50	group work <is> Root
51	hours on device <is> Root
52	innovation <is> Root
53	internet <is> Root
54	internet cost <is> Root
55	lack of information <is> Root
56	language <is> Root
57	late arrival at school <is> Root
58	life-long learning <is> Root
59	location for data collection <is> Root
60	location of school and their effects to strangers <is> Root
61	long standing staff members <is> Root
62	maintenance <is> Root
63	manage school work <is> Root

64	most used mobile device features <is> Root
65	motivation <is> Root
66	negotiations during data collection <is> Root
67	network interconnectedness <is> Root
68	noise and other disruption affecting school <is> Root
69	norm <is> Root
70	number of teachers, students, supporting staff <is> Root
71	observability <is> Root
72	online help <is> Root
73	parents involvement with school <is> Root
74	parents perception (concern) <is> Root
75	personal information <is> Root
76	power cuts <is> Root
77	pressure of final examinations <is> Root
78	primary school students <is> Root
79	reasons for buying device <is> Root
80	reasons not to use device <is> Root
81	reasons to attend tuition <is> Root
82	reasons to call teacher <is> Root
83	reasons to use device for learning <is> Root
84	relative advantage <is> Root
85	relative advice <is> Root
86	religion affiliation <is> Root
87	remedial classes <is> Root
88	renovations <is> Root
89	researchers role in preparing for data collection <is> Root
90	respect for elders <is> Root
91	respect for teachers <is> Root
92	role of educated people as source of data <is> Root
93	role of host in assisting with data collection <is> Root
94	role of researcher <is> Root
95	role of teacher discouraging use of device <is> Root
96	roles of students <is> Root
97	school emblem and its representation <is> Root
98	school ownership <is> Root
99	school terms <is> Root
100	search feature/ <is> Root
101	search feature/engine <is> Root

102	security guards role at school <is> Root
103	shop attendant advice <is> Root
104	simplify <is> Root
105	socializing <is> Root
106	student internet expenses <is> Root
107	student leaders <is> Root
108	student perception <is> Root
109	subject teacher discourages student to use device <is> Root
110	subjects students use devices to gain knowledge <is> Root
111	sustainability <is> Root
112	Tanzania school syllabi <is> Root
113	teacher challenges students <is> Root
114	teacher encouraging <is> Root
115	teacher perception (concern) <is> Root
116	teachers fear towards their leaders/bosses <is> Root
117	teachers role in classes <is> Root
118	trialability <is> Root
119	type of device <is> Root
120	use device for entertainment <is> Root
121	use device for learning <is> Root
122	use device to plan <is> Root

## Appendix 5: School B initial codes

### Codes hierarchy

Code-Filter: All

---

HU: Cape Interviews and Field notes

Date/Time: 2015-11-23 13:24:04

---

Code No	Code Name
1	academic reason to contact teacher
2	administrative officials
3	advice from parent
4	age of respondents and ethics issues
5	applications mostly used
6	assist sibling in academic issues
7	Available
8	better understanding or explanation
9	break times
10	cannot rely on teacher mostly
11	clarification from teacher
12	class times
13	communicate with friends from other school for academic reasons
14	Compatibility
15	Complexity
16	computer lab and its environment
17	concern towards teachers
18	confusion because of searching on the internet
19	Consequences
20	contacting friends
21	contacting relatives
22	contacting teacher
23	Cost
24	cost of buying device
25	create friendship
26	Culture
27	delegation of power by leaders to subordinate

28	device features
29	distance from nearest bus stop
30	destruction from using device
31	dress codes for students
32	Effective
33	Email
34	entry requirements to school
35	extra classes
36	extra curricula
37	failure on trialability
38	farewell functions
39	fear of attacks at school
40	features to consider for learning using devices
41	feeling after contacting teacher
42	feeling of using device
43	Fees
44	festive season
45	Fine
46	focus on multimedia
47	focus on text
48	Friend
49	friend advice
50	generation gap between students and elders
51	group work
52	hours on device
53	Innovation
54	Internet
55	internet cost
56	lack of information
57	Language
58	late arrival at school
59	life-long learning
60	location for data collection
61	location of school and their effects to strangers
62	long standing staff members
63	Maintenance
64	manage school work
65	most used mobile device features

66	Motivation
67	my perception
68	negotiations during data collection
69	network interconnectedness
70	noise and other disruption affecting school
71	Norm
72	number of teachers, students, supporting staff
73	Observability
74	online help
75	parent's involvement with school
76	parent's perception (concern)
77	parents supporting their child
78	personal information
79	power cuts
80	pressure of final examinations
81	primary school students
82	reasons for buying device
83	reasons not to use device
84	reasons to attend tuition
85	reasons to call teacher
86	reasons to use device for learning
87	relative advantage
88	relative advice
89	religion affiliation
90	remedial classes
91	Renovations
92	researcher's role in preparing for data collection
93	respect for elders
94	respect for teachers
95	role of educated people as source of data
96	role of host in assisting with data collection
97	role of researcher
98	role of teacher discouraging use of device
99	roles of students
100	Safety
101	school emblem and its representation
102	school ownership
103	school rules

104	school terms
105	search feature/
106	search feature/engine
107	security guard's role at school
108	shop attendant advice
109	Simplify
110	Socializing
111	student internet expenses
112	student leaders
113	student perception
114	subject teacher discourages student to use device
115	subject's students use devices to gain knowledge
116	Sustainability
117	Tanzania school syllabi
118	teacher challenges students
119	teacher encouraging
120	teacher perception (concern)
121	teachers fear towards their leaders/bosses
122	teacher's role in classes
123	technical details
124	Theft
125	Time
126	Trialability
127	type of device
128	use device for entertainment
129	use device for learning
130	use device to plan



## Appendix 6: Ethics application to Faculty of Commerce



UNIVERSITY OF CAPE TOWN  
**FACULTY OF COMMERCE**  
 Igniting Knowledge and Opportunity



### Updated Ethics Form March 2013

Any individual in the Faculty of Commerce at the University of Cape Town undertaking any research that involves the use of human subjects, or research that may hold ethical consequences for the University of Cape Town, is required to complete this form and obtain approval before conducting research. The completed form should be submitted as an electronic document to departmental Ethics Committee representatives for submission to the Commerce Faculty Ethics in Research Committee. Please also submit electronic copies of your research proposal, informed consent form or other information used to obtain consent, and any questionnaires or other material shown to subjects.



#### 1. PROJECT DETAILS

<b>Project title:</b> The influence of effective use of mobile devices for learning outside the classroom: Case study of secondary school students in Tanzania and South Africa.		
<b>Principal Researcher/s:</b> Samwel Dick Mwapwele	<b>Email address(es):</b>	samwel.mwapwele@hotmail.com
<b>Research Supervisor:</b> Dr Sumarie Roodt	<b>Email address(es):</b>	sumarie.roodt@uct.ac.za
<b>Co-researcher(s):</b>	<b>Email address(es):</b>	
<p><b>Brief description of the project:</b> There is an ongoing debate on whether mobile devices should be allowed to be used in classroom at secondary schools or not. While this tackles the access level of mobile devices, research depicts there is a significant increase in mobile devices penetration in developing countries, including Tanzania and South Africa. There is little empirically and theoretically research on the use of mobile devices by students outside the classroom environment from both countries.</p> <p>This research intends to contribute to the body of knowledge on mobile learning, to policy makers on the need to include mobile devices as a tool that could be used in informal learning, and to theory by development of the model of effective student's use of mobile devices for learning outside the classroom.</p>		
<p><b>Data collection:</b> (please select)</p> <p><input checked="" type="checkbox"/> Interviews   <input checked="" type="checkbox"/> Questionnaire   <input type="checkbox"/> Experiment   <input type="checkbox"/> Secondary data   <input checked="" type="checkbox"/> Observation</p>		

Other (please specify): \_\_\_\_\_

**Procedure: (please describe)**

This research will use a framework developed from the Theory of diffusion of innovation, the Theory of Moral panic, and the Theory of Positive deviance, here by referred to as the model of effective student's use of mobile devices for learning outside the classroom environment. The research will employ Interpretivist paradigm, the approach used is Case studies, with Questionnaires, Interviews, and participant observation employed for data collection.

Descriptive statistics, and thematic analysis will be used to analyse quantitative, and qualitative (including field notes) data respectively.

## 2. PARTICIPANTS

### Characteristics of participants:

Gender: Male and Female, students and teachers  
Race / Ethnicity: All races  
Age range: Students are between 17 – 20 years, and teachers are above 23 years.  
Location: Dar-es-salaam, Tanzania and Cape Town, South Africa.  
Other:

### Race / Ethnicity:

Have you included a "Prefer not to Answer" response category in your questionnaire? (please select)

Yes     No     Not applicable

If you answered "No" why not?

### Affiliations of participants: (please select)

Company employees     UCT staff     General public     UCT Students

Other (please specify): It is students and teachers from School A in Dar-es-salaam, Tanzania, and learners and teachers from School B in Cape Town, South Africa.

If your sample includes children (aged 18 and below), mentally incompetent persons, or legally restricted groups please explain below why it is necessary to use these particular groups. If subjects are minors or mentally incompetent, please describe how and by whom permission will be granted? If you are including children under the age of 18 and are not getting parental consent, please explain why you believe that their parents would consent if it was possible to contact them.

I am using children (students) below the age of 18 as my study intends to understand use of mobile devices for learning outside the classroom environment and students have been identified as one of the groups with high interaction to mobile devices. Little empirical evidence is available on whether they use their mobile devices for learning and hence the need for this study to cover that research gap. I am using grade 12 students as it has been argued that, their use of mobile devices is higher since they are preparing for national examinations.

I am awaiting approval from the Western Cape Department of Education and Temkeke Municipal Department of Education and Culture.

The head of the school will be given sample questionnaire, and interview instruments as a way to ensure that none of the questions are out of context in regards to what the researcher wants to achieve. As a control measure, the researcher will request for presence of a teacher, or matron (patron) during the interview to ensure that students (respondents) rights are not violated, questions asked are not intimidating and/or out of scope. The location of the interview will be in open space where everyone can view the researcher, student, and teacher and hence ensuring security for all parties.

The research aim, and objectives will be discussed with the student prior to commencement of the interview. The outcome of the discussion will be asking the student for their permission to conduct an interview with. The students will be asked to sign a consent form if they are willing to undertake the interview.

### 3. ORGANISATIONAL PERMISSION

If your research is being conducted within a specific organisation, please provide organisational permission or explain how permission will be obtained.

I have acquired verbal permission to collect data at the schools. I am awaiting written consent from them, they have also requested for written permission from the University.

Are you making use of UCT students as respondents for your research? (please select)  Yes  No

If yes, have you contacted Executive Director: Student Affairs for permission? (please select)  Yes  No

Was approval granted? (please select)  Yes  No  Awaiting a response

Are you making use of UCT staff as respondents for your research? (please select)  Yes  No

If yes, have you contacted Executive Director: Human Resources for permission? (please select)  Yes  No

Was approval granted? (please select)  Yes  No  Awaiting a response

Contact Emails: Executive Director: Human Resources ([Miriam.Hoosain@uct.ac.za](mailto:Miriam.Hoosain@uct.ac.za))  
Executive Director: Student Affairs ([Moonira.Khan@uct.ac.za](mailto:Moonira.Khan@uct.ac.za))

#### 4. INFORMED CONSENT

What type of consent will be obtained from study participants?

- written consent
- anonymous survey
- oral consent (please justify)
- other (please specify)
  - Oral Consent
  - Written Consent
  - Anonymous survey questionnaire (covering letter required, no consent form needed)
  - Other (please specify)

How and where will consent/permission be recorded?

Consent permission will be signed in a printed paper within school premises.  
I will store the signed consent forms in a locked cabinet.

### 5. CONFIDENTIALITY OF DATA

What precautions will be taken to safeguard identifiable records of individuals? Please describe specific procedures to be used to provide confidentiality of data by you and others, in both the short and long run. This question also applies if you are using secondary sources of data that is not anonymous.

For questionnaires, no identification will be required.

For interviews, participants will be given codes e.g. T1F to refer to Teachers, first to be interviewed, Female by gender or S3M for Third student who is a male.

All questionnaires, field notes, and recorded interviews will be stored in a locked cabinet with password protection for interviews.

### 6. RISK TO PARTICIPANTS

Does the proposed research pose any physical, psychological, social, legal, economic, or other risks to study participants you can foresee, both immediate and long range? (please select)

Yes       No

If yes, answer the following questions:

1. Describe in detail the nature and extent of the risk and provide the rationale for the necessity of such risks
2. Outline any alternative approaches that were or will be considered and why alternatives may not be feasible in the study
3. Outline whether and why you feel that the value of information to be gained outweighs the risks.

1.

2.

3.

**What authorship agreement have you reached with your co-researchers or supervisor?**

This research is not intended for publication

Standard authorship agreement (principal researcher first author, co-researcher(s) and supervisor(s) co-authors)

Customised agreement (please specify below):

I certify that we have read the the UCT Authorship Policy, and Commerce Faculty Authorship Guidelines   
<http://www.commerce.uct.ac.za/Commerce/Information/research.asp>

I certify that that the material contained herein is truthful and that all co-researchers and supervisors are  aware of the contents thereof.


I understand that it is my responsibility to conduct research in accordance with the ethical requirements of  UCT.

*D. D. D. D.*

Applicant's signature:

Date:

CHECKLIST	SELECT
A FULL COPY OF A RESEARCH PROPOSAL OR A LITERATURE REVIEW WITH METHODOLOGY IS ATTACHED	<input checked="" type="checkbox"/>
RESEARCH PROPOSAL/ INTERVIEW SCHEDULES / COVER LETTERS / QUESTIONNAIRES / FORMS AND OTHER MATERIALS USED IN THE STUDY ARE ATTACHED/ CONSENT FORM	<input checked="" type="checkbox"/>
ORGANISATIONAL CONSENT LETTER/ UCT STUDENT OR STAFF APPROVAL LETTER	<input type="checkbox"/>

<p>1. The following UCT Logo </p> <p>2. A sentence explaining the aim of the research</p> <p>3. Sentences of a similar nature to below must be included in the cover letter or consent form:</p> <p>This research has been approved by the Commerce Faculty Ethics in Research Committee.</p> <p>Your participation in this research is voluntary. You can choose to withdraw from the research at any time.</p> <p>The questionnaire will take approximately X minutes to complete</p> <p>You will not be requested to supply any identifiable information, ensuring anonymity of your responses..</p> <p>Due to the nature of the study you will need to provide the researchers with some form of identifiable information however, all responses will be confidential and used for the purposes of this research only.</p> <p>Should you have any questions regarding the research please feel free to contact the researcher (insert contact details)..</p> <p>4. Have you scanned in your signature for the last section of the form?</p>	<p><input checked="" type="checkbox"/></p> <p><input checked="" type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input checked="" type="checkbox"/></p> <p><input checked="" type="checkbox"/></p> <p><input checked="" type="checkbox"/></p> <p>OR</p> <p><input checked="" type="checkbox"/></p> <p><input checked="" type="checkbox"/></p> <p><input checked="" type="checkbox"/></p>
--	---

For Ethics committee representative only

Recommendation(  approved  
s):

Signature:



Date:

13 April 2015

For Ethics committee chairperson only

Recommendation:

Signature:

Date:

## Appendix 7: Ethics application to Doctoral Degree Board at University of Cape Town

Samwel Dick Mwapwele  
PhD Student  
Department of Information Systems  
University of Cape Town

31<sup>st</sup> March 2015

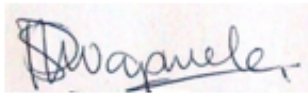
Doctoral Degrees Board  
University of Cape Town

Dear Board Members,  
**Ethics Approval Request**

I will be conducting research aimed at understanding student's use of mobile devices for learning outside the classroom environment in Tanzania and South Africa. To obtain data, I will use questionnaires and conduct semi-structured interviews. This data will be obtained from School A, Charambe in Dar-es-salaam, Tanzania, and School B, Zonnebloem in Cape Town, South Africa.

These schools have given me permission to collect data verbally, they still require that I present to them ethics clearance from UCT before engaging. Following this limitation, I kindly request to be granted ethics approval with provision that I will only start collecting data after obtaining ethics clearance from these schools.

Sincerely,



**Mr. Samwel Mwapwele**  
PhD Student  
Department of Information Systems  
University of Cape Town  
Email: samwel.mwapwele@hotmail.com



**Dr Sumarie Roodt**  
Research Supervisor  
Department of Information Systems  
University of Cape Town  
Email: sumarie.roodt@uct.ac.za

## Appendix 8: Ethics approval from University of Cape Town

UNIVERSITY OF CAPE TOWN



---

Faculty of Commerce  
Ethics in Research Committee  
University of Cape Town Private Bag Rondebosch 7701  
Email: [kincaidharold592@gmail.com](mailto:kincaidharold592@gmail.com)  
Telephone: 071 823 7573

April 16, 2015

Samwel Dick Mwapwele  
Information Systems

**Project title:** The influence of effective use of mobile devices for learning outside the classroom: Case study of secondary school students in Tanzania and South Africa.

Proposal no. 47-2015

Dear Researcher,

This letter serves to confirm that this project as described in your submitted protocol has been approved.

Please note that if you make any substantial change in your research procedure that could affect the experiences of the participants, you must submit a revised protocol to the Committee for approval.

Regards,

Professor Harold Kincaid

A handwritten signature in black ink that reads 'H. Kincaid'.

Commerce Faculty Ethics in Research Committee

---

"OUR MISSION is to be outstanding teaching and research university,  
educating for life and addressing the challenges facing our society."

---

## Appendix 9: Ethics application to Western Cape department of Education

Directorate: Research



[Audrey.wynngaard@westerncape.gov.za](mailto:Audrey.wynngaard@westerncape.gov.za)

tel: +27 021 467 9272

Fax: 0865902282

Private Bag x9114, Cape Town, 8000

[wced.wcape.gov.za](http://wced.wcape.gov.za)

### APPLICATION TO CONDUCT RESEARCH IN PUBLIC SCHOOLS WITHIN THE WESTERN CAPE

#### Note

- This application has been designed with students in mind.
- If a question does not apply to you indicate with a N/A.
- The information is stored in our database to keep track of all studies that have been conducted on the WCED. It is therefore important to provide as much information as is possible

#### 1 APPLICANT INFORMATION

1.1 Personal Details		
1.1.1	Title (Prof / Dr / Mr/ Mrs/Ms)	Mr
1.1.2	Surname	MWAPWELE
1.1.3	Name (s)	SAMWEL DICK
1.1.4	Student Number (if applicable)	MWPSAM001

1.2 Contact Details		
1.2.1	Postal Address	28 RHODES AVENUE, EDWIN HART (ROOM 7), 7701 MOWBRAY, CAPE TOWN.
1.2.2	Telephone number	N/A
1.2.3	Cell number	0797851322
1.2.4	Fax number	N/A
1.2.5	E-mail Address	Samwel.mwapwele@hotmail.com
1.2.6	Year of registration	2014
1.2.7	Year of completion	2016

## 2 DETAILS OF THE STUDY

<b>2.1 Details of the degree or project</b>		
2.1.1	Name of the institution	UNIVERSITY OF CAPE TOWN
2.1.2	Degree / Qualification registered for	DOCTORATE OF PHILOSOPHY IN INFORMATION SYSTEMS.
2.1.3	Faculty and Discipline / Area of study	FACULTY OF COMMERCE, DEPARTMENT OF INFORMATION SYSTEMS.
2.1.4	Name of Supervisor / Promoter / Project leader	Dr. SUMARIE ROODT
2.1.5	Telephone number of Supervisor / Promoter	+27 21 650 2286
2.1.6	E-mail address of Supervisor / Promoter	<a href="mailto:Sumarie.roodt@uct.ac.za">Sumarie.roodt@uct.ac.za</a>

<b>2.1.7</b>	<b>Title of the study</b>
The influence of effective use of Mobile devices for learning outside the classroom: Case study of Secondary School Students in Tanzania and South Africa.	

<b>2.1.8</b>	<b>What is the research question, aim and objectives of the study</b>
<p>This research will be informed by the following research question; <i>What influence does effective use of mobile devices for learning outside the classroom have on academic performance of secondary school students in Tanzania and South Africa?</i></p> <p>Sub questions are;</p> <ol style="list-style-type: none"> <li>1. To what extent are secondary school students in Tanzania and South Africa using their mobile devices for learning outside the classroom?</li> <li>2. What mobile device affordances do secondary school students use mostly outside the classroom for learning?</li> <li>3. What influences secondary school students use of mobile devices for learning outside the classroom?</li> <li>4. What does effective use of mobile devices for learning outside the classroom infer in the context of secondary school students in Tanzania and South Africa and how does it influence academic performance?</li> <li>5. What are teacher's perceptions on students' use of mobile devices for learning outside the classroom?</li> </ol> <p>In that, this research aims to contribute practically in the following ways;</p> <ul style="list-style-type: none"> <li>➤ Equip Tanzanian students and teachers on how their colleagues in South Africa are using mobile devices for learning outside the classroom.</li> <li>➤ Explain to policy makers of the important aspects to consider during the development of curriculum in terms of resources students have at their disposal.</li> <li>➤ Inform students and teachers of effective ways they can use mobile devices for learning and how this helps their knowledge on different subject matters based</li> </ul>	

on peer input.

- Assist teachers and parents in understanding students use of mobile devices and hence create relationships that are not based on fear.

2.1.9	<b>Name (s) of education institutions (schools)</b>
School B in Zonnebloem, Cape Town.	

<b>2.1.10</b>	<b>Research period in education institutions (Schools)</b>	
2.1.11	Start date	13 July 2015
2.1.12	End date	30 September 2015

## Appendix 10: Ethics approval from Western Cape department of Education



Directorate: Research

[Audrey.wyngaard@westerncape.gov.za](mailto:Audrey.wyngaard@westerncape.gov.za)

tel: +27 021 467 9272

Fax: 0865902282

Private Bag x9114, Cape Town, 8000

[wced.wcape.gov.za](http://wced.wcape.gov.za)

**REFERENCE:** 20150410-46097

**ENQUIRIES:** Dr A T Wyngaard

Mr Samwel Mwapwele  
28 Rhodes Avenue  
Edwin Hart (Room 7)  
Mowbray  
7701

Dear Mr Samwel Mwapwele

### RESEARCH PROPOSAL: THE INFLUENCE OF EFFECTIVE USE OF MOBILE DEVICES FOR LEARNING OUTSIDE THE CLASSROOM: CASE STUDY OF SECONDARY SCHOOL STUDENTS IN TANZANIA AND SOUTH AFRICA

Your application to conduct the above-mentioned research in schools in the Western Cape has been approved subject to the following conditions:

1. Principals, educators and learners are under no obligation to assist you in your investigation.
2. Principals, educators, learners and schools should not be identifiable in any way from the results of the investigation.
3. You make all the arrangements concerning your investigation.
4. Educators' programmes are not to be interrupted.
5. The Study is to be conducted from 13 July 2015 till 30 September 2015
6. No research can be conducted during the fourth term as schools are preparing and finalizing syllabi for examinations (October to December).
7. Should you wish to extend the period of your survey, please contact Dr A.T Wyngaard at the contact numbers above quoting the reference number?
8. A photocopy of this letter is submitted to the principal where the intended research is to be conducted.
9. Your research will be limited to the list of schools as forwarded to the Western Cape Education Department.
10. A ~~brief summary~~ of the content, findings and recommendations is provided to the Director: Research Services.
11. The Department receives a copy of the completed report/dissertation/thesis addressed to:  
The Director: Research Services  
Western Cape Education Department  
Private Bag X9114  
CAPE TOWN  
8000

We wish you success in your research.

Kind regards,  
Signed: Dr Audrey T Wyngaard  
Directorate: Research  
DATE: 10 April 2015

---

Lower Parliament Street, Cape Town, 8001  
tel: +27 21 467 9272 fax: 0865902282  
Safe Schools: 0800 45 46 47

Private Bag X9114, Cape Town, 8000  
Employment and salary enquiries: 0861 92 33 22  
[www.westerncape.gov.za](http://www.westerncape.gov.za)

## Appendix 11: Consent forms sent to schools (Principals and parents) where data was collected

12 March 2015

Dear Principal School A

I would like to invite your school to participate in an academic research case study on students' use of mobile devices for learning in secondary schools in Tanzania.

The aim of this study is to gain an understanding and insight into students' use of mobile devices for learning outside the classroom at School A, and to identify possible areas (or "gaps") for future consideration, by distributing survey questionnaire to all Form IV students and teachers at the school, and conducting one-on-one interviews with students over the next month.

Your participation in this research is voluntary. All information will be treated in a confidential manner and used exclusively for this study. No individual names will be recorded or published. You will not be requested to supply any identifiable information, ensuring anonymity of your responses. You can choose to withdraw from the research at any time for whatever reason, in accordance with ethical research requirements.

The anonymous survey questionnaire will take approximately 20 minutes to complete and the one-on-one interviews will take approximately 30 minutes at School A's premises in Charambe, Dar-es-salaam.

Would you kindly respond in writing (either via email or in print) to this request. This is one of the requirements in the Department of Information Systems at University of Cape Town.

Should you have any questions regarding this research, please feel free to contact me on 019 186 1322 or email: [samwel.mwapwale@hotmail.com](mailto:samwel.mwapwale@hotmail.com).

Thank you for your time and participation.

Sincerely, |



Samwel Mwapwale  
PhD Student  
Department of Information Systems  
University of Cape Town  
Email:  
[samwel.mwapwale@hotmail.com](mailto:samwel.mwapwale@hotmail.com)



Doctor Sumarie Roodt  
Research Supervisor  
Department of Information  
Systems  
University of Cape Town  
Email:  
[sumarie.roodt@uct.ac.za](mailto:sumarie.roodt@uct.ac.za)

**RESEARCH PARTICIPANT CONSENT FORM**

I, \_\_\_\_\_, consent to participate in the research on students' use of mobile devices for learning in secondary schools in Tanzania.

I am aware that participation is voluntary and that I may choose to withdraw from this study at any time, should I choose to do so.

Signature

Date

\_\_\_\_\_

\_\_\_\_\_

12 March 2015

Dear Principal School B

I would like to invite your school to participate in an academic research case study on students' use of mobile devices for learning in secondary schools in South Africa.

The aim of this study is to gain an understanding and insight into students' use of mobile devices for learning outside the classroom at School B, and to identify possible areas (or "gaps") for future consideration, by distributing survey questionnaire to all Grade 12 students and teachers at the school, and conducting one-on-one interviews with students over the next month.

Your participation in this research is voluntary. All information will be treated in a confidential manner and used exclusively for this study. No individual names will be recorded or published. You will not be requested to supply any identifiable information, ensuring anonymity of your responses. You can choose to withdraw from the research at any time for whatever reason, in accordance with ethical research requirements.

The anonymous survey questionnaire will take approximately 20 minutes to complete and the one-on-one interviews will take approximately 30 minutes at School B's premises in Lonnebloem, Cape Town.

Would you kindly respond in writing (either via email or in print) to this request. This is one of the requirements in the Department of Information Systems at University of Cape Town.

Should you have any questions regarding this research, please feel free to contact me on 079 785 1322 or email: [samwel.mwapwela@hotmail.com](mailto:samwel.mwapwela@hotmail.com).

Thank you for your time and participation.

Sincerely,



**Samwel Mwapwela**  
PhD Student  
Department of Information Systems  
University of Cape Town  
Email:  
[samwel.mwapwela@hotmail.com](mailto:samwel.mwapwela@hotmail.com)



**Doctor Sumaria Roodt**  
Research Supervisor  
Department of Information  
Systems  
University of Cape Town  
Email:  
[sumaria.roodt@uct.ac.za](mailto:sumaria.roodt@uct.ac.za)

## RESEARCH PARTICIPANT CONSENT FORM

I, \_\_\_\_\_, consent to participate in the research on students use of mobile devices for learning in secondary schools in South Africa.

I am aware that participation is voluntary and that I may choose to withdraw from this study at any time, should I choose to do so.

Signature

Date

\_\_\_\_\_

\_\_\_\_\_